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PETROL (PMS) PUMP PRICE FLUCTUATION AND CONSUMERS' BEHAVIOUR IN NIGERIA (1970- 2016): A VECTOR ERROR CORRECTION APPROACH

***A. J. AKPAETI, N. N. FRANK AND D. I. AGOM**

Department of Agricultural Economics and Extension, Akwa Ibom State University, Obio-Akpa Campus P.M.B. 1167, Uyo, Akwa Ibom State, Nigeria.
***Corresponding Author:** aniekanakpaeti@aksu.edu.ng **Tel:** +234

ABSTRACT

In Nigeria, most light and heavy-duty automobiles are powered by the premium motor spirit (PMS) aka petrol, and its pump price fluctuation is expected to affect consumer behaviour. This study investigated the connection between petrol pump price fluctuations and consumers' behaviour in Nigeria from 1970 to 2016 using the framework that applies multivariate Vector Error Correction. There was the presence of both long and short-run associations amid the pump price of petrol and consumers' behaviour. Petrol pump price negatively affects behaviour and other variables of macro-economic policy such as importation of food, foreign private investment, exchange rate and government funds allocation for agriculture in both the long and short run. There was a negative and significant effect of petrol pump price shock on these macro-economic variables while the variation in the forecast error for petrol price on consumer behaviour shock had a declining and fluctuating value from period one to four (0.96%), averaging in period five with 1.36% of the variation of petrol pump price and continue fluctuating to the ten years. This indicated the negative impact unstable petrol pump price had on consumers' behaviour hence their purchasing power. The petrol pump charge influence on the macro-economic policies in the economy created room for local producers and foreign private investments to thrive. The local producers seized the opportunities to export their produce while the foreign private investors invested in the local producers to make a profit. As such, the government need to create a better conducive environment for the local agricultural producers and foreign private investors to export and invest accordingly.

Keywords: Petrol pump price, Consumers' behaviour, Fluctuation, Impulse Response Functions.

DOI

INTRODUCTION

If knowing the economic determinants of consumers' behaviour is relevant for any reason in an economy, then, it is more important in a mono-product-dependent but "geographically-specific dispersed agricultural produce" economy such as Nigeria. This is because it bears directly on wide-ranging issues and policies such as consumer behaviour patterns, economic growth and the equity premium equation. Aigbedion and Iyayi (2007) affirm that the Nigerian economy has assumed a precarious dimension since its total dependence on oil because it is vulnerable to the caprices of the international crude oil market – the only raw material and basis of premium motor spirit (PMS) *aka* petrol in the nation. This product which

is the fuel used to power nearly all light automobiles and most generators in the nation is a factor in the industrial and commercial sectors of the nation both in terms of price and availability of other commodities. Odoko *et al* (2003) stated that every development in the oil sector in Nigeria has great significant consequences for industrial production as oil and its offshoot are used in the production of goods and services. Petrol pump prices and the availability of the product affect both the micro and macro economy of every "fossil fuel" - dependent nation and Nigeria is no exception. The effect could be "hydra-headed" if the premium motor spirit (PMS) is a direct factor in production. If otherwise, then the real effect will be on the marketing mix. The marketing mix is a collection of controllable elements (product, price, promotion and place) of marketing tools and strategies of a marketing process that must be coordinated to achieve the goals of the Institute of Marketing (Hakansson and Walaszewski, 2005). Thus, a slight change in the pump price of petrol whether in an oil-producing or non-producing nation, affects all elements within the marketing mix and most excruciating will be the effect on an economy with "geographically-specific" dispersed produces. This is because these products need to be transported even as value is being added along the chain to the nooks and crannies of the country. The far-reaching implications on produce and all goods in the economy and by extension psychological and financial ripple effects on consumer behaviour can only be imagined. Corroborating this assertion, Ikram and Waqas (2014) opined that the increase in petroleum product prices has a direct and indirect effect on agricultural inputs. With food production being the end product of agricultural efforts and one of the most important needs of man, the effect of petroleum products and their derivatives on consumer behaviour can only be better imagined.

A historical trend of petrol pump prices in Nigeria (1970-2018) gives a picture of fluctuation in the country showing a continuous increase from 1970 until 1990 (Fig 1). The downward and decreasing trend in the petrol pump prices from 1990-1993, 2008 - 2010 and 2012 – 2014 probably indicates periods of fewer demand pressures occasioned by diminishing worldwide output growth, owing largely to continental/global economic and financial crises, local political rivalry as well as other vagaries both in the global crude oil market and consumption pattern of the people, since PMS's demand is mostly indirect. This has also been attested to by eminent scholars like Sean *et al* (2007), and Binuomote and Odeniyi (2013). For example, the period 1990-1993 corresponded to the period when Nigeria headed the Economic Community of West African States Monitoring Group (ECOMOG) to invade Liberia. According to Salami (2015), Nigerian dominance of the force challenged the readiness and keenness of fellow countries to partake as well as regional and international organizations' financial contribution to the operation. This must have been the reason for declining oil demand as some countries must have been envious and thus refuse to buy the country's oil". Internationally, Grey (2019) reported that the price of oil went down so low in 2014 because China's booming economy started slowing down in growth. Russia, India and Brazil experienced similar economic trajectories and America and Canada started prospecting for oil in North Dakota and Alberta's oil sand, respectively. These series of activities threatened not only the country's crude oil production but its demand in the world market as well as the

price and demand of premium motor spirit (PMS).

Akinwale *et al* (2013) examining the economic implication of phasing out oil subsidies in Nigeria, reported the existence of a negative relationship between petrol consumption and the price of petrol while earnings per capita took a positive connection using petrol consumption. This means, if the subsidy on petrol is removed and the price is increased by ₦1 (One Naira), petrol intake will be reduced by less than 1 litre and vice versa. They concluded that both petrol pump price and income per head have a significant ($P<0.05$) impact on petrol consumption. Binuomote and Odeniyi (2013) in their paper on the effect of crude oil prices on agricultural productivity in Nigeria (1981-2010), opined that the reality of Nigeria as a member of the Organization of the Petroleum Exporting Countries (OPEC) nation does not exempt her from the negative consequence of oil price shocks. They concluded that except for very few households, others are subjected to higher food prices, energy costs, higher transport and further deprivation. Oil price and agricultural productivity are so highly correlated that Sean *et al;* (2007) asserted that any approach that neglects the economics of a producer's alternatives to a favoured energy source will produce partial insights at best and useless policy at worst. What do we think will be the effect of the neglect of these energy sources on consumer behaviour?

