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Estimating the impact of price fluctuations on millet marketing in Yobe State, Nigeria

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ABSTRACT

The study examined the influence of price fluctuations in millet marketing in Yobe State, Nigeria. Specifically, it aimed to determine the factors influencing price variation in millet marketing, the coping strategies adopted, and the challenges encountered by the respondents. Data for the study were collected using a structured questionnaire administered to 157 respondents and analyzed using descriptive statistics and regression analyses. Multiple regression results revealed that the significant factors affecting price fluctuation in millet marketing include market information asymmetry ($p<0.01$), unstable government policies ($p<0.05$), and variations in quantities of product marketed ($p<0.01$). Similarly, middlemen speculation ($p<0.01$) and the demand-supply gap ($p<0.01$) were statistically significant but negatively related to price fluctuation in millet marketing. The major coping strategies adopted by the respondents were regular and up-to-date market information and the provision of adequate storage facilities. The main problem faced by marketers was high transportation costs (80%) due to poor road networks and linkages. The study concludes that price fluctuation in millet marketing is challenging and inevitable but needs to be addressed through the concerted efforts of stakeholders. The research recommends that the feeder road network be reconstructed and maintained to curtail hindrances associated with transporting goods and services. Additionally, market information indices should be made available, accessible, and utilized to guide marketers

Keywords: Pprice, Millet, marketing, Regression anaysis, Nigeria.

INTRODUCTION

Price fluctuation is rapidly becoming an intolerable problem in the agricultural sector, affecting virtually all major stakeholders in the value chain and immediately impacting consumers' purchasing power. In the short run, farmers can benefit significantly from high prices, resulting in increased returns and profits. However, price fluctuation generally imposes a concomitant burden on active participants in the food chain, including producers, middlemen, speculators, processors, and final consumers. The negative effects of sudden price changes at the onset of the season, during, and off-season can lead to dwindling purchasing power, loss of capital, decreased profits, economic instability, and emotional and psychological imbalance in food security for individuals, households, and the nation at large. The effect of price fluctuations, either in the short or long run, cannot be underestimated, particularly in rural areas where the majority live below the poverty line in developing countries like Nigeria (Mukaila *et al.,* 2022). Price fluctuations in agricultural products are a significant aspect of the agricultural economy. Major changes in prices from year-to-year impact supply and influence producers' decisions regarding production (Hoek *et al.,* 2021).

The impacts of price fluctuations on stakeholders in the marketing value chain are significant. Producers often have to accept established prices because the price of an agricultural product for a given year is determined not by the costs incurred during that year, but by the total supply and demand for the product throughout the year. Moreover, since the supply of agricultural products cannot be altered in the short term, demand plays a more decisive role in determining price (Putra *et al.,* 2021). Agricultural production is significantly affected by climatic conditions and the impact of pests and diseases, leading to fluctuations in product supply. The observed effect of price fluctuation and its impact on small-scale farmers and marketers need to be studied and researched to reduce the effects, improve marketing investment, and enhance the development of the sub-sector.

Individuals, groups, and communities in rural settings are more vulnerable to increases in food prices because these populations prioritize basic needs (Amolegbe *et al.,* 2021). Similarly, farmers and other investors in agricultural enterprises rely heavily on profits from sales of products and by-products, which depend directly on the costs of production factors and other investments leading to overall production. The incubation period between production and marketing requires proper data gathering, monitoring, and management. However, there is little or no substantive data with empirical evidence on market price variation, particularly for cereals and grains (Aggarwal *et al.,* 2024; Lundberg & Abman, 2021; Cedrez *et al.,* 2020). Millet is an important cereal

