

ANALYSIS OF SUPPLY FUNCTION FOR MILLET IN KADUNA AND KANO STATES OF NIGERIA.

ABSTRACT

This study analyzed supply function for millet in Kaduna and Kano States of Nigeria. Secondary data used for the investigation were sourced from Kano Agricultural and Rural Development Authority; Kaduna Agricultural and Rural Development Authority; Project Coordinating Units, Abuja. Descriptive statistics, Nerlove adaptation hypothesis and grafted polynomials model were used for the analysis of data. The results showed that price of fertilizer lagged one year and cost of production were the significant factors affecting output supply of millet in Kaduna state at 5% and 1% probability levels respectively. The price and fertilizer cost lagged one year were the significant factors affecting output supply of millet in Kano state at 1% and 5% probability levels respectively. The grafted polynomials model used for forecasting output supply of millet in tonnes for Kaduna and Kano States showed an increase in output of millet for a forecast period of 2006-2015. It is recommended that more agricultural inputs should be provided for farmers in Kaduna and Kano States by the Government to enable those farmers increase their millet output.

Keywords: - Supply Function, Nerlove Adaptation Hypothesis, Millet, Nigeria.

1.0 INTRODUCTION

Millet (*Pennisetum glaucum*) constitutes the most important cereal produced in Nigeria [1]. The current national production figure for millet was estimated at 7 million tonnes [2]. In Nigeria millet and sorghum account for over 60% of cereal grain production [3]. [4] reported that farmers in the semi-arid tropics of West Africa produced about 9.6 million tonnes of pearl millet on average between 1995-1997. Nigeria accounts for about 70% of the total sorghum production and more than half of the pearl millet production in West Africa [4]. [4] stated that farmers in West Africa semi-arid tropics planted over 14 million hectares of pearl millet between 1995-1997. Nigeria and Niger account for less than 15% of the West African's pearl millet acreage [4]. Millet is still the most important food grain in West Africa. Since, 1984, production and area planted have been increasing. However, production growth results from area expansion rather than yield. The returns to the major factor of production (land and labour) for millet must be raised to stimulate yield enhancing production practices [5]. Supply enhancing technologies, land and water management techniques and technology to improve productivity such as the use of improved varieties combined with fertilizers are well known and labour saving technologies have the potential of alleviating the labour constraints [5, 6]. [7] reported that in Kaduna state, most important cereals and food crops grown in terms of hectare and quantity are: maize, sorghum, millet and roots/tubers. In Kano state, production of millet, cowpea, maize and rice had increased [8]. Cereals are generally deficient in some important amino acids including lysine and tryptophan, which are required by humans, that is why it is important to supplement cereal-based food with legumes, which in addition to their high protein content are good sources of

minerals such as calcium and iron as well as vitamins, these cereals are now used for the wide range of products including baby food, edible oils, syrups, sugar, industrial starch, corn flakes, biscuits and beverages and a range of all product [9].

1.1 Research Questions

This study intends to provide answers to the following research questions:-

- (i) What are the variability in output and price of millet in Kaduna and Kano States?
- (ii) What is the supply function for millet in Kaduna and Kano States?
- (iii) What will be the forecast for millet in Kaduna and Kano States?

1.2 Objectives of the Study

The broad objective of this study is to analyzed supply function for millet in Kaduna and Kano States of Nigeria. The specific objectives are to:-

- (i) describe variability in output and price of millet in Kaduna and Kano States ;
- (ii) estimate supply function for millet in Kaduna and Kano States;
- (iii) forecast for (10) years the output supply for millet in Kaduna and Kano States.

2.0 METHODOLOGY

This study was conducted in Kaduna and Kano States of Nigeria. Kaduna State is located between Latitudes 9°N and 12°N and Longitudes 6°E of the prime meridian. It shares common borders with Abuja in the South-East and six other states namely, Katsina, Kano, Zamfara, in the North-North Nasarawa, Plateau in the North-East, Niger in the North-West. The climate varies from North to South of the state. The vegetation in the state is divided into Northern Guinea Savanna in the North and Southern Guinea Savanna in the South. Kaduna State is one of major producers of millet with annual production of 489,000 metric tonnes [10]. The State has a population of 6,066,562 people according to 2006 census [11].

