**ESTIMATION OF PRICE VARIABILITY OF SELECTED AGRICULTURAL PRODUCTS IN AKWA IBOM STATE, NIGERIA: 2000-2015**

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Abstract

The study estimated price variability of selected agricultural products in Akwa Ibom State between 2000 to 2015. Objectively, it assess trend in prices of agricultural products, percentage changes in prices and its effect on output and the determinants of price variability of agricultural products in the study area. Secondary were obtained from Ministry of Economic Development, Akwa Ibom State, Akwa Ibom Agricultural Development Program (AKADEP), National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) publications. Simple percentages and multiple regression models were used to analyse data obtained and results are presented in graphs and tables. Findings show trending agricultural product prices and also a fluctuating percentage change in the prices of agricultural products. Agricultural products price variability show a positive relationship to agricultural output. A variation in prices of the products results in a corresponding change on output. Also, pump price, exchange rate, average rainfall, aggregate input price and inflation rate were the determinants of variability of prices of agricultural products in the study area. Study suggests the implementation of policies which will buffer the agricultural sector from the effect of variability of agricultural product prices. Also, policies which reduce the rate of inflation will minimize price variability among agricultural commodities and consequently reduce inefficiency, distortions and misallocation of resources in agriculture that might be caused by inflation.

Keywords: Price variability, Trending, Agricultural products, Nigeria

Introduction

Instability in commodity prices among markets is highly detrimental to the marketing system and the economy as a whole, resulting in inefficiency in the allocation of resources depending on the source of variability. Comparing the role of agriculture in Nigeria economic growth and development, with any other major sector in the economy, it is highly competitive and most of the output are perishable, agriculture is the least able to pass input and output cost increases (Ukoha, 2008). Price variability of agricultural products constitutes one of the most threatening problems facing the agricultural sector worldwide today. This is mainly due to inelastic nature of aggregate demand and supply for the products, associated with their characteristics. Some studies identified widespread inter-regional and inter-seasonal variation in prices as factors that affect adequate planning of farming, industrial operations and output expansion. The effect of this is felt as the fluctuating prices of agricultural products take many unaware, causing an increased concern over the ability of the world food economy to adequately feed billions of people now and in future. The International Monetary Fund (2008) reported that most of the food crisis in developing countries is triggered by the surging prices of food and fuel occurred in developing countries. Many of these developing countries are food importers and so far have seen their annual food import bills double since 2000.

Central Bank (2016), reported that about $11bn ($8.1tn) was spent to import four (4) consumable commodities -rice, wheat, fish and sugar- annually. Food import is seen to be growing at a rate of 11 per cent per annum (CBN, 2016), and this is worrisome! Agricultural product prices have been fluctuating widely over the last few years,
affecting not only consumers but producers too, and the negative food security impact of higher food prices is greatest on poor consumers in the developing countries. In Akwa Ibom State, study carried out by Etuk and Mfonobong, (2016) shows that retail market prices of selected food commodities are increasing overtime. It shows no uniformity in terms of the periods during which these price increase occurred for the selected agricultural commodities during the period (2000-2015). The degree of variability in commodity prices is traditionally believed to depend heavily on output levels and on the nature and frequency of unexpected shifts in demand and supply. Thus, essentially all market forces affecting commodity price formation could potentially come into play in determining price variability of commodities such as climatic conditions, total acreage for cultivation, government policies, and international trade factors such as import, export and exchange rate.

Price variability is not only harmful to consumers but also affects producers both in business and decision making. On the positive side, higher product prices enable producers to invest in promising productivity and production. Although high prices can technically be good news for farmers, price fluctuation is extremely dangerous, as farmers and other agents in the food chain risk losing their investments if prices fall intermittently. Most rural farmers do not have enough investment capital as well as insurance option to absorb such unpredictable shocks. Randy (2015) submitted that extreme variability in commodity prices, particularly of food commodities, affects farmers adversely because their incomes are uncertain. Farmers have variable income through sales of their products and this may be caused by factors such as varying prices of inputs, weather, change in acreage, lack of storage facilities, change in technology etc. such farmers cannot be sure of what income they will receive from year to year to enable them plan and allocate their resources efficiently.

