Econometric Analysis of the Effect of Changes in Price on Consumption Pattern of Petrol, Rice and Bean in Owerri City, Imo State, Nigeria

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ABSTRACT: It was hypothesized that changes in price could affect the consumption pattern of petrol, rice and bean, their status as basic needs notwithstanding. To test this hypothesis, primary data were generated, subjected to econometric model and analyzed. Two-hundred residents of different income groups who live in Owerri city, Imo State, Nigeria and have used petrol, rice and bean for at least ten years and were not less than thirty-one years old were sampled using standard method. The pretest result of questionnaire validity and reliability was $r = 0.726$ and this indicates high reliability. A total of 90% strongly agreed and agreed that prices of petrol, rice and bean are unstable in Owerri City, Imo State, Nigeria. The results indicate that 70% of the consumers strongly agreed and agreed that price affects consumption of the products irrespective of need. This was a significant observation too. In the study, availability of petrol, rice and bean affected consumption in an urban environment. Grain quality was found a strong determinant of consumption of rice and bean in the city. There was a positive and non-significant relationship between price and consumption of petrol, rice and bean and this shows that price is not the most important determinant of consumption of all commodities. Necessity was more important than price in consumption of petrol, rice and bean in the city of Owerri, Imo State, Nigeria. These findings are useful to econometricians, policymakers, governments and households.

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and food security. Aliyu and Amadu (2017) stressed that in Nigeria, per-capita growth of production of major foods is not enough to meet the demands of ever increasing urbanization and population. This creates the need to perform routine analysis in order to identify factors of importance. The removal of petrol subsidy and economic recession led to alarming increase in the price of commodities in Nigeria. Till date, many Nigerians are yet to recover. Petrol, rice and beans appear indispensable in the basic items on the consumption pattern of petrol, rice and bean in the study area.

MATERIALS AND METHODS
This study was carried out in Owerri city, Imo State, Nigeria in 2019. The population of Imo was projected as 5,408, 800 in 2016 (National Population Commission of Nigeria and National Bureau of Statistics). Owerri city is situated in the cities place category with global positioning system coordinates of 5° 28' 34.7160'' N and 7° 1' 33.0708'' E. The latitude is 5.476310 and the longitude is 7.025853 (https://www.latlong.net/place/owerri-imonigeria-13046.html). Primary data were sufficiently generated for the investigation. Well-structured questionnaire was self-administered randomly to two-hundred residents who live in Owerri city and are not less than thirty-one years old. The sampled population must have used petrol, rice and bean for at least 10 years. Petrol, rice and bean were chosen because of their importance. The questionnaire was validated and the reliability was tested using Cronbach Alpha coefficient (Robinson, 2009; Feng and Yamat, 2019). The questionnaires were completed on the spot and were returned immediately.

The questionnaire provided answers to the research questions and hypothesis. The null hypothesis (H0) tested states that changes in price do not have any effect on consumption rate of petrol, rice and bean in Owerri City, Imo State, Nigeria. Whereas, the alternative hypothesis (H1) states that changes in price have an effect on consumption rate of petrol, rice and bean in Owerri City, Imo State, Nigeria. The level of significance considered was 0.05. The decision rule was to reject the null hypothesis if the p-value is less than the level of significance and accept if otherwise. To test this hypothesis and check whether consumption rate remains unaffected irrespective of changes in price, multiple regression econometric model was applied as follows:

\[ Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{2i} + \beta_3 X_{3i} + u_i, \]

\[ i = 1, 2, 3, n \] (1)

From theoretical perspective, the model states that consumption rate depends on price of petrol, rice and bean. The consumption pattern is weighted combination of petrol, rice and bean. The weights \( \beta_1, \beta_2 \) and \( \beta_3 \) are the respective effects of a unit change in the increase in the prices of these basic items on the consumption rate through price change. Thus consumption rate is expressed as follows;