Kano State lies with Savanna except the southern part where Guinea Savanna predominates; it is located between Latitudes 10⁰N and Longitudes 8⁰E and 9⁰E of the prime median. The population of the state on the basis of a census conducted in 2006 was out at 9,383,682 people [11]. The secondary data used were sourced from Kano Agricultural and Rural Development Authority; Kaduna Agricultural and Rural Development Authority, Project Coordination Units (PCU) Abuja.

2.1 Descriptive Statistics:- such as percentage, frequency distribution table, arithmetic mean and coefficient of variation were used to group and summarized the data collected from the field. The coefficient of variation is expressed as:

$$CV = \frac{S}{\bar{X}} \times 100$$

Where, CV = Coefficient of Variation, S = Standard Deviation, $\bar{X}$ = Arithmetic Mean

2.2 Supply Function:- Nerlove adaptive expectation hypothesis was used to estimate supply function.

$$Q_t = \alpha_0 + \alpha_1 P_{t-1} + \alpha_2 F_{t-1} + \alpha_3 R_t + \alpha_4 C_P + V_t$$

Where, Q_t = Output of millet in year t in tonnes, α_0 = Constant term; P_{t-1} = Price of millet in year t-1 (~~N~~/tonnes); F_{t-1} = Price of fertilizer in year t-1 in (~~N~~/tonnes); R_t = Amount of rainfalls in mm in year t; C_P = Cost of production in year t (~~N~~/hectare); $\alpha_1 - \alpha_4$ = Structural parameters to be estimated; V_t = Error terms.

2.3 Grafted Polynomials or Spline Function: these models are also referred to as grafted relationship or grafted function or spline function. Segment of polynomials can be used to forecast time series. These segmented curves are restricted to be continuous and have continuous derivation at a joint [12]. For quadratic – linear function, the mean function can be representing as:

$$Y_t = \alpha_2 + \beta_2 t + \lambda dt$$

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$$d_t = \begin{cases} (K - t)^2 & \text{for } t < K \\ 0 & \text{for } t > K \end{cases}$$

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104 Y_t = Estimate forecast in the year (t) for millet; K = Joint point; $\alpha_2, \beta_2, \lambda$ =
 105 Structural parameters; t = Time factors in years.

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107 **3.0 RESULTS AND DISCUSSION**

108 **3.1 Variation for Output and Prices of Millet:** - The price of millet in Kaduna State
 109 fluctuated widely within the sampled period with a coefficient of variation of 64%.
 110 The production of millet in Kano State fluctuated widely with a coefficient of
 111 variation of 92% within the sampled period for the study (Table 1).

112 **3.2 Supply Function Analysis:-** The lagged price ; cost of fertilizer ; cost of
 113 production and amount of rainfall explained about 90% of supply variation for
 114 millet within the sampled period in Kaduna State (Table 2). The cost of production
 115 and fertilizer cost lagged one year were significant at 1% and 5% level of
 116 probability respectively. Price lagged one year of millet in this case was not a
 117 strong factor that determines output of millet in Kaduna State. This agrees with
 118 the findings of [13] which revealed that farmers were less responsive to price, and
 119 that macroeconomic factors such as exchange rate and food import policies had
 120 strong and significance influence on the production of cereals which
 121 overshadowed the price influence. However the amount of rainfall was positively
 122 related to the estimated production of millet. The study observed the Coefficient
 123 of Multiple Determinations, R^2 of 0.57 for millet in Kano State supply with respect
 124 to Nerlove adaptive expectation hypothesis. This implies that 57% of the variation

in millet supply within the sampled period was explained by the variables included in the model (Table 3). The price of millet lagged one year and fertilizer cost lagged one year had significant influence on output of millet at 1% and 5% levels of probability respectively (Table 3). The regression coefficient for the fertilizer cost lagged one year had a negative relationship with the supply of millet in Kano State. This implies that millet farmers are less responsive to fertilizer cost lagged one year based on production equation form (Table 3).

Table 1: Variations for Output and Prices of Millet in Kaduna and Kano States of Nigeria

Estimates	Kaduna		Kano	
	Output (tonnes)	Prices (₦/tonnes)	Output (tonnes)	Prices (₦/tonnes)
Maximum	523,087.20	43,117.00	2,163,840.00	35,000.00
Minimum	57,260.00	5,547.00	195,000.00	5,486.00
Average	341,614.70	18,580.50	157,339.80	21,575.95
Standard Deviation	173,235.30	11,897.50	1,441,896.81	10,419.96
Coefficient of Variations (%)	50.71	64.03	92.09	48.29

Source: Field Survey, 2007

Table 2: Estimate Supply Function for Millet in Kaduna State based on Nerlove Adaptive Expectation Hypothesis.