The majority of existing work on consumer behaviour have centred on wealth, income and a variety of individual-specific characteristics like labour market status and educational attainment. Equally, considerable attention has been given to crude oil production/price fluctuation and agricultural product prices, productivity, economic performance and many more. However, not much consideration has been paid to consumer behaviour based on petrol pump price fluctuations. This is because most authors feel that income and wealth inequality are sacrosanct to consumption inequality, therefore, resulting in inequality in consumer behaviour. In as much as there is no dispute about these, suffice it to say that income and wealth inequality has come to stay especially in developing countries for now, even as it is the most envisage debatable topic for the 22nd century (Mclewee, 2014). The focus presumably, should be on the "next most" if not the "ultimate" other determinant of consumer behaviour which is the price of petroleum as a whole and its derivatives (PMS) in particular. This is because the underlying foundation of demand even with income and wealth inequality is a model of how consumers behave with their set of preferences and values whose determination is within and outside the realm of economics. This will orchestrate the consumption behaviour and preferences of consumers at the slightest changes in the petrol pump price of PMS. This is why this research work is not only topical but timely to x-ray the behaviour of consumers when searching for, purchasing, using and disposing of the product bought for their utility vis-a-vis the fluctuating petrol pump price. It is against this backdrop that it becomes imperative to assess the impact of petrol pump price fluctuation on consumers' behaviour in Nigeria as will be modelled by an impulse purchase.

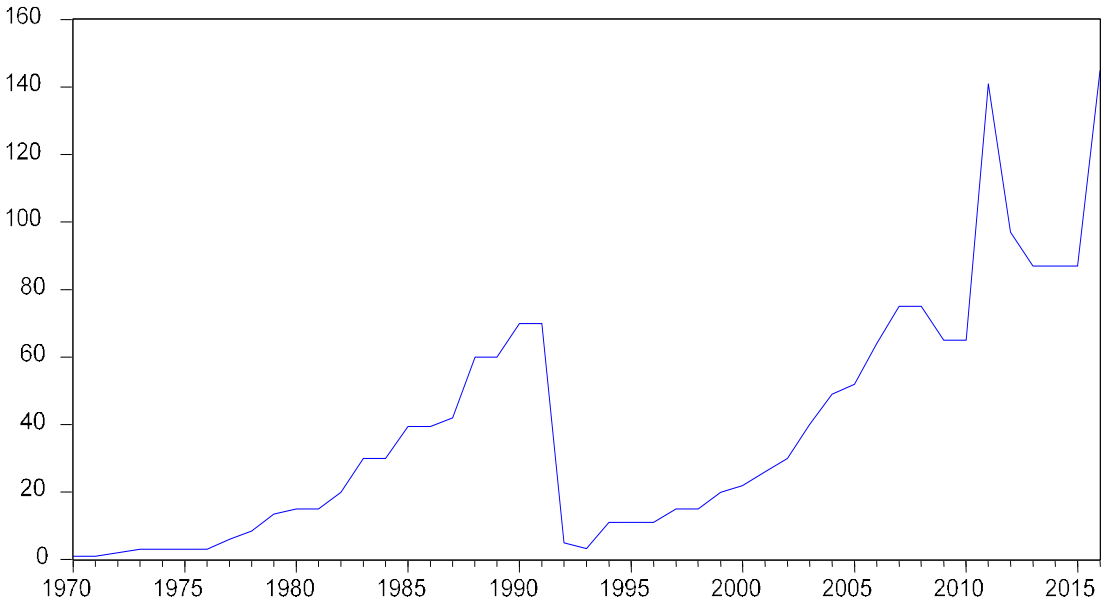

Fig 1: Graph of Petrol (PMS) Pump Prices Fluctuation in Nigeria (1970- 2018)

Literature review

Consumers' behaviour can be linked to the idea of "impulse buying" which is built around the concept of "unplanned purchase" adduced by Stern (1962). Impulse buying has been defined by different authors differently. This may not be unconnected with its hydra-headed roots in different disciplines. Therefore, there has not been a unanimous and acceptable definition. This dynamic concept, though, initially thought of as an unplanned purchase, has over the years been changing. Rook and Hoch (1985) believe that it is more arousing, less intentional and more attractive. Rook (1987) describes it as a quick, mighty and persistent desire to purchase something instantly. Hoch and Lowenstein (1991) and Rook and Fisher (1995) believe that it is often emotion-related but with proof of a cognitive component. Hoch and Lowenstein (1991) said it is a contest between the psychological forces of desires and willpower whereas Ghani *et, al;* (2010) opined that it is a spontaneous and instant purchase decision with no prior intention. Pham *et al* (2017) see it as a complicated behaviour that happens due to the interactions among different psychological, social and personality factors. These time-tested technocrats all agree that there is proof of a cognitive component in spontaneous purchasing behaviour even when it is often emotion-related (Hoch and Lowenstein, 1991; Rook and Fisher, 1995). Barratt (1993) stated that acting momentarily is a personality trait and has to do with the tendency of acting without forethought, making quick cognitive decisions and failing to cherish the situations in the present and the future. Puri (1996) affirms that impulsive act is considered a priority and appropriate before engagement, however, short-term gains may be chosen irrespective of their ability for grave long-term ef-

fects, depending on the situation or a person's "chronic values".

Whichever definition of impulse buying is applied or from whichever perspective is it viewed, petrol (PMS) price fluctuation and consumer behaviour in Nigeria can best be explained with impulse buying theory. Analytically, if the unplanned purchase is used, PMS purchase in the face of price fluctuation is unplanned. If the concept of more arousing, less intentional and more attractive is applied, PMS purchase in the face of "price fluctuation" is sacrosanct. Every consumer is however presumed to maximize a utility function subject to a monetary budget constraint (Bigsten and Levin, 2000). Equally, if Barratt's (1993) impulsivity definition is considered, PMS purchase in the face of "price fluctuation" applies. Assuming an innocent consumer drives into a filling station with insufficient fuel to take him home only to discover that the pump price has not only been increased but there are long queues. Though, he may have wanted to buy beverages for the children on his way back, the usual Nigeria fuel scarcity reality (presumption of price rise/outright scarcity) would force him to rethink and act otherwise. This is an assurance for the children to go to school in the car the next day. The reality is that the increased purchase of fuel will be the opportunity cost of buying beverages for the children. Only the rich will be able to use the automated teller machine (ATM) to fill their tanks and get some for domestic usage but the poor will be hindered. The anticipation of a higher price by the next day or longer queues could evoke emotional and cognitive reactions but as opined by Hoch and Lowenstein (1991), it is not a sine qua non-condition to an impulse purchase. This is not without gratification for the petrol attendance or station manager for preferential treatment - a major distinguishing characteristic of the bourgeoisie in Nigerian culture.