Consumption Pattern = \( \beta_0 + \beta_1 \) Petrol Price + 
\( \beta_2 \) Rice Price + \( \beta_3 \) Beans Price + Error

Where, Error = Consumption Pattern
- \( \beta_0 - \beta_1 \) Petrol Price - \( \beta_2 \) Rice Price - \( \beta_3 \) Bean Price

On the estimation, the intercept (\( \beta_0 \)) and slope coefficient (\( \beta_1, \beta_2, \beta_3 \)) are expected prior to having a positive sign, \( \beta_i \) (i =0, 1, 2, 3) > 0, implying that consumption rate is expected to correlate positively with the increase in prices of petrol, rice and bean while error is the random disturbances in the model. The model is based on some basic assumptions about the regressors and the error terms.

The assumptions concerning the error term;

i. \( \mu \) is a random vector
ii. \( E(\mu) = 0 \)
iii. \( E(\mu \mu’) = \sigma^2 I_n \) that is \( E(\mu \mu’) = \begin{cases} \sigma^2 & i = j \\ 0 & i \neq j \end{cases} \)
iv. \( \mu \sim NID(0, \sigma^2 I_n) \)

The assumptions concerning the explanatory variables;

i. The values taken by X variables are fixed in repeated sampling.
ii. The non-stochastic regressors (X) and the stochastic error terms are uncorrelated. That is \( E(X’ \mu) = 0 \)
iii. The regressors are linearly independent, hence \( |X’X| \neq 0 \), which follows that X matrix has rank \( r = (k - 1) < n \)
Statistical Package for the Social Sciences (SPSS) version 23.0 was the software used to run the analysis. The normal percentage probability was plotted against the residual for the model. The residuals are 
\[ \hat{e}_{ij} = y_{ij} - \hat{y}_{ij} \]
where \( \hat{y}_{ij} \) is the average observation in the \((ij)\)th cell. If the points follow approximately along the diagonal line, it is concluded that the data are approximately normally distributed. If the points have a distinct curvature, the data are likely skewed. If the points follow S-curve shape, data are likely uniform. Homoscedasticity test (using Levene’s test of constant variance) was also done to determine the suitable model to be applied.

RESULTS AND DISCUSSION
In the study, the result of questionnaire validity and reliability test was \( r = 0.726 \). Figure 1 shows the result of the probability plot of the residual during investigations on normality of data collected in Owerri city, Imo State, Nigeria during August, 2019. It was observed that the points in the probability plot follow approximately along the diagonal line. Table 1 shows the result of homoscedasticity test of data collected in Owerri City in August, 2019. The consumption pattern passed the assumption of constant variance and Figure 2 shows the distribution plot. Table 2 presents the gender of the respondents in Owerri city, Imo State, Nigeria who have consumed petrol, rice and beans for a minimum period of 10 years. The results showed a total of two hundred respondents. Eighty respondents which represented 40% of sampled population were males while one hundred and twenty respondents which represented 60% of the population were females. Table 3 shows the age grade of respondents. Ages 31-40 years were the lowest age grade in the survey and constituted 20% of the sample whereas, > 60 years of age was the highest age grade and constituted 20% of the sample too. Table 4 shows the marital status of sampled population. Forty respondents representing 20% were single while 160 individuals (80%) were married. Table 5 presents information on the highest educational qualification of sampled population. A total of six respondents (3%) have First School Leaving Certificate as their highest qualification. Thirty individuals (15%) have the West African Senior School Certificate as highest qualification. Fifty respondents which represent 25% of the sampled population possess the Ordinary National Diploma or Nigerian Certificate of Education or Advance Level Certificate. Seventy respondents (35%) hold Bachelor’s degree or Higher National Diploma while the remaining 22% (44 respondents) possess postgraduate degree. Table 6 shows the occupational distribution of the respondents. One hundred respondents (50%) worked in the public sector, 50 respondents (25%) worked in the private sector and 50 respondents (25%) were self-employed.