Variable	Coefficient	t-value	Level of Significance
Constant	109884	1.409	NS
P_{t-1}	-0.014	0.054	NS
F_{t-1}	-0.569	2.404	0.05
C_p	1.419	4.134	0.01

145	R_t	0.087	0.564	NS
146	$R^2 = 0.90$			

147 **Source: Field Survey, 2007**

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149 **Table 3: Estimate Supply Function for Millet in Kano State based on Nerlove**
150 **Adaptive Expectation Hypothesis.**

151	Variable	Coefficient	t-value	Level of
152				Significance
153	Constant	37394.2	0.022	NS
154	P_{t-1}	0.162	2.977	0.01
155	F_{t-1}	-0.832	3.793	0.05
156	C_p	0.518	0.916	NS
157	R_t	0.448	0.994	NS
		$R^2 =$	0.57	

158 **Source: Field Survey, 2007**

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166 **Table 4: Estimates of the Parameters of the Output of Millet in tonnes for**
167 **Kaduna State (Grafted Function).**

168	Variable	Coefficient	t-value	Level of
169				Significance
170	Intercept	-148885	0.275	NS
171	X_1	58452.49	2.61	0.05
172	X_2	-18054.9	1.161	NS
173	X_3	13912.74	2.746	0.05

174	$R^2 =$	0.547
175	d.f	15
176	$F - Value$	2.812

177 **Source: Field Survey, 2007.**

178 This study agrees with [14] who reported in his study on agricultural supply
 179 response for four cereal crops in Nigeria that prices of maize, sorghum, millet and
 180 rice lagged one year had a positive and significance on the supply of these cereals
 181 in the subsequent years. The structural coefficients of output of millet in Kaduna
 182 State were presented in Table 4. The estimate coefficients for X_1 and X_3 were
 183 significant at 5% probability level. The estimate of the grafted function was
 184 utilized to obtain expost forecast of output of millet (tonnes) in Kaduna State of
 185 Nigeria. The structural coefficients of output of millet in Kano State were
 186 presented in Table 5. The estimate of the coefficients on X_2 , X_3 and $F - Value$
 187 were significant at 1% level of probability. The estimate of the grafted function
 188 was utilized to obtain expost forecast output of millet (tonnes) in Kano State of
 189 Nigeria. This study agrees with [15] who reported in his study using grafted
 190 polynomial function to forecast maize production trend in Nigeria that the
 191 intercept, coefficients of X_1 and X_2 were significant at 1% probability levels
 192 respectively. Table 6 shows the expost forecast of millet in tonnes for Kaduna and
 193 Kano States of Nigeria.

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 195 **Table 5: Estimates of the Structural Parameters of the Output of Millet in tonnes**
 196 **for Kano State (Grafted Function).**

197	Variable	Coefficient	t-value	Level of
198				Significance
199	Intercept	-183474	0.586	NS

200	X_1	4374572	1.135	NS
201	X_2	-1453572	7.556	0.01
202	X_3	176718.7	7.962	0.01
203	$R^2 =$	0.938		
204	d.f	15		
205	F Value	35.26***		

206 **Source: Field Survey, 2007.** ***- Significant at 1% Probability Level

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208 **Table 6: Expost Forecast of Millet (tonnes) in Kaduna and Kano States.**

209	Year	Output in	Output in
210		Tonnes (Kaduna)	Tonnes (Kano)
211	2006	436046.38	1800822.14
212	2007	537400.37	2144911.6
213	2008	638754.46	1581977.1
214	2009	631783.65	742129.4
215	2010	624814.6	255719
216	2011	613703	122746.0
217	2012	630417.68	166491.7
218	2013	674957.4	210237.4
219	2014	733409	253983.2
220	2015	791862.39	297728.9

221 **Source: Field Survey, 2007**

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4.0 CONCLUSION AND RECOMMENDATIONS

This study evaluated supply function analysis for millet based on Nerlove adaptive hypothesis in Kaduna and Kano States which is greatly influenced by fertilizer cost lagged one year and cost production for millet in Kaduna State and price of millet and fertilizer cost lagged one year in Kano State respectively. Based on the results, more agricultural inputs should be given to farmers in Kaduna and Kano States to produce more millet.

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