IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 3 Ver. III (Mar. 2015), PP 46-50
www.iosrjournals.org

Response of Cotton Supply to Price Changes in the Cotton Market In Zamfara State, Nigeria [1995-2013]: Application of Nerlovian Adaptive Expectation Model.

Odedokun,[1] V.O., Ahmed,[2] B., Omolehin,[3] R.A. and Atala,[2] T.K.
[1]*Department of Agricultural Economics and Rural sociology, Ahmadu Bello University, Zaria, Nigeria.*
[2]*Department of Agricultural Economics and Rural sociology, Ahmadu Bello University, Zaria, Nigeria.*
[3]*Department of Agricultural Economics and Extension, Federal University, Oye-Ekiti, Nigeria.*

Abstract: *The focus of this paper is on cotton production and supply trend estimation that deals with the response of cotton supply to price changes in the cotton market in Zamfara State, Nigeria. In the linear function, the explanatory powers for R^2 and $\bar{R}^2$ were 28.50% and 14.20% of the supply of cotton in the domestic market respectively which were explained by the explanatory variables between the periods under consideration. For the Y_{t-1}, P_{t-1} and P_c, showing the t-values of (0.95), (-0.35) and (-0.91) respectively were not significant at 1% level of significance. The semi-log and double-log showed that the coefficients indicating the t-values of (1.30), (-0.49), (-0.77) and (1.23), (-0.60), (-0.84) respectively were not significant at 1% level of significance. The R^2 for semi-log and double-log functions were 31.70% and 33.6% respectively. The R^2 was quite below average. Therefore, the response of cotton supply to price changes in the domestic markets in the study area was inelastic and unsatisfactory*

Keywords: *Response, cotton, supply, price changes, cotton market, Zamfara State.*

I. Introduction

Agriculture constitutes one of the most important sectors of the Nigerian economy. The sector is particularly important in terms of employment generations and its contribution to the gross domestic product (GDP) and export earnings. However, the sector has been characterised since 1970 by declining productivity and increase dependence on import of food and raw materials. (Manyong et al. 2005)

Efforts have been made by various governments to reverse the trend by diversification of the productive base through increase production of cash crops such as cotton, groundnuts, palm oil, rubber, cocoa and coffee. These crops were the main export crops of the country where large revenue have been generated in the 60's (Idem, 1999). However, the role of generating revenue through exports had experienced decline. The decline in total food and fibre crop production and astronomical rise in input prices derived it legitimacy from the major consequences of neglect of the agricultural sector in Nigeria during the oil boom years of between 1970 and 1980's. These general problems of agricultural sector also affect the cotton industries which has hitherto played an important role in the economy.

According to the National Bureau of Statistics **(**NBS**) (**2011**)**, the per cent share in the GDP of the crop sub-sector from 1981 to 1990 had been fluctuating between 28.37% and 22.99% and did not register any significant increase. This trend continued as the contribution of the crop sub-sector was almost stagnant at about 36% from 1994 to 1997 and from 2003 to 2006. The Central Bank of Nigeria (CBN) (2012), in its annual report indicated the per cent share in total of the contribution of the agricultural sector to the GDP at 1990 constant basic prices. From 2007 through 2012, the share has been declining from 42% of the total GDP to 40.2%. The place of the crop production sub-sector in the total GDP have shown similar trend with a decline from 37.5% to 35.8% between the same period. Despite this marginal decline in recent years, the demand for many agricultural products outweighs the supply.

It is with respect to this that cotton was chosen to form the basis of this study. With regards to fibre crop, cotton is an important crop in the world, it ranks first followed by jute, kenaf and sisal in the world production of fibres. It is noticeable from the performance of the cotton production industry that since 2003/2004 cropping season, there has been a fall and fluctuating pattern in the production trends in cotton. According to United States Department of Agriculture (USDA) (2011), the production trend in cotton had not witnessed remarkable improvement between 2007/2008 cropping year while the 2010 - 2012 cropping seasons experienced a decline.