Theoretical framework

Analytically, there are various consumer behaviour models viz the theory of reasoned action initially propounded by Ajzen and Fishbein (1977). They saw consumers as rational actors who act in their best interests. This theory was fined-tuned, expanded, given definite steps and renamed the theory of reasoned action by Engel *et al* (1982). Others are the motivation-need theory model by Abraham Maslow which sees the consumer's action on a five-part priority needs-based system-survival, safety, love, esteem, and self -actualization and the impulse behaviour idea by Hawkins Stern in 1962. This focuses on consumer action on the bases of impulse rather than rationality. Whichever model is applied, petrol pump price fluctuation is a determinant of consumer behaviour, especially in a developing economy like Nigeria. However, out of the numeral propounded, expounded and fine-tuned theories of consumer behaviour, the one considered most appropriate, with its relevance support for this paper is the impulse buying theory by Hawkins Stern. The reasons for consideration are that it is multi-faceted. Apart from impulse buying being a simple and unequalled way of consumption in the daily life of consumers and accounting for 90% of people's consumption behaviour (Hausman, 2000), it has its roots crisscrossing many disciplines, consequently, its dynamic definition (Parboteeah *et al.,* 2009). Secondly, both positive and negative feelings are found to be important predictors of impulse buying (Verplanken *et al.,* 2005; Herabadi *et al.,* 2009). Thirdly, the vogue conceptualization of impulsive buying from "an unplanned purchase" to a quick, mighty and persistent

desire to purchase something instantly (Rook, 1987). Stern (1962) modified the concept to mean "without regard for the consequences" as well as Kacen and Lee (2002) stated - that impulse buying is less intentional and more arousing and attractive.

Equally, it is the outcome of a complicated behaviour that happens due to the interactions among different psychological, social and personality factors (Pham *et al.,* 2017). Lastly, time-tested socio-cognitive behaviour models articulating the theory of reasoned action and theory of planned behaviour, suggest that consumers are cognitive in actions and that they give consideration to behavioural intentions along with perceived personal and social norms before exhibiting any social buying behaviour (Ajzen and Fishbein, 1977; Ajzen *et al.,* 1982). Kacen and Lee (2002) confirmed that impulse buying is less intentional and more arousing and attractive. This is not in anywhere dispute with the well-established rational consumer behaviour models of utility maximizations. The challenge is that they fail to unravel the misery of why in today's market, a quick, mighty and persistent desire to purchase something instantly is largely looked at as a pervasive and distinctive feature of consumers' purchasing behaviour (Baumeister, 2002; Beatty and Ferrell, 1998). This is the case with petrol (PMS) pump prices in Nigeria**.** It is often very normal to walk into a petrol dispensing station to witness a price rise without prior information even with under-adjusted dispensing pumps and for 11.7 million (58.08% commercial and 31.92% private) cars in Nigeria (nairametric.com), the PMS purchase condition by owners is always impulsive.

MATERIALS AND METHODS

Data Sources

The secondary data used for the study was derived from the Central Bank of Nigeria (CBN), Statistical Bulletins, Annual Reports and Statements of Account of the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS) and International Monetary Fund from 1970-2018.

Analytical Techniques

The paper made use of a Vector Error Correction Model (VECM) based on theoretical exposition and following the existent literature as evidenced in the works of Olarinde and Abdullahi (2014), Akpaeti (2013 and 2015), Akpaeti *et al*., (2018). According to Engle and Granger (1987), two equilibrium models – the short-run and long-run equilibrium model exist in VECM once the variables are co-integrated of the order 1(1). Therefore, the short-run analysis of the system would include the error correction term to correct the adjustment arising from the deviation of its long-run equilibrium. The VECM specifications used in this study are presented in eight endogenous variables as follows:

$$\Delta \mathrm{LN}CPI = \varphi_0 + \varphi_1 \sum_{i=1}^{k} \Delta \mathrm{LN}FUEP_{q,t-i} + \varphi_2 \sum_{i=1}^{k} \Delta LNEXR_{q,t-i} + \varphi_3 \sum_{i=1}^{k} \Delta \mathrm{LN}FI_{q,t-i} + \varphi_4 \sum_{i=1}^{k} \Delta LNFPI_{q,t-i} + \varphi_5 \sum_{i=1}^{k} \Delta \mathrm{LN}GCAA_{q,t-i} + \varphi_6 \sum_{i=1}^{k} \Delta \mathrm{LNARGDP}_{q,t-i} + \varphi_7 \sum_{i=1}^{k} \Delta LNINTR_{q,t-i} + \mu_{1t} \quad 1$$

$$\Delta \mathrm{LNFUEP} = \theta_0 + \theta_1 \sum_{i=1}^{k} \Delta \mathrm{LNCPI}_{q,t-i} + \theta_2 \sum_{i=1}^{k} \Delta LNEXR_{q,t-i} + \theta_3 \sum_{i=1}^{k} \Delta LNFI_{q,t-i} + \theta_4 \sum_{i=1}^{k} \Delta \mathrm{LNFPI}_{q,t-i} + \theta_5 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \theta_6 \sum_{i=1}^{k} \Delta LN\mathrm{ARGDP}_{q,t-i} + \theta_7 + \mu_{2t} \quad 2$$

$$\Delta \mathrm{LN}EXR = \lambda_0 + \lambda_1 \sum_{i=1}^{k} \Delta LNCPI_{q,t-i} + \lambda_2 \sum_{i=1}^{k} \Delta LNFUEP_{q,t-i} + \lambda_3 \sum_{i=1}^{k} \Delta LNFI_{q,t-i} + \lambda_4 \sum_{i=1}^{k} \Delta \mathrm{LNFPI}_{q,t-i} + \lambda_5 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \lambda_6 \sum_{i=1}^{k} \Delta \mathrm{LNARGDP}_{q,t-i} + \lambda_7 \sum_{i=1}^{k} \Delta \mathrm{LN}INTR_{q,t-i} + \mu_{3t} \quad 3$$

$$\Delta \mathrm{LN}FI = \beta_0 + \beta_1 \sum_{i=1}^{k} \Delta LNCPI_{q,t-i} + \beta_2 \sum_{i=1}^{k} \Delta LNFUEP_{q,t-i} + \beta_3 \sum_{i=1}^{k} \Delta LNEXR_{q,t-i} + \beta_4 \sum_{i=1}^{k} \Delta \mathrm{LNFPI}_{q,t-i} + \beta_5 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \beta_6 \sum_{i=1}^{k} \Delta LN\mathrm{ARGDP}_{q,t-i} + \beta_7 \sum_{i=1}^{k} \Delta \mathrm{LN}INTR_{q,t-i} + \mu_{4t}$$