Agricultural products price variability has greater impact on the developing world. Garri, plantain, palm oil, chicken, okra, pepper and maize are the classified among the most staple food in the study area. Unstable prices for important food staples listed can cause undesired economic, social and political consequences. Highly unstable prices can lead to inefficient agricultural production decisions, especially when markets for credit and risk are poorly developed. The human costs of food price shocks can be disastrous for the poor, because food staples often constitute a large share of poor farmers’ incomes and poor consumers’ expenditures (Gilbert & Morgan, 2010). Price variability of agricultural products leads also to increased volatility of farming household’s income which may increase their rate of diversification from farming to non-farm activities, thereby reducing productivity in agriculture (Akpan and Edet, 2016). When prices of commodities within agriculture vary due to different factors, such movement may decrease economic welfare for society as a whole and the agricultural sector in particular (Ukoha, 2008), resource allocation efficiency is decreased because decision makers have less useful information on prices to guide them in decision making. When prices fluctuate, even if they are tolerable on average, the short-term shock make both smallholder farmers and poor consumers vulnerable to long-term poverty situations, forcing them to take up temporary coping mechanisms such as distress asset sales or reduced intake of nutritious foods, and making them food insecure. The risk associated with choosing which commodity to produce increases with inflation (Ukoha, 2008).

Hence this study has the following objectives: to assess the trend of price of selected agricultural products in the study area, to estimate the annual percentage variation in prices of selected agricultural products in the study area from 2000 – 2015, to assess the effect of agricultural products price variability on selected agricultural output in the study area over the years and estimate the determinants of agricultural price variability in the study area.

Theoretical framework
Cobweb Theory
This study is based on cobweb theory propounded by Nicholas Kaldor in 1934. It asserts that supply adjusts itself to changing conditions of demand which are manifested through price changes not instantaneously but
after certain period. The cobweb theory is an economic model that explains why prices might be subject to periodic fluctuations in certain types of market. It describes cyclical supply and demand in a market where the amount produced must be chosen before prices are observed; it is based on the time lag between supply and demand decisions. The cobweb theory suggests that prices can become stuck in a cycle of ever-increasing volatility. Example, if price fall, many farmers will go out of business, the next year supply will fall. This causes price to increase. However, this higher price acts as incentive for greater supply. Therefore, next year supply increases and prices fall again.

**Conceptual framework**

![Diagram of determinants of price variability](image)

**Figure 1: Determinants of Price Variability**

Prices of agricultural products exhibit variability for many reasons. Some price changes may be largely predictable, such as those caused by a factor as seasonality of the product, whereby price is lowest during and soon after harvest and highest immediately before harvest. On the other hand, some factors such as weather shock and may be typically unpredictable and may lead to unpredictable changes in prices, especially if stock is low. It is seen that multiple factors contribute to price variability of agricultural products. In short term, the benefits of high prices go primarily to farmers with a large marketed surplus, and these farmers are not the poorest. People usually buy more food than they sell. Thus, high food prices tend to worsen poverty, food insecurity and malnutrition among other negative effects. However, high prices represent an opportunity to spur long-term investment in agriculture, which may contribute to sustainable food security in the longer run.

Figure 1 describes the nature of price variability of agricultural products, showing the various determinants of price variability and its effect on consumers and investors.

**Review of related literature**

Tothora and Monika (2011) discussed the main challenges of price volatility in agricultural commodity markets and concluded that though volatility has always been a feature of agricultural commodity market, the evidence suggests that volatility has increased at least in
some commodity market and there seems to be an overlap between periods of high prices and increased volatility. It was identified that volatility peaks also seem to coexist with decreased stocks. The study abstained from considering the development of fundamentals and macroeconomic factors, such as exchange rate developments. Etuk and MfonObong (2016) estimated the percentage changes in prices of agricultural products. Data obtained was analysed using Coefficient of variance (CV) and result revealed that mean annual percentage changes in the retail prices of selected products showed a fluctuating trend. Huka et al., (2014) studied how price variability affect small scale farmers’ development, and found several contributions of good price to farmers’ livelihood as well as enhancing the use of better farming technology.