This phenomenon revealed a glaring disparity between demand and supply thereby creating a gap in the cotton production industry. According to Batterham, (2000) supply is yet to satisfy the level of demand for cotton.**[1]** This has caused great concern in the textile cotton fibre supply situation in the local market and export

profile in the country thereby having a declining effect in its contribution to the agricultural economy of the country.

1.1 Research Question and Objective

It is based on this credence that this research question was addressed by the study:

What is the response of cotton supply to price changes in the cotton market in the state?

The broad objective of the study was to estimate supply trend among cotton farmers in the study area. The specific objective of the study was to;

estimate the elasticity of cotton supply to price changes in the cotton market from 1995 to 2013 in the state.

1.2 Test of Hypothesis

The hypothesis that was tested was stated in the null form.

There is no significant difference between supply and prices (P_t, P_{t-1} and P_c) of cotton trends in the study area.

II. Materials And Methods

Zamfara state was used for this study. The state lies between latitude 10^0 50`N and $13^0$ 38`N and longitudes 4^o16`E and $7^o$18`E. The state is located in the Sudan Savanna ecological zone of Nigeria. It has a land area of 39,762km^2. Zamfara state shares common borders with Sokoto and the Republic of Niger to the north, Katsina and Kaduna states to the east, Niger and Kebbi states in the South (Yakubu, 2005., Zamfara State 2010). The state has a population of about 3,259,846 people in 2006 according to the National Population Commission (NPC,2006). This is projected in 2011 to be 3,667,326 People representing 3.2% annual growth rate in population (UNFPA, 2013).

The climate is essentially that of tropical climate. The climate is generally characterized by alternating dry and wet seasons. The rains usually commence in May/June and end in September/October. The effective rainy season in the study area is restricted to July to mid September[10]. The main ethnic groups in these areas are Hausas, Beriberis, Buzzaye and Fulanis. Indeed, agriculture forms the main occupation of the entire population. This constitutes the bulk of those involved in traditional farming, fishing, hunting and nomadic pastoralism(ZADP, 2010) .

2.1 Data Source

Secondary data were collected and used in this study. Data on cotton output and prices from the state for various years were collected from Central Bank of Nigeria (CBN annual reports), Food and Agriculture Organizations (FAO) production yearbook or quarterly bulletin of statistics, Federal Office of Statistics (FOS), National Agricultural Extension and Research Liaison Services (NAERLS) Wet Season Production Report, Bulletin of Prices, internet and the Zamfara State Agricultural Development Project (ZADP).

III. Models With Lagged Variables

In economic time series, past values could influence present values and present values could influence future values. The variables with such properties are called lagged variables. There are lagged variable models to address problem constituted by lagged variables.

3.1 Estimation of Response of Cotton Supply to Price Changes in the Cotton Market

The response of cotton supply to price changes in the cotton market between 1995 through 2013 in Zamfara state was estimated. This is to ascertain that the response of farmers in the supply of cotton depends on the ruling price, price expectations, previous price profile, price of competing enterprise and some impinging non-economic factors determined by the ecology and biology of cotton production in the state. It is based on this premise that farmers respond and decide on the amount of cotton to produce in a current year using last year's market prospects as a basis for decision at farm level thereby justifying the level of profits accruing to them. The lagged model known as Nerlovian adaptive expectation model was used to estimate the response of cotton supply to price changes in the cotton market in the state. The model was used to achieve the stated objective of the study.

3.2 Nerlovian Adaptive Expectation Model

The assumption in the Nerlovian adaptive expectation model is that, supply of an agricultural product is a function of the expected price for that commodity, in this case cotton was used in the estimation. The derivation of the linear trend relationship between output and price at various time periods is summarized in appendix (I). The equation that was used to determine the response of cotton supply to price changes in the cotton market is expressed in equation (8) while P_C is price of a competitor to cotton such as groundnuts.