$$\Delta \mathrm{LN}FPI = \gamma_0 + \gamma_1 \sum_{i=1}^{k} \Delta \mathrm{LNCPI}_{q,t-i} + \gamma_2 \sum_{i=1}^{k} \Delta LNFUEP_{q,t-i} + \gamma_3 \sum_{i=1}^{k} \Delta \mathrm{LN}EXR_{q,t-i} + \gamma_4 \sum_{i=1}^{k} \Delta LNFI_{q,t-i} + \gamma_5 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \gamma_6 \sum_{i=1}^{k} \Delta \mathrm{LNARGDP}_{q,t-i} + \gamma_7 \sum_{i=1}^{k} \Delta \mathrm{LN}INTR_{q,t-i} + \mu_{5t} \quad 5$$

$$\Delta \mathrm{LN}GCAA = \psi_0 + \psi_1 \sum_{i=1}^{k} \Delta \mathrm{LN}CPI_{q,t-i} + \psi_2 \sum_{i=1}^{k} \Delta LNFUEP_{q,t-i} + \psi_3 \sum_{i=1}^{k} \Delta LNEXR_{q,t-i} + \psi_4 \sum_{i=1}^{k} \Delta LNFI_{q,t-i} + \psi_5 \sum_{i=1}^{k} \Delta \mathrm{LN}FPI_{q,t-i} \psi_6 \sum_{i=1}^{k} \Delta LNINF_{q,t-i} + \psi_7 \sum_{i=1}^{k} \Delta \mathrm{LN}INTR_{q,t-i} + \mu_{6t} \quad 6$$

$$\Delta \mathrm{LNARGDP} = \sigma_0 + \sigma_1 \sum_{i=1}^{k} \Delta LNCPI_{q,t-i} + \sigma_2 \sum_{i=1}^{k} \Delta \mathrm{LN}FUEP_{q,t-i} + \sigma_3 \sum_{i=1}^{k} \Delta \mathrm{LN}EXR_{q,t-i} + \sigma_4 \sum_{i=1}^{k} \Delta LNFI_{q,t-i} + \sigma_5 \sum_{i=1}^{k} \Delta LNFPI_{q,t-i} + \sigma_6 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \sigma_7 \sum_{i=1}^{k} \Delta LNINTR_{q,t-i} + \mu_{7t} \quad 7$$

$$\Delta \mathrm{LN}INTR = \phi_0 + \phi_1 \sum_{i=1}^{k} \Delta LNCPI_{q,t-i} + \phi_2 \sum_{i=1}^{k} \Delta LNFUEP_{q,t-i} + \phi_3 \sum_{i=1}^{k} \Delta \mathrm{LN}FEXR_{q,t-i} + \phi_4 \sum_{i=1}^{k} \Delta \mathrm{LN}FI_{q,t-i} + \phi_5 \sum_{i=1}^{k} \Delta LNFPI_{q,t-i} + \phi_6 \sum_{i=1}^{k} \Delta LNGCAA_{q,t-i} + \phi_7 + \mu_{8t} \quad 8$$

Where:

LNCPI = Log of Consumers' Behaviour (a proxy for Consumer Price Index)

LNFUEP = Log Petrol Pump Price (Naira)

LNEXR = Log of Exchange Rate (Naira)

LNFI = Log value of Food import (Naira)

LNFPI = Log value of Foreign Private Investment (Naira)

LNGCAA = Log of Government Capital Allocation to Agricultural Sector (Naira)

LNINFLA = Log of Inflation Rate (Percent)

LNINTR = Log of Interest Rate (Percent)

$\mu_t = (\mu_{1t}, \mu_{2t}, \ldots \mu_{nt})$ = the 8x1 vector of error terms, independent and identically distributed (I.I.D).

$\varphi_0, \theta_0, \lambda_0 \ldots \phi_0$ were the intercept terms while $\varphi_1 \theta_1, \lambda_1 \ldots \phi_1$ were the coefficients for the variables estimated and k =the number of lagged terms

Estimated Procedures

Augmented Dickey-Fuller and Philip Peron test was conducted as a preliminary diagnostics unit root test on time series properties of the variables used in the model to establish the order of integration to avoid spurious regression. The series equation for the unit test is as follows:

$$\Delta Y_t = \alpha_1 + \alpha_{1t} + \alpha_2 + \alpha_1 Y_{t-1} + \sum_{i=0}^{k} \beta_1 \Delta Y_{t-i} + \mu_t \quad 9$$

Where $\sigma_1 + \sigma_{1t} + \sigma_2$ and β_1 were parameters to be estimated while μ_t was the error term, which was assumed to be normally and identically distributed. To be sure that the results obtained are not spurious (Maddala, 2002; Akpaeti *et al.,* 2018), the co-integration test was carried out. In economic terms, two variables are co-integrated if they have a long-term or equilibrium relationship (Gujarati, 2003; Akpaeti *et al.,* 2019). To test for the presence of a long-run relationship, the maximum likelihood method developed by Johansen (1988 and 1991) was utilized. Using the Johansen approach, two test statistics can be used in testing the number of co-integrating vectors: The Trace and the Maximum Eigenvalue statistics. The null hypothesis for the trace test was that there are at most *r* co-integrating vectors, while for the Max Eigenvalue test, the null of $r = 0$ was tested against the alternative that $r = 1$; $r = 1$ was tested against the alternative that $r = 2$ and so on. The Schwarz Information Criterion (SIC) was used to select the optimal lag length for the co-integration test. Estimation of both the long and short-run macroeconomic variables within the Vector Error Correction Model was the next analysis. To test for long-run causality, the null hypothesis that the coefficient of t-1 is zero was tested in equations 1-8 while Granger causality tests (a Wald F-test non-causality) were performed for the short run by setting the coefficients of all order-lagged differences of each of the variables on the right-hand side equal to zero for the same equations.

After estimating the co-integrated VECM, innovation accounting was conducted to ascertain the dynamic responses of the variables to one-standard deviation shocks for other variables in the system. This was done by generating the impulse response functions from the system. Impulse Response Functions (IRF), trace the responsiveness of the dependent variable in the (VECM) to a unit shock in the error terms. For each variable from each equation, a unit shock was applied in the error term and the effects upon the VECM to a unit shock in error terms were observed over some time. If there were *K* endogenous variables in the model, a total of K^2 impulse responses were generated. In this study, the analysis was confined to the responses of LNCPI, LNFUEP, LNEXR, LNFI, LNFPI, LNGCAA, LNINF and LNINTR to the shocks in LNFUEP. To assess information concerning the relative importance of each innovation towards explaining the behaviour of the endogenous variables, variance decomposition analysis (VDC) was conducted. The generalized forecast error variance decomposition technique attributed to Koop *et al.,* (1996) and; Pesaran and Shin (1998) were used. This technique has the edge that its results are not sensitive to the ordering of the variables in the VECM.

RESULTS AND DISCUSSION

Results of Augmented Dicker Fuller (ADF) and Phillips-Perron (PP) Unit root test

Augmented Dicker Fuller *(ADF)* and Phillips-Perron *(PP)* unit root test results revealed that all the variables were homogenous in order one (Table 1). They were stationary by first difference before subsequent estimations to forestall spurious regressions. This implied that they are integrated in the order of 1 {i.e, *1(1)*} using intercept specification.