Etuk and Mfon-Obong (2016) analysed the market prices of selected agricultural commodities in Akwa Ibom State. Data obtained were analysed using regression model and findings showed that retail market prices of selected food commodities such as rice, garri, yam, maize, palm oil, egg, beans and plantain in Akwa Ibom State all showed an increasing trend in prices overtime. Edet et al., (2014) assessed price transmission and market integration of paw-paw and leafy Telfa in Akwa Ibom State, Nigeria. The trend analysis showed that the products in the rural and urban markets have positive significant relationships with time and positive exponential growth rate. Akpan et al., (2009) in their study examined the price transmission and market integration of maize and bean in the rural and urban market of Akwa Ibom State Nigeria. Using a time series data, the trend analysis showed that prices of maize and beans in the rural and urban markets had exponential growth rates were less than one. Also, Pearson Correlation Coefficient (PCC) for the pairs revealed significant and linear symmetric relationships. This implies the existence of symmetric market information flows between the rural and urban markets for maize and beans in the study area.

Akanni and Okeowo (2011) analysed the aggregate output supply response of selected food grains in Nigeria. The main objective was to examine the various determinants of the quantities of cereals, considering prices changes as one of the determinants. Findings indicated that Producer price of rice was positive and statistically significant at 1% level. There is the tendency for the price of agricultural products to drop, which may consequently reduce the level of domestic production and thus discourage commercial production. Obayelu and Salau (2010) examined the response of aggregate agricultural output to exchange rate and price movements of food and export crops in Nigeria using available time series data. Augmented Dickey Fuller (ADF) and unit root test were used for the analysis and results showed that total agricultural output respond positively to increases in exchange rate and negatively to increases in food prices both in the short and long run. The significance of food crop prices and exchange rate at 5% and 1% respectively both in the short and long run suggest that changes in these variables are passed immediately to agricultural output.

Mustapha and Culas (2013) assessed the impact of increased agricultural commodity price variability. Cross sectional data collected was analysed using Pearson Correlation and regression analysis. The study found that food prices in Africa is influenced by events such as population growth, oil price fluctuations, implication policies, water availability and political instability. The effect of food price variability was also identified as one of the causes of nourishment rate and rising death rate in sub-Saharan Africa, including Nigeria. Etuk and Mfonobong (2016) in their study found variations in prices of agricultural products are due to their bulkiness, the transportation and handling costs, their perishable nature and the seasonal pattern of production which is influenced by weather condition. Akpan and Udoh (2009) estimated the functional relationship between relative price variability of grains and inflation rate in various agricultural policy periods in Nigeria, result revealed that inflation has a positive significant effect on relative price variability of grains. The result further showed that the Structural Adjustment Programme (SAP) and civilian post Structural Adjustment Programme agricultural policy
regimes brought about a positive significant shift in the coefficient of inflation which implies an increase in the price variability of grains.

**Methodology**

**Study Area**
The study was conducted in Akwa Ibom State, located in the coastal South-South region of Nigeria. The region is popularly called the Niger Delta region or the oil rich region of Nigeria. The state is located between latitudes 4°32'N and 5°33'N and longitudes 7°25'E and 8°25'E. It has a total land area of 7,245km². Akwa Ibom State has a tropical climate marked by two distinct season, dry (November – March) and wet (April – October). The mean annual rainfall ranges from 2,000mm to 3,000mm, depending on the area. Naturally, maximum humidity is recorded in July while the minimum occurs in January. The mean annual temperature of the state lies between 26°C and 29°C and average sunshine of about 1,450 hours per year. The state is bordered on the east by Cross River State, on the west by Rivers State and Abia State, and on the South by the Atlantic Ocean. Akwa Ibom State has a population of about 3,902,051. The state is basically an agrarian society where crops like maize, okra, cassava, yam and rice are cultivated in large quantities. Politically and for ease of administration, the State is divided into 31 Local Government Councils or Areas.

**Sources of data**
Secondary data obtained from Ministry of Economic Development, Akwa Ibom State, Akwa Ibom Development Programme (AKADEP) office, Central Bank Nigeria (CBN) publications, and National Bureau of Statistics (NBS). Average annual prices per kilogram and the output (tonnes) of selected agricultural products (garri, plantain, palm oil, chicken, okra, pepper and maize) between the periods of 2000 to 2015 were collected.

**Methods of data analysis**
The trend of price of each selected agricultural products were evaluated using descriptive statistics where graphs are used to show the trend (pattern) in prices of selected products in Akwa Ibom State. Annual percentage change in prices collected for the selected products was estimated using percentage change, given as:

\[
\% \Delta = \frac{p_y - p_x}{p_x} \times \frac{100}{1} \quad \text{(1)}
\]

Where:
- \( \% \Delta \) = percentage change in period \( y \) of a product
- \( p_y \) = price of product in current year
- \( p_x \) = price of a product in preceding year

Descriptive statistics was used to show the effect of price variability of each agricultural product on the output in the study.