Figure 3 summarizes the percentage responses of respondents that prices of petrol, rice and bean are unstable in Owerri City, Imo State, Nigeria. A total of 90% strongly agreed and agreed to this assertion and this is a significant observation. Figure 4 shows the percentage responses of respondents that price affects consumption of petrol, rice and bean in Owerri City, Imo State, Nigeria and 70% of the sampled population strongly agreed and agreed. This is significant too. Figure 5 presents the percentage response of the respondents that availability of petrol, rice and bean affects the consumption of the products in Owerri City, Imo State, Nigeria. A total of 84% strongly agreed and agreed to this assertion. Figure 6 shows the percentage response of respondents that grain quality affects consumption of rice and bean in Owerri City, Imo State, Nigeria and 90% of the respondents strongly agreed and agreed that grain quality affects consumption rate. The analysis of variance testing whether changes in price affect the consumption of petrol, rice and bean is shown in Table 7a and Table 7b presents the model summary. The correlation coefficient R of consumption of petrol, rice and bean and price was 0.407. The relationship is positive but was not significant.

![Probability Plot of Residual during Investigations on Normality of Data Collected in Owerri City during August, 2019.](image)

Table 1. Result of Homoscedasticity Test of Data Collected in Owerri City, Imo State, Nigeria in 2019.

| Test | Levene Statistic | Df | P-value |
|------|-----------------|----|---------|
| Consumption based on Mean | 5.363 | 2 | 0.065 |
| Consumption based on Median | 1.529 | 2 | 0.147 |
| Based on Median and trimmed mean | 1.929 | 2 | 0.148 |
| Based on trimmed mean | 1.535 | 2 | 0.065 |

The analysis of result of questionnaire validity and reliability showed high reliability and this is supported by Hinton et al. (2004), Straub et al. (2004) and Feng and Yamat (2019).

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Changes in prices of petrol rice and bean in Nigeria have continued to attract widespread attention (Ocheni, 2015; Orlu, 2017; Nwosu et al., 2016). The consumption pattern of petrol, rice and bean has faced dramatic changes even in recent times and therefore estimates of how their consumption is affected by changes in price is necessary (Dunnem and Edkins, 2005). Hike in the prices of petrol, rice and bean could incontrovertibly lead to food security problems and poverty. The economic recession experienced by Nigeria has greatly affected all sectors of the economy and part of the consequence is that the consumption pattern of many Nigerians is adversely affected. From the analysis of the probability plot of the residual and the distribution plot, the data were approximately normally distributed and this provided part of the justification for its use. In the study, the consumption pattern passed the assumption of constant variance since the p-value 0.063 is greater than the probability value of 0.05.

### Table 2. Gender of Respondents in Owerri City, Imo State, Nigeria during 2019.

| Sex     | Frequency | Percentage constitution |
|---------|-----------|-------------------------|
| Male    | 80.0      | 40.0                    |
| Female  | 120.0     | 60.0                    |
| Total   | 200.0     | 100.0                   |

*Source: Authors computation from questionnaire.*

### Table 3. Age Grade of Respondents in Owerri City, Imo State, Nigeria during 2019.

| Age (years) | Frequency | Percentage constitution |
|-------------|-----------|-------------------------|
| 31-40       | 40.0      | 20.0                    |
| 41-50       | 60.0      | 30.0                    |
| 51-60       | 60.0      | 30.0                    |
| >60         | 40.0      | 20.0                    |
| Total       | 200.0     | 100.0                   |

*Source: Authors computation from questionnaire.*

### Table 4: Marital Status of Respondents in Owerri City, Imo State, Nigeria during 2019.

| Marital status | Frequency | Percentage constitution |
|----------------|-----------|-------------------------|
| Single         | 40.0      | 20.0                    |
| Married        | 160.0     | 80.0                    |
| Total          | 200.0     | 100.0                   |