Table 1: Augmented Dicker Fuller (ADF) and Phillips-Perron (PP) unit root test Results

Logged Variable	ADF		PP		Conclusion
	Level Intercept	1st Difference Intercept	Level Intercept	1st Difference Intercept	
CPI	-0.8308[2]	-3.5236[0] ***	-0.5969 [3]	-3.4031 [4] ***	*I (1), I (1)*
ARGDP	-1.0494[0]	-.57704[0] ***	-1.1819[2]	-5.7657[2] ***	*I (1), I (1)*
FUEL	-2.0064[0]	-6.0108[1] ***	-1.9788[3]	-5.9394[4] ***	*1(1), I (1)*
EXR	-0.1404[0]	-5.4253[0] ***	-0.2519[3]	-5.4211[2] ***	*I (1), I (1)*
FI	-0.4726[1]	-8.9687[0] ***	-0.6370[4]	-8.7267[4] ***	*I (1), I (1)*
FPI	-1.9819[0]	-6.4586[0] ***	-1.9867[4]	-6.4917[4] ***	*I (1), I (1)*
GCAA	-0.2634[0]	-8.2848[1] ***	-0.3011[23]	-24.1118[35] ***	*I (1), I (1)*
INTR	-1.8309[0]	-7.7774[0] ***	-1.7017[2]	-7.7810[1] ***	*I (1), I (1)*

Source: Computed by Author, 2018. Notes: *** indicates significance at 1% level. The values in bracket [ ] for the ADF test show the optimal lag length selected by the SIC within a maximum lag of 9. The values in the bracket for the PP test indicated bandwidth selection, using the Newey-West's Bartlett Kernel.

Co-integration Test

The unit root test in Table 1 indicated that all the variables in the study became stationary at the first difference and integrated of order 1 {i.e, *1(1)*}. This necessitated the need for further tests to find the existence of a co-integrating relationship between the non-stationary variables. Both the Trace and the Maximum Eigenvalue tests revealed the presence of two co-integrating vectors relationship among consumer price index, agricultural real gross domestic product, the petrol pump price, exchange rate, food import, agricultural foreign private investment, government capital allocation to the agricultural sector and interest rate at 5% level of significance respectively (Table 3). This was evidence of a long-run relationship among these variables in Nigeria. Thus, applying the Vector Error Correction Model (VECM) would enable us to track the long-run relationship between the variables and tie it to a deviation that may occur in the short run (Lorde *et al.,* 2009; Akpaeti, 2015; Akpaeti *et al.,* 2018a).

Table 2 Johansen co-integration trace test

Null Hypothesis	Alternative Hypothesis	Test Statistic	Critical Value
r = 0	r = < 1	183.4264	159.5297**
r = 1	r = < 2	124.3295	125.6154
r = 2	r = < 3	86.45482	95.75366
r = 3	r = < 4	59.01462	69.81889
r = 4	r = < 5	35.78864	47.85613
r = 5	r = < 6	18.08416	29.79707
r = 6	r = < 7	7.565931	15.49471
r = 7	r = < 8	0.230737	3.841466

Source: Computed by Author, 2018. Notes: r indicates the number of the co-integrating vector. ** Significance levels at 5% respectively. P-values were obtained using response surfaces in Mackinnon *et al* (1999).

Table 3 Johansen co-integration maximum Eigen value test

Null Hypothesis	Alternative Hypothesis	Test Statistic	Critical Value
r = 0	r = 0	59.09695	52.36261**
r = 1	r = 1	37.87466	46.23142
r = 2	r = 2	27.44020	40.07757
r = 3	r = 3	23.22598	33.87687
r = 4	r = 4	17.70447	27.58434
r = 5	r = 5	10.51823	21.13162
r = 6	r = 6	7.335194	14.26460
r = 7	r = 7	0.230737	3.841466

Source: Computed by Author, 2018. Notes: r indicated the number of the co-integrating vector. ** Significance levels at 5% respectively. P-values are obtained using response surfaces in Mackinnon *et al* (1999).

Vector Error Correction Model Estimates

Long Run Result

The result of the long-run vector error correction model (Table 4) validates the earlier co-integration results (Tables 2 and 3 respectively). It confirmed a long-run relationship and close movement among the variables in the model. The VECM estimated using an optimum lag of 1 showed that five of the variables were significant against the four variables in the previous research with petrol pump price and farmers' productivity (Akpaeti *et al.,* 2018a). The five variables in this research were exchange rate (LNEXR), food import (LNFI), petrol pump price (LNFUEP), government capital allocation to the agricultural sector (LNGCAA) and interest rate (LNINTR). They were significant determinants of Consumer behaviour in Nigeria during the period of analysis and were statistically different from zero at 1% and 5% respectively. The remaining two variables: agricultural real gross domestic product (LNARGDP) and foreign private investment (LNFPI) were not significantly

different from zero. This means that previous agricultural real gross domestic product (LNARGDP) and foreign private investment (LNFPI) did not significantly affect the present variables. It was observed that both government capital allocation to the agricultural sector (LNGCAA) and interest rate (LNINTR) were significantly positive while exchange rate (LNEXR), food import (LNFI) and petrol pump price (LNFUEP) were negatively significant. This implies that past government capital allocation to the agricultural sector (LNGCAA) and interest rate (LNINTR) positively influenced the flow of the current government capital allocation to the agricultural sector (LNGCAA) and interest rate (LNINTR) while past exchange rate (LNEXR), food import (LNFI) and petrol pump price (LNFUEP) negatively influenced the current flow of exchange rate (LNEXR) and government capital allocation to the agricultural sector (LNGCAA) in Nigeria. Therefore, an increase or decrease in these significant variables will either increase or decrease consumer behaviour in Nigeria during the period reviewed.