3.3 The Model

The model assumes that supply of any agricultural commodity is a function of expected price for that commodity (Nerlove, 1958). This is expressed as;

$Yt = f(P_t)$……..……(1)

This mean that;

$Yt = \alpha_0 + \alpha_1 P_t^e + ut$……...….(2)

Where;

Yt = Acreage planted in year t

α_0 = Intercept term

α_1 = Coefficient of Regression

P_t = Expected price in year t.

The assumption in the Nerlovian case is that, the expected price is expressed as;

$P_t^e = P_{t-1}^e + ß\,(P_{t-1} - P_{t-1}^e)$……(3)

Where;

P_t^e = Price expected this period

P_{t-1}^e = Price expected last one period

$(P_{t-1} - P_{t-1}^e)$ = Forecast error

ß = Adaptation expectation coefficient

For this hypothesis to hold, the value of ß must lie between 0 and 1.

If ß = 0 , $P_t^e = P_{t-1}^e$, Expected price last year and this year is the same.

If ß = 1, $P_t = P_{t-1}$, Prices are the same for both year.

If the value of ß lies between 0 and 1 how can we estimate the model?

From equation (3) we derive the following expressions;

$P_t^e = P_{t-1}^e + ßP_{t-1} - ßP_{t-1}^e$

$P_t^e = ßP_{t-1} + P_{t-1}^e - ßP_{t-1}^e$

$P_t^e = ßP_{t-1} + (1 - ß)P_{t-1}^e$ ……..……..(4)

Applying lag operator to equation (4) gave the following expressions;

$ßP_{t-1} = P_t - (1 - ß)LP_t^e$

$ßP_{t-1} = [1 - (1 - ß)L]\,P_t^e$

$$P_t^e = \frac{ßP_{t-1}}{[1 - (1 - ß)\,L]} \quad \text{……..……(5)}$$

Substitute equation (5) into supply function expressed in equation (40) to give;

$$Y_t = \alpha_0 + \alpha_1 \left[\frac{ßPt_{-1} + ut}{1 - (1 - ß)\,L}\right] \text{……..……(6)}$$

Clear fraction by multiplying through by [1 – (1 – ß) L].

$Y_t[1 - (1 - ß)\,L] = \alpha_0[1 - (1 - ß)\,L] + \alpha_1 ßP_{t-1} + u_t[1 - (1 - ß)\,L]$

$Y_t - (1 - ß)\,Y_{t-1} = \alpha_0 - \alpha_0(1 - ß) + \alpha_1 ßP_{t-1} + u_t - (1 - ß)u_{t-1}$

$Y_t = \alpha_0 - \alpha_0 + \alpha_0 ß + (1 - ß)\,Y_{t-1} + \alpha_1 ßP_{t-1} + u_{t-1}(1 - ß)u_{t-1}$

$Y_t = \alpha_0 ß + (1 - ß)\,Y_{t-1} + \alpha_1 ßP_{t-1} + u_{t-1}(1 - ß)u_{t-1}$ …… (7)

For estimation,

$Y_t = a_0 + a_1 Y_{t-1} + a_2 P_{t-1} + v_t$…….……(8)

Where;

$a_0 = \alpha_0 ß$

$a_1 = (1 - ß)$

$a_2 = \alpha_1 ß$

$v_t = ut_{-1}(1 - ß)\,u_{t-1}$.

Equation (8) is the empirical model and estimated using Ordinary Least Squares (OLS) regression so as to obtain a_0, a_1, a_2 and v_t.

If $a_1 = 1 - ß$

$ß = 1 - a_1$

The ordinary least squares (OLS) method was used in which multiple regression analysis was adopted. Three functions namely linear, semi-log and double-log (logarithm) functions were used. The essence of using semi-log and double-log functions in this analysis is to help us validate if a more linear relationship between the dependent variable and independent variables can be estimated in the analysis.