Multiple Regression analysis model was used to analyse the determinants of price variability on agricultural products. The regression model is specified as follows:

\[
P_{y_{t}} = b_0 + b_1PMP_{t-1} + b_2POP_{t-1} + b_3EXC_{t-1} + b_4AVR_{t-1} + b_5AIP_{t-1} + b_6GVE_{t-1} + b_7INF_{t-1} + U_{t} \quad \text{(2)}
\]

Where:
- \( P_{y_{t}} \) = agricultural product price variability, given by price variability index
- \( PMP_{t-1} \) = pump price in year \( t-1 \) (₦)
- \( POP_{t-1} \) = population in year \( t-1 \) (no.)
- \( EXC_{t-1} \) = exchange rate in year \( t-1 \) (₦)
- \( AVR_{t-1} \) = average rainfall in year \( t-1 \) (mm)
- \( AIP_{t-1} \) = input price in year \( t-1 \) (₦)
- \( GVE_{t-1} \) = government expenditure in year \( t-1 \) (₦)
- \( INF_{t-1} \) = inflation in year \( t-1 \) (CPI)
- \( t \) = period (year)
- \( U_{t} \) = Error Term
- \( b_0,b_1,b_2,b_3,b_4,b_5,b_6,b_7 \) and \( b_8 \) are the regressions co-efficients.

**Results and discussion**
This chapter presents results and discussion of the findings of the study. The analyses in this study were based on seven agricultural commodities: garri, palm oil, plantain, chicken, okra, pepper, maize. These produce are among the agricultural commodities produced in Akwa Ibom State.

![Graph showing trend in price variability of selected agricultural products in Akwa Ibom State from 2000 to 2014.](image)

Figure 2. Trend in price variability of selected agricultural products in Akwa Ibom State

Garri had the lowest average annual price range within the period relative to the other crops selected for the study. Garri price has an undulating trend during the period and increased from N6.75 in 2000 to N22.2 in 2015. The least price for the period was recorded in 2000 with N6.75/kg. The first national policy on agriculture was adopted in 1988 and was expected to remain valid for about thirteen years, from 1988 to 2000. The policy was aimed at the attainment of self-sustaining growth in all the sub sectors of agriculture and the structural transformation necessary for the overall socio-economic development of the country as well as the improvement in the quality of life while the highest price was observed in 2013 with N32.29. This result is in line with the findings of Etuk and Mfonobong (2016) in their study on the analysis of market prices of selected agricultural commodities in Akwa Ibom State. The trend showed a persistent increase as the price increased from N6.75 in 2000 to N29.56 in 2005 at percentage change of 71.6% in 2001, 31.3% in 2002, 19.6% in 2003, 26.3% in 2004 and 28.6% in 2005. The price fell in 2006 and 2007 at -2.4% and -53.1% respectively. The percentage increase in prices between 2008 and 2009 was constant (34.7% and 34.7% respectively) and in 2011, there was a fall in the price of garri from N27.93 in 2010 to N19.29 in 2011(-30.9%). This may be linked to provision made by the state in partnership with the Federal Government and World Bank providing grants to cooperatives under FADAMA III programme. This caused an increase in cassava production, thereby causing garri price to fall. It increased afterwards but fell later in 2014 and 2015 at -22.8% and -11.0% from N32.29 in 2013 to N22.2 in 2015.

The annual prices of plantain fluctuated between N57.5 to N165.5 with its peak periods in 2001, 2007, and 2013. These peak periods were observed to come after about 5 years interval, reasons for this result may be attributed to weather, demand for plantain, productivity, cost of transportation, inflation etc. The result also showed that plantain had the highest percentage variation (156.5%) in price in 2001. The price fell the next two years (2002 and 2003) at a percentage of -21.2% and -7.1%, increased in the next two years (2004 and 2005) by 5.8% and 13.6%. In 2006, the price fell again by -13.6% and increased in 2007 by 72.6%, the price of plantain fell again in the next two years (2008 and 2009) at -9.5% and -23.4% respectively and rose the next two years (2010 and 2011 at 13.5% and 6.9%, the price fell then from year 2012 to 2015 except in 2013 where it increased at 46.1% change from the previous year. The result showed that the average yearly prices of plantain rose and fell mostly at two years interval. This may be said to be due to climatic variation. This result is consistent with that of Udoka, Akpan.
and Patrick (2015), in their analysis on price transmission of unripe plantain in Akwa Ibom State, that the price trend show undulating fluctuation between 2005 and 2013 but galloped towards the peak in 2010.