Table 4: Vector Error Correction Estimates included Observation:44 after adjustment for Standard errors in ( )& t-statistics in [ ]

Co-integrating Eg:	**Co-integrated Eq. 1**
LNCPI (-1)	1.000000
LNARGDP (-1)	-2.277156
	(7.70565)
	[0.29552]
LNEXR (-1)	-15.10947
	(3.25213)
	[-4.64602] ***
LNFI (-1)	-12.06973
	(5.60740)
	[-2.15246] **
LNFPI (-1)	-0.990953
	(5.10797)
	[-0.19400]
LNFUEL (-1)	-8.804169
	(3.31667)
	[-2.65452] **
LNGCAA (-1)	30.07633
	(6.32690)
	[4.75372] ***
LNINTR (-1)	36.50574
	(11.1404)
	[3.27687] ***
C	-156.4208

Source: *Computed by Author, 2018. Note: ***1% and **5% significance levels.*

Short Run Causality Test

To examine the significant relationship existing between the macroeconomic variables and tied it to a deviation that may occur in the short-run of the study, a Vector Error Correction Granger Causality test was carried out. The result (Table 5) revealed five significant dependent variables namely: consumer price index (LNCPI) [cell 1], food import (LNFI) [cell 4], foreign private investment (FPI) [cell 5], petrol pump price (LNFUEP) [cell 6] and government capital allocation to the agricultural sector (LNGCAA) [cell 7]. They were determinants of short-run relationships within the Vector Error Correction Granger Causality test. These dependent variables had a significant unidirectional relationship with some of their independent variables (Table 5). For instance, under the dependent variable of lagged government capital allocation to the agricultural sector (LNGCAA) [cell 7], there was a unidirectional relationship between consumer behaviour proxy for consumer price index (LNCPI), agricultural productivity (LNARGDP), an exchange rate (LNEXR), food import (LNFI), petrol pump price (LNFUEP) and interest rate (LNINTR) and it moved from consumer behaviour(LNCPI), agricultural productivity (LNARGDP), the exchange rate (LNEXR), food import (LNFI), petrol pump price (LNFUEP) and interest rate (LNINTR) to government capital allocation to the agricultural sector (LNGCAA). This implied that the null hypothesis at 10% and 5% of statistical significance was rejected since the coefficients on the lagged variables of consumer behaviour (LNCPI), agricultural productivity (LNARGDP), an exchange rate (LNEXR), food import (LNFI), petrol pump price (LNFUEP) and interest rate (LNINTR) were statistically different from zero. Hence, consumer behaviour (LNCPI), agricultural productivity (LNARGDP), exchange rate (LNEXR), food import (LNFI), petrol pump price (LNFUEP) and interest rate (LNINTR) granger cause government capital allocation to the agricultural sector (LNGCAA). Conversely, the null hypothesis was not rejected at that level of statistical significance of foreign private investment (LNFPI). This implied that government capital allocation to the agricultural sector (LNGCAA) does not granger cause or had no relationship with foreign private investment (LNFPI) since the coefficient on the lagged government capital allocation to the agricultural sector (LNGCAA) was not statistically different from zero. The same decision rules applied to the remaining four dependent variables - consumer price index (LNCPI) [cell 1], food import (LNFI) [cell 4], foreign private investment (FPI) [cell 5] and petrol pump price (LNFUEP) [cell 6].

The results further showed four bi-directional relationships among variables unlike the previous research with petrol pump price and farmers' productivity with two-directional relationships between variables (Akpaeti *et al.,* 2018a) between consumer behaviour (LNCPI) and foreign private investment (LNFPI), food import (LNFI) and government capital allocation to the agricultural sector (LNGCAA), foreign private investment (LNFPI) and petrol pump price (LNFUEP), petrol pump price (LNFUEP) and government capital allocation to the agricultural sector (LNGCAA) and vice versa. This implied that the estimated coefficients on the lagged consumer behaviour (LNCPI) and lagged foreign private investment (LNFPI), lagged food import (LNFI) and lagged government capital allocation to the agricultural sector (LNGCAA), lagged foreign private investment (LNFPI) and lagged petrol pump price (LNFUEP), lagged petrol pump price (LNFUEP) and lagged govern-

ment capital allocation to the agricultural sector (LNGCAA) were statistically different from zero. Both the unidirectional and the bidirectional relationship of these dependent variables with their significant independent variables confirmed a short-run relationship between them within the Vector Error Correction Granger Causality test in Nigeria under the period reviewed. However, the dependent variables of agricultural gross domestic products (LNARGDP) [cell 2], the exchange rate (LNEXR) [cell 3] and interest rate (LNINTR) [cell 8] had no relationship with their independent variables since they were not significantly different from zero, as such, were not discussed further.

Table 5: Short Run VEC Granger Causality/Block Exogeneity Wald Tests.
Sample: 1970-2016. **Included Observations:** 44

Dependent variable: D(LNCPI) CELL 1				Dependent variable: D(LNARGDP) CELL 2			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D(LNARGDP)	5.152757	2	0.0760*	D(LNCPI)	0.107292	2	0.9478
D(LNEXR)	1.686310	2	0.4304	D(LNEXR)	0.390047	2	0.8228
D(LNFI)	2.283837	2	0.3192	D(LNFI)	0.033665	2	0.9833
D(LNFPI)	5.401646	2	0.0672*	D(LNFPI)	3.101158	2	0.2121
D(LNFUEP)	2.228461	2	0.3282	D(LNFUEP)	0.777805	2	0.6778
D(LNGCAA)	3.625398	2	0.1632	D(LNGCAA)	2.571635	2	0.2764
D(LNINTR)	1.764930	2	0.4138	D(LNINTR)	0.702348	2	0.7039
All	30.10512	14	0.0074	All	6.787836	14	0.9426

Dependent variable: D(LNEXR) CELL 3				Dependent variable: D(LNFI) CELL 4			
Excluded	Chi-sq	df	Prob.	Excluded	Chi-sq	df	Prob.
D(LNCPI)	3.319436	2	0.1902	D(LNCPI)	1.410214	2	0.4941
D(LNARGDP)	1.144005	2	0.5644	D(LNARGDP)	0.967107	2	0.6166
D(LNFI)	0.759464	2	0.6840	D(LNEXR)	0.890389	2	0.6407
D(LNFPI)	1.439998	2	0.4868	D(LNFPI)	5.931577	2	0.0515*
D(LNFUEP)	0.845722	2	0.6552	D(LNFUEP)	3.265977	2	0.1953
D(LNGCAA)	2.556635	2	0.2785	D(LNGCAA)	5.809978	2	0.0547*
D(LNINTR)	4.148071	2	0.1257	D(LNINTR)	4.563476	2	0.1021
All	11.47416	14	0.6485	All	28.02421	14	0.0141

Dependent variable: D(LNFPI) CELL 5

Excluded	Chi-sq	df	Prob.
D(LNCPI)	8.628537	2	0.0134*
D(LNARGDP)	0.547963	2	0.7603
D(LNEXR)	1.165505	2	0.5584
D(LNFI)	1.921421	2	0.3826
D(LNFUEP)	5.606946	2	0.0606*
D(LNGCAA)	1.487644	2	0.4753
D(LNINTR)	1.593743	2	0.4507
All	22.38969	14	0.0710

Dependent variable: D(LNFUEP) CELL 6

Excluded	Chi-sq	df	Prob.
D(LNCPI)	3.556695	2	0.1689
D(LNARGDP)	0.278821	2	0.8699
D(LNEXR)	1.702367	2	0.4269
D(LNFI)	1.497771	2	0.4729
D(LNFPI)	8.220814	2	0.0164*
D(LNGCAA)	6.869858	2	0.0322*
D(LNINTR)	4.861801	2	0.0880*
All	17.64754	14	0.2233