crop in the northern part of Nigeria, alongside rice, maize, and wheat. It serves as a major food source for millions of people, especially those living in hot and dry environments. Thus, it acts as a pillar of food security in the context of growing climate change concerns worldwide (Saxena *et al.,* 2018). Millions of people rely on millet as a supplementary source of energy in Nigeria and the sub-Saharan Africa region. It is predominantly grown in marginal areas under specific agricultural conditions, such as limited rainfall, which are unsuitable for cultivating other cereals like maize, wheat, and rice. Millets are nutritionally comparable to major cereals and serve as a good source of protein, micronutrients, and phytochemicals (Ajikashile *et al.,* 2023). Millet contains fewer cross-linked prolamins, which may be an additional factor contributing to the higher digestibility of millet protein (Sachdev *et al.,* 2021). Millet also contributes to antioxidant activity, with phytates, polyphenols, and tannins playing an important role in aging and metabolic diseases. It is often ground into flour, rolled into large balls, parboiled, and then consumed as porridge with milk. Sometimes millet is prepared and served as a beverage. Millet production faces several challenges, including crop failure and yield instability (Numan *et al.,* 2021).

On a global scale, the threats to food security and sustainable development, particularly in the developing countries of Sub-Saharan Africa, have become more critical than ever. Uncontrolled and incessant increases in food prices will exacerbate an already turbulent world affected by conflicts, human trafficking, high inflation, and unstable exchange rates in international markets. Therefore, it is necessary for governments and institutions to address the observed phenomenon of volatility in grain prices in the region so that a vast number of people will not be pushed out of food security (Bjornlund *et al.,* 2022). This study aims to investigate the potential causes of price fluctuations, focusing on three main objectives: i. to identify the factors affecting price fluctuations in millet marketing; ii. to outline the coping strategies employed by millet marketers; and iii. to recognize the challenges encountered by these marketers.

MATERIAL AND METHODS

The Study Area:

This study was conducted in Bade Local Government Area (LGA), Yobe State, located in the Sahel Savannah Agro-Ecological Zone of Nigeria. Bade LGA lies between longitude 12º58' North, 10º36' East and latitude 12.7161, with its headquarters in Gashua. It covers an area of about 103,000 hectares (397.69 sq. miles) and has an estimated population of 140,882 (NPC, 2019). The LGA comprises ten wards, six located within Gashua town, the headquarters of the LGA. These are Lawan Musa, Sarkin Hausawa, Lawan Fannami, Sabon Gari, Zango, and Katuzu. The other four wards—Usur/Dawayo, Dagona, Sugum-Tagali, and Gwio-Kura—are districts or clusters of villages and settlements surrounding Gashua. The major economic activities in the area include farming, marketing of farm produce, and potash mining.

Agriculture is the economic mainstay of the people of Bade Local Government Area, with crops such as millet, sorghum, rice, and groundnut grown in fairly large quantities. Trade is also an important economic activity in the area, with markets like the Garin-Alkali Sunday market attracting hundreds of buyers and sellers.

Data Collection:

Primary data were employed for the study, and data were collected using well-structured questionnaires. The questionnaires were administered with the help of trained extension specialists.

Sampling Procedure:

A multi-stage sampling technique was adopted for the selection of respondents. In the first stage, four wards were randomly selected using the raffle-draw ballot-box method. In the second stage, two villages/polling units were randomly selected from each of the following wards: Sugum/Tagali, Usur/Dawayo, Sabongari, and Lawan Fannami, using the raffle-draw ballot-box method. In the third stage, the number of millet marketers in each of the eight villages was collected using the sampling frame from the archive of the Agricultural Development Project (ADP) Office. The fourth and final stage involved using the appropriate proportion to determine the sample size from the sampling frame, as stated in (Table 1). One hundred fifty-seven (157) respondents were used for the study. A summary of the sample size determination is provided below (Simarjeet, 2017):

$$\mathrm{n} = \frac{N}{1 + N(e^2)} = 157 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

n = Sample Size (Units)
N= Sample Frame/Population size (Units)
e = Level of Precision (5%)