*Source: Authors computation from questionnaire.*

### Table 5: Highest Educational Qualification of Respondents in Owerri City, Imo State, Nigeria during 2019.

| Qualification                          | Frequency | Percentage constitution |
|----------------------------------------|-----------|-------------------------|
| First School Leaving Certificate (FSLC) | 6.0       | 3.0                     |
| West African Senior School Certificate (WASSC) | 30.0     | 15.0                    |
| OND*/NCE/**Advance Level               | 50.0      | 25.0                    |
| Bachelor’s degree/Higher National Diploma | 70.0     | 35.0                    |
| Postgraduate degree                    | 44.0      | 22.0                    |
| Total                                  | 200.0     | 100.0                   |

*Ordinary National Diploma; ** Nigerian Certificate of Education. Source: Authors computation from questionnaire.*

The biometrics of sampled population indicates that the consumers of the products in the city were of different gender, age, marital status and had different educational background. The variation encountered is interesting and ultimately reduced bias in the study. They had used the products for at least ten years and so data obtained from them are reliable. This is because experience is vital in reliability of information supplied (Katarzyna and Shaofeng, 2018). The results further revealed that prices of petrol, rice and bean are unstable in the area and this significant observation has serious economic implications. Instability in the price of petrol, rice and bean disorganises many Nigerian households, causes disorderliness in the feeding pattern of the people and ultimately impoverishes the citizenry. Evidences (Ocheni, 2015; Orlu, 2017) have shown that when the price of petrol increases, even when it is marginal, cost of transportation becomes too exorbitant. This in turn affects every other activity in the country and prices of other commodities including rice and bean become adversely affected. Many families cannot afford to pay school fees and house rents when this occurs. Price instability and impact on economic growth has continued to receive controversial attention (Akalplcr and Nuhu, 2018). Some legislators and economists advice that price instability has the capacity to stimulate domestic production and development (Olomola, 2006; Akpan, 2009) whereas earlier report by Darby (1982) maintains that price instability restricts development. It is clear that the immediate consequence of price instability is disorderliness and many households and businesses cannot immediately adjust. The study also revealed that price affects consumption of petrol, rice and bean in Owerri city, Imo State, Nigeria. This has shown that even in the city where many residents are well-to-do individuals, price is a strong determinant of

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consumption. Our study revealed that availability of the products affects consumption rate. This is in line with normal economic attitude where the propensity to consume tends to be higher when the product is abundantly available. We also found that grain quality is an important factor of consumption of rice and bean in the city.

Table 6: Occupational Distribution of the Respondents in Owerri City, Imo State, Nigeria during 2019.

| Occupation category | Frequency | Percentage |
|---------------------|-----------|------------|
| Public sector       | 100.0     | 50.0       |
| Private sector      | 50.0      | 25.0       |
| Self-employed       | 50.0      | 25.0       |
| Total               | 200.0     | 100.0      |

Source: Authors computation from questionnaire.

In other words, the sampled population would consume more, when available grains are of good quality. This agrees with the issue of visual appeal in both local and international markets.

According to Lale (2002) bad quality grain is often neglected in markets and it faces lower attraction and consumption. In econometrics, this has some implications since the food security of the products have been compromised. The result of the correlation coefficient implies that consumption of petrol, rice and bean is not significantly affected by changes in price. This is probably because; the concerned items constitute basic needs of life. It is now obvious why increases in price did not reduce consumption of the products. Therefore, this study has revealed that increase in the price of basic needs does not ultimately lead to reductions in consumption rate.

Conclusion: The present study reveals that price is not the most important determinant of consumption of all commodities. Necessity was more important than price in consumption of petrol, rice and bean in the city of Owerri, Imo State, Nigeria (an urban environment). We recommend that basic items of need should be subsidized by the government to ensure stable and affordable prices. Individuals should involve in active occupations to ensure they have stable sources of income. Nigerians should reconsider agriculture as major source of income.

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