The price of palm oil had fluctuated from 2000 to 2007 and then rose almost steadily thereafter. Palm oil prices as any other agricultural product is responding to seasonal variation as price increased throughout the period. This shows an inverse relationship between palm oil prices and the demand for palm oil in the study area. This observation is in line with that made by Ntukwak and Udum (2012) in analysing palm oil prices in Ini local government area of Akwa Ibom State. The implication therefore is that government policies and programmes have been unable to affect palm oil production since it is a perennial crop.

Chicken had the highest yearly prices relative to the other products in this study from 2000-2015. Its price fluctuated with peak in 2006, 2008 and 2012, went down from 2012 – 2015. The result shows an undulating trend throughout the period, with the price of chicken increasing in 2000, 2001, 2002, 2003, 2004, 2005 and 2006 with percentage changes of 8.4%, 17.9%, and 9.2%, 7.5%, 9.9% and 13.3% respectively. Between 2006 and 2007, the price of chicken was almost constant with a percentage change of 1.0%. The price peaked in 2008 at 22.9% from #406.25 to #409.28 and further increased and had its highest price (#747.24) in 2012. Chicken prices reduces again in 2013 to 2015 at percentage changes of -8.6%, -3.5% and -1.4%. The results obtained may be due to the high cost of production in the livestock subsection as compared to crops.

Assessing the variation in prices of okra, okra prices increased by an average of 10.6% in 2001, 15.4% in 2002 and 41.7% in 2003. Okra recorded a positive growth in price between 2006 and 2007 of a percentage change of 74.4% and gave okra the highest price of #262.18 while its lowest price for the period was recorded in year 2000. The prices of okra fluctuated tremendously at almost the same rate as plantain throughout, having the highest prices in 2004, 2007, 2009, 2012 and 2017. This variation may be associated with cost of production and storage of the product and the demand on the product in relation to other products.

The trend analysis as in figure 1 shows that pepper has average price over the study period (2000-2015). The growth in prices of pepper ranged between #47.0 and #226.18 from 2000 to 2007 with an average percentage change of between 5.4% and 45.4%. The highest percentage change was observed in 2009 to be 108.7% and the lowest (-25.6%) in 2010. The price per kg of pepper fluctuated slightly from 2001 -2008, peaked in 2009 and reduced in 2010 due to financial contribution made by the Federal government under Commercial Agricultural Credit Scheme (CACS) to boost agricultural production, the price fluctuates slightly till 2015. From the graph, it shows that there is no significant change in price of pepper in the study area. Price instability in pepper is associated with its perishable nature. The implication therefore is that business speculators who buy and store to take advantage of time are most unlikely to make any substantial profit. It is advisable for producers to sell immediately as they produce pepper.

Maize and garri shows almost same pattern in price variation. The price of maize fluctuated slightly throughout until 2014 and increased significantly in 2015. The trend pattern of maize prices within the period of 2000 to 2015 shows asymptotic fluctuations in the prices of this product from one year to the other. The prices increased throughout from 2000 to 2015, except in 2003 where it fell from #15.98 in 2002, to #14.8% in 2003 at -6.9%. In 2013, it fell from #39.81 in 2012 to #37.91 in 2013 at -4.8% and in 2014, where it fell from #37.91 in 2013 to #31.42 in 2014 at -17.1%. The prices of maize is slightly higher than that of garri until 2006 where it reduced slightly and rose again above that of garri from 2007. Possible contributions to the variability of this product may be associated to cost of storage. Price instability in maize is also associated with its perishable nature, pest and disease infestation and the seasonal pattern of production which is influenced by weather condition. These results indicate that the trend in prices of agricultural products in Akwa Ibom State generally increases as the years go by irrespective of the numerous agricultural policies and programs made by the different administration.
The highest average annual percentage change in price for the period was observed for maize (32.03%). Handling cost and cost of storage of this commodity contributed to this observed high variability in price. Price instability in maize is also associated with its perishable nature, pest and disease infestation and the seasonal pattern of production which is influenced by weather conditions. Pepper, okra had an average percentage change in retail prices of 14.71%, 15.15%, respectively. Plantain and garri had and average percentage change of 13.82% and 13.29% respectively for the period, 2000-2015. This observed moderate percentage in retail prices of these products may have resulted due to weather conditions, export of the products and government policies which encouraged investment in agriculture. Chicken and palm oil had the least average annual percentage change of 7.97% and 7.48%. This may be attributed to involvement of farmers in poultry production, making the price of poultry product less volatile. Palm oil is also produced in large quantities in the state and is not a seasonal product as compared to other crops studied.
Figure 5. Effect of price variability of palm oil on output of palm oil and on output of chicken