Table 1 Sampling matrix and sample size of millet marketers in the study areas

S/N	Wards	Villages	No of Millet Marketers	Proportion	Sample Size
1	Sugum/Tagali	Gabarwa	33	0.127	20
		Tak vir-vir	31	0.1197	19
2	Usur/Dawayo	Azbzk	35	0.1351	21
		Alagarno	30	0.1158	18
3	Sabon Gari	Goni Aji	34	0.1312	21
		Gari Lamido	32	0.1236	19
4	Lawan/Funnami	Filin Tanda	31	0.1197	19
		Babuje	33	0.1274	20
TOTAL	**4**	**8**	**259**		**157**

Source: Field Survey, 2023.

Analytical techniques:

Data were analyzed using descriptive statistics such as frequency, percentage, and mean to analyze objectives II and III, while multiple regression analysis was used to analyze objective I. The multiple regression model was specified as follows (Fisher, 1963):

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6$..... (1)

Where;

Y = Price of Millet (₦/kg)

X_1 = Market information, including sources of price information available to marketers, can be measured by the number of available sources. These sources include watching and listening to agricultural shows on TV and radio, attending field demonstrations, and maintaining frequent contact with other marketers through physical meetings and phone calls.

X_2 = Government policies (years of operation)

X_3 = Quantity of millet marketed (Kg)

X_4 = Weather and climatic conditions (measured by level of awareness of climate information services, CIS); 1= Strong level of awareness

2= Medium level of awareness

3= low level of awareness

X_5 = Speculation by middlemen (measured by marketers risk categories);

1= risk averse/avoidance

2= risk acceptance

3= risk neutral

X_6 = Demand-supply gap on millet marketing (measured by available millet in kg/market on market days)

μ = Error term

RESULTS

Determinants of factors influencing price fluctuation in millet marketing:

Multiple regression analysis was used to determine the variables affecting price fluctuation in millet marketing in the study area, as shown in (Table 2). Millet price was regressed on limited market information, quantities of millet marketed, weather and climatic conditions, middlemen speculation, and the demand-supply gap. The semi-log functional form was chosen as the lead equation based on the number of significant variables, the magnitude of the coefficient of multiple determination (R^2), the conformity of variables to a priori expectations, and the significance of the F-ratio. The coefficient of multiple determination (R^2) was 0.6864, implying that 68.64% of the changes in the price of marketed millet were explained by the explanatory variables included in the model. The F-ratio of 30.28 indicated that the joint determination of the explanatory variables was significant at the 1% level.

Table 2. Multiple regression result on factors affecting price fluctuation of millet marketing.

Variables	Linear	Exponential	Semi log+	Double log
Intercept	19277.5 (10.02)***	9.88 (115.19)***	-1678.89 (-12.09)***	-5063.73 (-3.16)***
Market information asymmetric	121.93 (2.60)**	0.006 (2.80)***	1244.46 (2.68)***	14.63 (3.04)***
Government policies	39.12 (1.25)	0.002 (1.37)	1067.318 (3.89)***	41.53 (3.04)***
Quantities of millet marketed	850.75 (1.52)	-0.04 (-1.57)	1229.546 (2.31)**	57421.55 (0.37)
Weather and climatic conditions	0.007 (1.56)	2.64e-07 (1.34)	-217.7626 (-1.29)	-5474.96 -0.39
Speculation activities by middlemen	-0.028 (-2.92)***	-1.36e-06 (-3.22)***	1734.54 (-3.06)***	90671.97 0.53
Demand-supply gap	-0.38 (-5.82)***	-0.0000 (-5.70)***	-4883.26 (-5.42)***	-390.38 -3.06***
R^2	0.6696	0.6817	0.6864	0.4657
Adj R^{-2}	0.6457	0.6587	0.6637	0.4135
F-ratio	28.04***	29.62***	30.28	12.94

Source: Field Survey, 2023
Note: Values in parentheses are t-value.