Dependent variable: D(LNGCAA) CELL 7

Excluded	Chi-sq	df	Prob.
D(LNCPI)	8.207772	2	0.0165*
D(LNARGDP)	7.175574	2	0.0277*
D(LNEXR)	5.463414	2	0.0651*
D(LNFI)	6.989590	2	0.0304*
D(LNFPI)	4.179496	2	0.1237
D(LNFUEP)	10.37490	2	0.0056**
D(LNINTR)	4.655868	2	0.0975*
All	33.32458	14	0.0026

Dependent variable: D(LNINTR) CELL 8

Excluded	Chi-sq	df	Prob.
D(LNCPI)	3.629082	2	0.1629
D(LNARGDP)	2.127537	2	0.3452
D(LNEXR)	0.682904	2	0.7107
D(LNFI)	3.503172	2	0.1735
D(LNFPI)	1.216215	2	0.5444
D(LNFUEP)	0.997635	2	0.6072
D(LNGCAA)	0.302571	2	0.8596
All	12.45934	14	0.5695

Source: Computed by Author, 2018. Note: ** and * =5% and 10% significance levels respectively

Going by the Johansen co-integration results, a vector error correction model (VECM) with at least two co-integrating vectors was conducted to ensure that the estimated VECM was not false. The residual autocorrelation and correlogram tests were also conducted (Akpaeti, 2015). The results revealed that the residuals of the estimated VECM were appropriately uncorrelated, implying that the estimated VECM is correctly specified or unbiased and the parameters estimated are consistent. This was because the spikes from the correlograms revealed the relative correlation of the error terms in the VECM equations and the closer the spikes are to the zero lines, the more uncorrelated the error terms (Akpaeti, 2015 and Akpaeti *et al.,* 2018b). The coefficients from the estimated VECM were not of primary interest in this empirical work. Instead, the focus was on the Impulse Response Functions (IRFs) and Variance Decomposition (VDC) generated from the VECM.

Impulse Response Functions

The Impulse Response Functions traced out the responsiveness of the dependent variable in the VECM to shocks on each of the variables using the Cholesky one standard deviation innovations (Choleskey one Standard deviations examine the dynamic interactions

among variables). This implies that impulse responses show the path of consumer behaviour (LNCPI) when there are innovations in macroeconomic policy variables. For each equation, a unit shock was applied to the error, and the effects upon the VECM system over 10 years were examined. The VECM system has eight variables, thus a total of 64 impulses could be generated. However, the primary objective is to examine the impact of petrol pump price shocks on the other seven macroeconomic or endogenous variables and themselves. Therefore, only the responsiveness of the petrol price on the macro-economic variables (LNCPI, LNARGDP, LNEXR, LNFI, LNFPI, LNFUEP, LNGCAA and LNINTR) was traced out. There were eight panels of impulse response graphs revealing how innovations in petrol pump price variables affected consumer behaviour, itself and other policy variables in Nigeria over 10 years (Figure 1). Each panel illustrates the policy variables' response to a one-standard-deviation innovation (corresponding to a positive shock) in the policy variable (Akpaeti, 2015; Akpaeti *et al.,* 2018a).

Panels A, C, D, E and G showed the impulse responses of consumers' behaviour, exchange rate, food import, foreign private investment and government capital allocation to agriculture respectively to the one-time shock in the petrol pump price (Figure 1). These five macroeconomic policy variables reacted negatively in a fluctuating and significant way over the the10-year period to the positive shock of the petrol pump price. This suggests that an increase in the petrol pump price will significantly be impacted negatively on agricultural consumer behaviour, exchange rate, food import, foreign private investment and government capital allocation to agriculture respectively both in the short and long run. This result corroborates the previous work of Akpaeti *et al.,* (2018a) where frequent and unstable petrol pump prices in Nigeria increased food import, inflation, foreign private investment and government capital allocation to agriculture. When consumer behaviour and foreign private investment are affected because of the hike in the petrol pump price, it lowers consumers' purchasing power and discourages investors from investing in the agricultural sector. Negative exchange rates and government capital allocation to agriculture will lower investment opportunities in the country. The negative exchange rate in the study is in line with negative theoretical postulation considering the seasonal nature of agricultural production in a country with an open economy having many trading partners. However, the negative food import was a blessing in disguise for the local producers, but where there was a lag in purchasing power, the wherewithal and propensity for the importation of food were questioned. The negative but significant impact of the petrol pump price shock on these macroeconomic variables (Figure 1) confirmed the weak and unstable nature of the Nigeria mono market (oil) economy.

Panel B, F and H (Figure 2) revealed the positive but undulating responses of agricultural productivity, interest rate and petrol pump price to itself for ten years to the shock of the petrol pump price. The positive impact of interest rate and agricultural productivity on the economy to the fluctuating shock of petrol pump price may be attributed to opportunities available to the local producers to export their produce due to the ban on the importation of goods by the government in a bid to increase investment opportunities.