Figure 6. Effect of price variability of chicken

Figure 7. Effect of price variability of okra on output

Figure 8. Effect of price variability of pepper on output

Figure 9. Effect of price variability of maize on output of maize

Figure 3 above shows the trend of price variability of garri (%) and the output of cassava (metric tonnes). Price variability fluctuates across the years within the period (2000 – 2015) with the highest percentage (71.6%) change observed in 2001. The output of cassava increased from 0.85 metric ton in 2000 to 2.8 metric tons in 2015.

Figure 4 shows the result of variability in price of plantain (%) and the output of plantain (metric tons) obtained between the periods of 2000 and 2015. Price of plantain fluctuated highly within the period, being highest in 2001 with 156.5%. There was a steady increase in the output of plantain from 5.1 metric tons in 2000 to 12.0 metric tons in 2015.
2014. Output of plantain reduced remarkably in 2015 to 1.2 metric tons in 2015.

The result of price variability of palm oil (%) and output (metric tons) for each year between 2000 and 2015 is shown in figure 5. Result shows that price fluctuated throughout the period with the highest price variability of 48.2% obtained in 2006. Output of palm oil increased throughout the period from 350.51 metric tons to in 2000 to 725.65 metric tons in 2015 except in 2003 where there was a drastic reduction in output of 38.0 metric tons. The least output (38.0 metric tons) was observed in 2003 and highest (725.65 metric tons) observed in 2015.

Figure 6 shows the trend in price variability of chicken (%) and the output of chicken in metric tonnes. Between periods 2000 to 2015, the output of chicken increased throughout with the fluctuating price variability (%) except in year 2012 which the output fell from 3585 metric tons in 2011 to 3052.25 metric tons in 2012. Output also reduced again in 2014 and 2015 from 3750.5 metric tons in 2013 to 3500.25 metric tons and 3550.1 metric tons in 2014 and 2015 respectively. The highest output (3750 metric tons) was obtained in 2013 at price variability of (8.6%) and the least output (1012.5 metric tons) obtained in year 2000.

In figure 7, the result shows that the price variability (%) of okra fluctuates within the period of 2000 – 2015. The output of okra increased at a low rate within the period with a difference of not more than 1 metric ton between the years. Okra output was highest in 2015 at 3.5 metric ton and least in 2000 with output of 0.27 metric ton.

The result of price variability of pepper (%) and the output of pepper for each year between 2000 and 2015 is shown in figure 8. Result showed a fluctuating trend pattern of price variability of pepper from 0% to 108.7%. The highest price variability of pepper was 108.7% and was observed in 2009. The output of pepper within the period increased at lower rate. Between 2000 and 2003, pepper maintained a constant output of about 0.1 metric tons, from 2004 to 2006, output increased to about 0.2 metric tons, it increased in 2007 and 2008 to 0.3 metric tons. In 2009 and 2010, output increased to 0.44 metric tons and 0.77 metric tons respectively. It increased further to about 1 metric ton in 2011 and 2012 and to about 2 metric tons in 2013 to 2015.

The graph in figure 9 shows that percentage change in price of maize fluctuated and is highest in 2015. This necessarily does not have any noticeable effect on the output as the output increased within the period (2000-2015). The output kept increasing between 2000 and 2005 from 26.1 metric tons to 57.5 metric tons and became stable in 2006 and 2007 with an output of about 62 metric tons. It further increased from 65.1 metric tons in 2008 to 105.5 metric tons in 2015, which it showed the highest output and the least (26.1 metric tons) observed in 2000.