Coping strategies adopted by millet marketers:
The major coping strategies adopted by the respondents are presented in (Fig. 1). Frequent checks for market information (70%) dominated the coping mechanisms adopted by millet marketers, followed by adequate storage facilities (65%) and other income sources (60%). The least common was cooperative membership (48%).

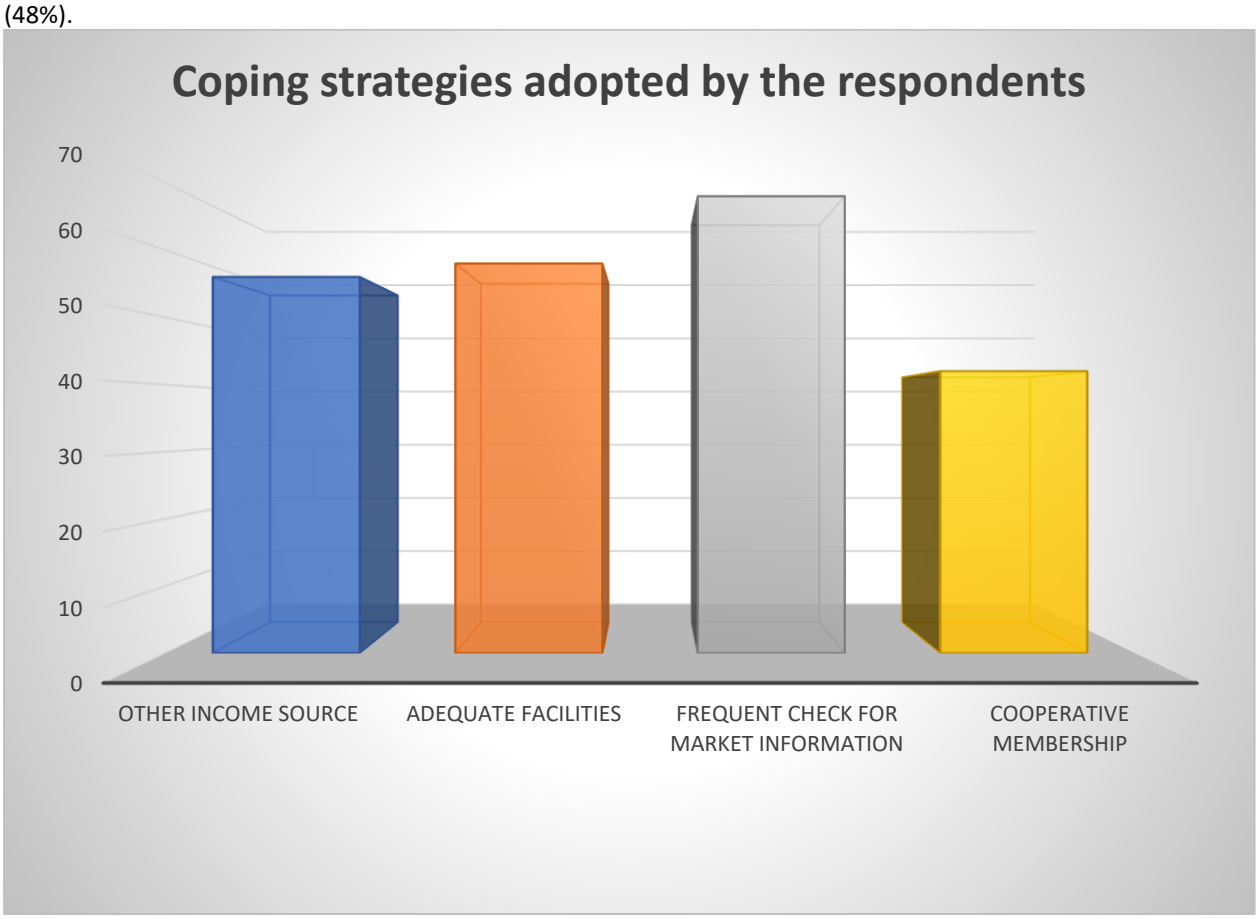

Fig. 1. The major coping strategies adopted by the respondents

Challenges encountered in millet marketing in the study area

The results presented in (Table 3) indicate that millet marketers face several challenges in carrying out their marketing activities. These include high cost of transportation costs (80%), poor market linkages (71.3%), lack of good road networks (66.3%), lack of standardization (61.3%) and multiple levies imposed by government officials (57.5%).