IV. Results And Discussion

In the linear model, the values of R^2 and $\bar{R}^2$ showed the performance of Cotton supply to price changes in the domestic market between 1995 and 2013 shown in table 50. Hence, the explanatory powers for R^2 and $\bar{R}^2$ were 28.50% and 14.20% of the supply of cotton in the domestic market respectively which were explained by the explanatory variables between the periods under consideration. For the Y_{t-1}, P_{t-1} and P_c, they were insignificant. This means that, the response of cotton supply to price changes in the domestic market was not dramatic and unimpressive within the period as might be expected.

Table1: Regression Analysis Result for Cotton Supply to Price Changes Using the Nerlovian Model (1995-2013)

Dependent Variable	Constant Term	Regression coefficients Y_{t-1}	P_{t-1}	P_C	R^2	F	$\bar{R}^2$
Linear	180.82***	0.2389	-0.0001354	-0.002607	0.285	1.99	0.142
	(2.39)	(0.95)	(-0.35)	(-0.91)			
Semi-Log	154814	112100	-26292	-105989	0.317	2.32	0.181
	(0.20)	(1.30)	(-0.49)	(-0.77)			
Double –log	5.469***	0.3046	-0.0916	-0.3332	0.336	2.53	0.203
	(2.40)	(1.23)	(-0.60)	(-0.84)			

Figures in parenthesis are the t-values
*** $P < 0.01$

The other two functions namely; semi-log and double-log showed that the coefficients were not significant. The R^2 for semi-log and double-log functions were 31.70% and 33.60% while adjusted R^2 were 18.10% and 20.30% respectively. The R^2 and adjusted R^2 were quite below average in explaining the relationship between the explanatory variables and the dependent variable in the time series. This means that the powers of the explanatory variables were not adequately expressed in consonance with the dependent variable. Therefore, the response of cotton supply to price changes in the domestic markets in the study area was inelastic and unsatisfactory. Also, in the semi-log and double-log functions the analysis revealed that the competitor to cotton that is groundnuts, have negative coefficients of regression. These have credence for the case of any competitive enterprise in which a fall in price of groundnut will enhance an increase in the level of production of the alternative enterprise where the price is more attractive, profitable and stable. In this case, inputs will be diverted to the production of the profitable alternative enterprise.

The phenomenon of inelasticity and unresponsiveness of cotton supply to price changes in the cotton market can be attributed to the deregulation of the cotton markets in Nigeria in January, 1986 when the commodity marketing boards were scrapped and abolished. In this regard, registered cotton merchants, agent middlemen and licensed buying agents (LBA's) ceased to exist thereby hampering cotton to be traded in organised markets through appropriate marketing channels. Presently, most cotton markets are still freely traded and there is no statutorily organised cotton market in existence within the immediate reach of cotton farmers in Nigeria.

This is a discouragement coupled with insufficient market incentives for farmers involved in cotton production. In other words, availability of organised markets and guaranteed market prices of cotton are the most important indicator for farmers decisions to cultivate the crop. If markets are not institutionalized to absorb produced cotton from farmers and the market price is below the cost of production, then there is no incentive for the farmer to continue to cultivate the product. Instead, farmers can decide to cultivate a substitute product in place.

4.1 Test of Hypothesis (Ho_1)

Test of hypothesis for the response of cotton supply to price changes in the cotton market was carried out using the result of analysis of trend in Table 1.The null hypothesis states that $P_t = P_{t-1} = P_c = 0$ implying that there is no significant difference between supply and prices in the study area. The result of the analysis in Table 2 shows that the highest calculated T-values of the prices were not significant at 10% level of probability in both models. Hence, the null hypothesis is accepted. Thus, there is no significant relationship between cotton supply and seed cotton prices (P_t, P_{t-1} and P_c) in the study area.