### Table 1: Estimation of the determinants of price variability

<table>
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<tr>
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<th>Coefficient</th>
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Mean dependent var 97.20000 S.D. dependent var 109.8205
Sum squared resid 23336.17 S.E. of regression 54.00945
R-squared 0.873930 Adjusted R-squared 0.763618
F(7, 8) 7.537576 P-value(F) 0.005343
Rho -0.352878 Durbin-Watson 2.379173

Source: computed from field survey using Greq, *, **, *** Significant at 10%, 5%, and 1% respectively.
The multiple regression analysis result above shows the determinants of price variability of agricultural products in Akwa Ibom state. The result shows that pump price, exchange rate, average rainfall, aggregate input prices and inflation were best determinants of price variability of agricultural products in the state and were significant at 5% and 1%. The coefficient of multiple determination (R²) was 0.874. It shows that 87.4% of the observed variations in prices of agricultural products was accounted for and explained by the independent variables. The adjusted R² was 0.764 (76.4%).

Pump price (PMF) was statistically significant at 1% level and had a positive coefficient of 8.0101, showing a positive relationship to price variability. This is in conformity to the a priori expectation because an increase in pump price leads to an increase in price variability of agricultural products, due to the changes in the cost of production, processing and transportation. Most agricultural machinery and technology depends on petroleum and any increase or decrease in oil prices in the world market could lead to increase in cost of production of agricultural products.

The result also shows that exchange rate (EXC) had a positive significance of 4.454 at 5% level of significance on price variability of agricultural products. The higher the exchange rate, the higher the price variability of agricultural products from period to period. Average rainfall (AVR) was found to be negatively related to price variability at 5% level of significance. This implies that a decrease in rainfall by 0.640 leads to a significant increase in price variability of agricultural products, this is because low rainfall leads to low productivity and where rainfall is to be substituted for by irrigation, additional cost is incurred. This finding was a deviation from the a priori expectation and consistent to the result obtained by Houghton (2001), which shows that precipitation variability results to varying moisture content of the soil that would not be optimal for the crops that are being cultivated.

Aggregate input price (AIP) negatively correlated to price variability of agricultural products at 5% level of significance. This signifies that 0.25 reduction in aggregate input prices will lead to an increase in price variability of agricultural products. This also is in contrast with the a priori expectation and in line with the findings of Thornton et al. (2010) which indicated that the availability of farm inputs like fertilizers, finance, machinery, seeds and chemicals has been limited, causing an increase in the cost of production.

Inflation (INF) was statistically significant at level of 1% and had a positive coefficient of 0.034, showing a positive relationship to price variability of agricultural products. This is in conformity with a priori expectation because increase in inflation increases cost of production thereby causing an increase in price variability of the products. The result is consistent with that of Akpan and Udoh (2009), which showed a positive significant shift in the coefficient of inflation which implies an increase in the price variability of grains. Also, Ukoja (2008) established quantitative relationship among relative price volatility of agricultural commodities and inflation in Nigeria, results showed that there was a significant positive impact of inflation on price variability, both in short run and long run.

**Conclusion and recommendations**

From the result obtained, it is evident that food price instability is a frequent occurrence, causing macroeconomic shocks and political turmoil, which discourage long-run investment and curtail growth. Also, price and quantity of output has a positive effect on each other, which corresponds to the theory of supply. Thus variability of products prices cause shocks which affects output in the next season, in line with Cobweb theory. No rational policy should aim at totally eradicating price variability of agricultural products, but effort could be put to suppress the effect of the factors which determine price variability of agricultural products. The following recommendations are made based on the findings and observation of the study:

1. Alternative private arrangement that do not require government to bear the risk of price change in commodity markets should be considered, such as commodity indexed bonds or insurance schemes of various types, to substitutes
for direct government intervention in price formation to reduce risk.

2) Policies which will buffer the agricultural sector from the effect of variability of agricultural product prices and policies which reduce the rate of inflation will minimize price variability among agricultural commodities and consequently reduce inefficiency, distortions and misallocation of resources in agriculture should be implemented.

3) Management agencies should be established to provide necessary tools and information for farm operators and other participants in agricultural markets to better understand and manage risk associated with producing and selling agricultural commodities.

4) Since increase in price brings about an increase in production, in line with the theory of Supply which states that the higher the price, the higher the quantity supplied: government should implement policies that will subsidize the price of agricultural products to consumers and increase the level of food security in the country.

References


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