Table 3. Challenges encountered by millet marketers in marketing

Marketing problem	Frequency	Percentages
Poor market linkages	57	71.3
Lack of good road networks	53	66.3
Multiple levies collection	46	57.5
High transportation costs	64	80.0
Lack of standardization	49	61.3

Source**: Field Survey, 2023**

Note: Multiple responses were allowed.

DISCUSSION

From the results, limited market information, government policies, quantities of millet marketed, speculation by middlemen, and the demand-supply gap were significant. The coefficients of limited market information and government policies, along with changes in production levels, were significant at the 1% level and positively related to price fluctuations in millet marketing. This means that an increase in any of these variables by a unit will lead to an increase in price fluctuation in millet per kilogram in the market and vice versa. The result conformed to the findings of (Aggarwal *et al.*, 2024) in their study on market access and technology adoption in Tanzania.

Our findings revealed that millet marketers in the study area obtain market information related to produce prices through various means. These include watching agricultural shows on television and radio, attending field demonstrations, maintaining constant contact with marketers in neighboring markets through physical meetings and phone calls, and conducting market surveys. Adequate facilities in the market refer to the availability and accessibility of shops, stores, and other storage materials for millet products. Proper storage of millet helps maintain quality and reduce post-harvest losses. Adopting appropriate storage technologies can help millet marketers achieve better prices for their products. Optimal marketing can lead to increased profits and various positive dividends (Jin *et al.,* 2024). Millet marketers mitigate the effects of incessant price variation through alternate sources of income. These sources include gainful employment as civil servants, involvement as middlemen in estate agencies, farming, animal husbandry, etc.

Transportation is the most significant challenge faced by marketers in the study area and represents a critical factor hindering marketer efficiency and performance in many developing economies. This is attributable to the poor road network that characterizes the majority of feeder roads in rural communities, as noted by (Mwale *et al.*, 2022).

CONCLUSION

The study was conducted to estimate the influence of price fluctuations in millet marketing in Yobe State, Nigeria. The study concludes that information asymmetry, unstable government policies, variations in quantities of products marketed, middlemen speculation, and the demand-supply gap were significant factors affecting price fluctuation in millet marketing in the study area. Similarly, reliance on market information, provision of storage facilities, and alternative sources of income generation are the predominant coping strategies adopted by the millet markets. Based on the findings, the study recommends the following:

i. Improving feeder roads in rural areas is essential to enhance accessibility and linkages, thereby facilitating the easy movement and transportation of products.

ii. Forecast analysts should make relevant marketing information accessible to millet marketers.

iii. The government should address the multiple taxes and levies collected at local markets.

COMPETING INTERESTS

The authors declared that there are no competing interests.

AUTHORS, CONTRIBUTION

Saheed Olakunle Sanusi conceptualized the research work and developed the manuscript, while Alhassan Elzaman Muhammad monitored and supervised data collection. The authors read and approved the final manuscript.

CONSENT (WHERE EVER APPLICABLE)

Not applicable

CONFLICT OF INTEREST

The authors declared there are no conflicts of interests with respect to the research, authorship and publication of this article.

ETHICAL COMPLIANCE

The authors have followed ethical standards in conducting the research and preparing the manuscript.