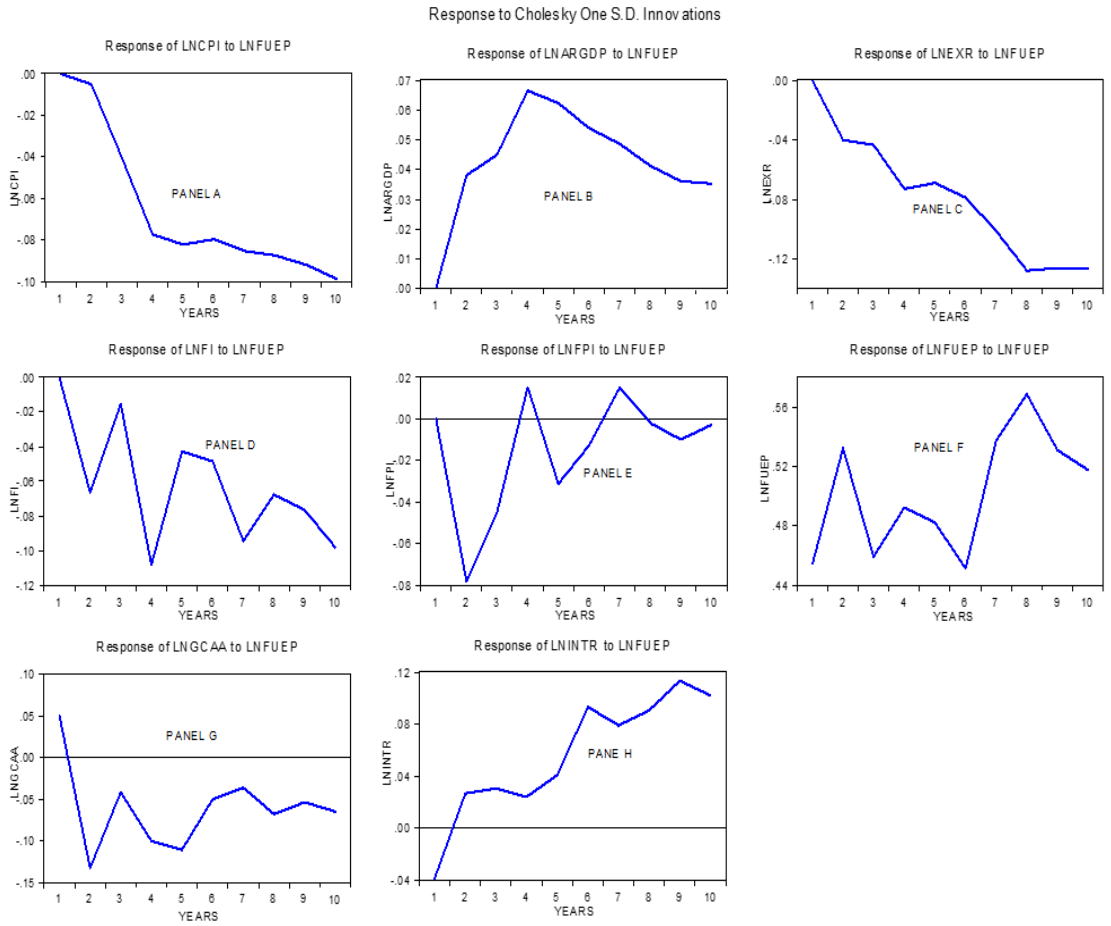

Figure 2: Response of LNCPI, LNARGDP, LNSAV, LNPCI, LNEXR, LNFI, LNFPI, LNFUEP, LNGCAA and LNINTR shock in Cholesky one standard deviation (Choleskey one Standard deviations examine the dynamic interactions among variables)

Variance Decomposition Analysis (VDC)

The Variance Decomposition Analysis (VDC) provided a means of analysis to determine the relative importance of the dependent variable in explaining the variations in the explanatory variables (Table 6). The values confirmed the results obtained from the Impulse Response analysis (IRF). On average, 78.55% of most of the variation in the forecast error for petrol price was explained by the shocks to itself while consumer behaviour shock had a declining and fluctuating value from period one to four (0.96%), averaging in period five with 1.36% of the variation of petrol pump price and continue fluctuating to the ten years. This indicated the negative impact unstable petrol pump price had on consumers' behaviour hence their purchasing power. Average contributions of agricultural productivity, exchange rate, food import, foreign private investment, government capital allocation to agriculture and interest rate were 1.20%, 0.76%, 3.51%, 13.29%, 0.51% and 0.82% respectively. The above figures showed the

negative impact fluctuating petrol pump price had on the economy. Every other macro-economy variable had its share of the fluctuating trend of petrol pump prices except for food import and foreign private investment. This was because the local producers and foreign private investment explore negative situations caused by the incessant increase in petrol pump prices to their advantage. The local producers exported their produce while the foreign private investment invested in the local producers to make a profit.

Table 6 Variance Decomposition of LNFUEP

Period	S.E.	LNCPI	LNARGDP	LNEXR	LNFI	LNFPI	LNFUEP	LNGCAA	LNINTR
1	0.477891	2.491164	0.008629	1.181026	2.754939	3.073254	90.49099	0.000000	0.000000
2	0.753160	1.333812	0.948492	1.091019	4.515007	5.319689	86.37837	0.037281	0.376327
3	0.955040	1.257317	1.650461	0.808404	5.188953	13.56362	76.83977	0.374805	0.316671
4	1.107699	0.965477	1.228119	0.697582	4.275302	14.78136	76.86410	0.538564	0.649503
5	1.223413	1.358089	1.196573	0.760327	3.510937	13.29335	78.55395	0.511581	0.815194
6	1.333106	2.156409	1.026187	0.836249	3.302067	13.58525	77.60944	0.444629	1.039770
7	1.475791	2.336046	1.056603	0.798442	3.286855	14.43989	76.57555	0.363198	1.143425
8	1.613676	2.239998	1.176008	0.873497	3.017904	14.60201	76.46073	0.404952	1.224906
9	1.728602	2.173464	1.175320	0.761313	2.810448	15.39762	76.06801	0.362762	1.251059
10	1.835052	2.184733	1.263259	0.676575	2.693475	16.18170	75.45411	0.323404	1.222748

Source: Computed by Author, 2018. Note S.E (Standard Error), LNCPI (log of Consumer Price Index), LNARGDP (log of Agric. GDP), LNEXR (Exchange rate), LNFI (Food Import), LNFPI (log Foreign Private Investment), LNFUEP (log of Petrol Pump Price), LNGCAA (Log of Government Capital Allocation to Agricultural Sector) and LNINTR (log of Interest Rate).

CONCLUSION AND RECOMMENDATIONS

The study investigated the relationship between petrol pump price fluctuations and consumers' behaviour in Nigeria from 1970 to 2016 using a multivariate Vector Error Correction framework. Results showed the existence of both long and short-run relationships between petrol pump prices and consumers' behaviour. Impulse response results showed that petrol pump prices negatively impacted consumers' behaviour and other macroeconomic policy variables such as exchange rate, food import, foreign private investment and government capital allocation to agriculture respectively both in the short and long run. The negative but significant impact of the petrol pump price shock on these macroeconomic variables confirms the weak and unstable nature of Nigeria's mono-market (oil) economy (Akpaeti *et al.,* 2018a). The petrol pump price impact on these macro-economic policies in the economy creates room for local producers and foreign private investment to thrive. The local producers seize the opportunities to export their produce while the foreign private investment invests in the local producers to make a profit. As such, the government needs to create a better conducive environment for the local agricultural producers and foreign private investors to export

and invest accordingly. This will be achieved by reducing the exchange rate for exported agricultural goods for the local farmers and increasing the interest rate for the investors. This corroborates with the economic postulation that the higher the interest rate arising from unstable price fluctuation, the higher the investment opportunities, and vice versa. There is also a need for government to embark on full deregulation of the petroleum downstream sector to ensure product market competitiveness, fast tract the construction of modular refineries for all the states in the Niger Delta of Nigeria, construct at least two tank farms per geographical zone of the country and ensure fast efficient and effective petroleum product transportation. The government should pursue policies that would control the price of petrol to ensure that its unstable price will not hamper the productivity of the agricultural sector while ensuring check and balance (using anti-corruption agencies) in the Nigeria National Petroleum Corporation (NNPC) for financial prudence. Above all, efforts should be geared toward the development of solar energy technology in line with developed countries like Britain which has proposed to ban the use of fossil fuel vehicles.

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