Table 2: Test of Hypothesis for the Response of Cotton Supply to Prices in the Cotton Market

	Null Hypothesis	Calculated T-value	Critical T-value	Decision
Price function	$P_x = 0$		2.40	Accept
	$P_{t-1} =$	$(-0.60)^*$		-
	$P_c =$	$(-0.84)^*$		-
	$Y_{t-1} =$	$(1.23)^*$		-

Figures in parentheses are the T-values
* Calculated T-values from Nerlovian adaptive expectation model

Since this hypothesis is accepted that there is no significant relationship between cotton supply and prices, there are some implications that can be deduced for production planning and investment in the cotton production industry. In most cases, output level from cotton enterprises are relatively low which tend to discourage farmers when compared to the level of output recommended. In order to overcome this problem, farmers need to plan their investments in cotton production by adopting improved recommended cotton production practices. Also, sufficient incentives in terms of inputs and output prices will encourage farmers to improve production while organized cotton markets are needed to absorbed cotton produced by farmers in the economy. The deregulation of the cotton market is a disincentive to cotton farmers which need to be reviewed by instituting relevant market policy so as to revamp the cotton production industry in Nigeria. This will provide raw material for textile industries and export the surplus to earn foreign exchange.

V. Conclusion And Recommendations

The thrust of this study started on the note that agriculture plays a vital role in the process of economic growth and development. The desired roles agriculture suppose to play have not been realised due to the neglect of the sector as a result of oil boom which led to a downturn and downward trend in food/cash crop production of which cotton is not an exception. The application of the models with lagged variables indicated that the response of farmers in the supply of cotton to price changes was unsatisfactory in the cotton market. These results can be utilised for policy purposes when formulating and planning to resuscitate cotton production industry in Nigeria.

Based on the above conclusions, some policy recommendations and suggestions that will help in improving upon the level of growth in cotton production industry are proffered:

(i) Provision of sufficient incentives by government and agro-service agencies in terms of inputs such as improved seed, fertilizers, adequate labour supply, agro-chemical, adequate and output prices will encourage farmers to improve production.

(ii) Adequate research and extension programme are required to disseminate and increase the level of awareness of farmers on the need to adopt and use improved cotton production technological packages.

(iii) The unsatisfactory response of cotton supply to prices in the market was attributed to unavailable organised market. An enabling marketing policy need to be instituted by government through product marketing corporation which will serve as a clearing house for cotton marketing.

References

[1]. Batterham, R. (2000). The Chance to Change. Discussion Paper by the Chief Scientist Camberra, African Summit, Abuja, Nigeria.
[2]. Central Bank of Nigeria(CBN)(2012). Estimated Output of Major Agricultural Commodities. Annual Report.
[3]. Idem, N .U .A. (1999). Cotton Production in Nigeria. Baraka Press and Publishers Ltd. Kaduna.
[4]. Manyong, V. M., Ikpi, A., Olayemi, J. K., Yusuf, S.A., Omonona, B.T., Okoruwa, V. and. Idachaba, F.S. (2005). Agriculture in Nigeria: Identifying Opportunities for Increased Commercialization and Investment. IITA., Ibadan, Nigeria, Pp. 159.
[5]. National Bureau of Statistics (NBS).(2011). Nigeria Gross Domestic Product at 1990 Constant Basic Prices.
[6]. National Population Commision (NPC), (2006). ,Population Census of the Federal Republic of Nigeria. Analytical Report at the National Population commission, Abuja, Nigeria.
[7]. Nerlove, M. (1958). The Dynamics of Supply: Estimation of Farmers' Responses to Price. John Hopkins Press.
[8]. United Nations Population Fund (UNFPA), (2013). Available on-line @http: Nigeria. unfpa.org/zamfara.html. Retrieved: 05/12/2013.
[9]. United State Department of Agriculture. USDA(2011). Nigeria Cotton Production by year. http://www.indexmundi.com Accessed, 02/09/2011.
[10]. Yakubu, A. A .(2005). Risk and Risk Management in Cotton Production among Farmers in Zamfara State, Nigeria. Unpublished M.Sc. Thesis Submitted to the Department of Agricultural Economics, Usman Dan Fodio University, Sokoto, Sokoto State, Nigeria.
[11]. ZADP (2010). Zamfara State Agricultural Development Project (ZADP) Reconnaissance Survey.
[12]. Zamfara State (2010). www.zamfarastate.net Accessed Jan. 2013