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Annex 1

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  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
___/   /   /___/   /   /___/   13.0   Copyright 1985-2013 StataCorp LP
 Statistics/Data Analysis          StataCorp
                                   4905 Lakeway Drive
    MP - Parallel Edition          College Station, Texas 77845 USA
                                   800-STATA-PC       http://www.stata.com
                                   979-696-4600       stata@stata.com
                                   979-696-4601 (fax)

3-user 8-core Stata network perpetual license:
      Serial number:  501306208483

Notes:
    1.  (/v# option or -set maxvar-) 5000 maximum variables

. *(14 variables, 170 observations pasted into data editor)

. regress up lm gpcp mc pmds

    Source |       SS       df       MS              Number of obs =     170
-------------+------------------------------           F(  6,    73) =   28.04
     Model |   563909417     6  93984902.8            Prob > F      =  0.0000
   Residual |   278243771    83  3352334.59           R-squared     =  0.6696
-------------+------------------------------           Adj R-squared =  0.6457
     Total |   842153188    89  9462395.37            Root MSE      =  1830.9

------------------------------------------------------------------------------
          up |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          lm |   121.9349   46.96935     2.60   0.011    -215.3551   -28.51478
        gpcp |   39.12161   31.40124     1.25   0.216    -23.33419    101.5774
          mc |   850.7477   561.1377     1.52   0.133    -1966.828    265.3327
        pmds |   .0068951   .0044067     1.56   0.121    -.0018697    .0156598
       _cons |  -.0276635   .0094837    -2.92   0.005    -.0465261   -.0088008
------------------------------------------------------------------------------

. regress lnup lm gpcp mc pmds

    Source |       SS       df       MS              Number of obs =     170
-------------+------------------------------           F(  6,    73) =   29.62
     Model |  1.18642351     6  .197737251            Prob > F      =  0.0000
   Residual |  .554047527    83  .006675271           R-squared     =  0.6817
-------------+------------------------------           Adj R-squared =  0.6587
     Total |  1.74047104    89  .019555854            Root MSE      =  .0817

------------------------------------------------------------------------------
         lnup |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          lm |   .0058589   .0020959     2.80   0.006    -.0100276   -.0016902
        gpcp |   .0019183   .0014012     1.37   0.175    -.0008687    .0047053
```

```
cp |  -.0393336   .0250398    -1.57   0.120    -.0891367    .0104695
       mc |   2.64e-07   1.97e-07     1.34   0.183    -1.27e-07    6.55e-07
pm |  -1.36e-06   4.23e-07    -3.22   0.002    -2.21e-06   -5.23e-07
ds |  -.0000167   2.92e-06    -5.70   0.000     .0000109    .0000225
     _cons |   9.888017   .0858436   115.19   0.000     9.717278    10.05876
------------------------------------------------------------------------------

. regress up lnlm lngp lncp lnmc lnpm lnds

    Source |       SS      df       MS              Number of obs =     170
-------------+------------------------------           F(  6,    73) =   30.28
     Model |   578042403     6  96340400.5           Prob > F      =  0.0000
   Residual |   264110785    83  3182057.64           R-squared     =  0.6864
-------------+------------------------------           Adj R-squared =  0.6637
     Total |   842153188    89  9462395.37           Root MSE      =  1783.8

------------------------------------------------------------------------------
       up |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lnlm |  1244.457    463.641    2.68   0.009     -2166.62   -322.2938
      lngp |   1067.318   274.1345     3.89   0.000     522.0752     1612.56
      lncp |  1229.546   532.8167    2.31   0.024    -2289.297   -169.7951
      lnmc |  -217.7626   169.3042    -1.29   0.202    -554.5019    118.9768
      lnpm |  -1734.544   566.3967    -3.06   0.003    -2861.084   -608.0038
      lnds |   -4883.26    900.209    -5.42   0.000     3092.781    6673.739
     _cons |  -1678.894   138.8093    12.09   0.000    -29287.51    25929.72
------------------------------------------------------------------------------
```