[1]K.C. Igwe, [2]B.C. Okoye and [1]U.J.N. Joe-Nkamuke

ANALYSIS OF THE SUPPLY RESPONSE OF MAIZE PRODUCERS IN NIGERIA

[1]K. C. Igwe, [2]B. C. Okoye and [1]U. J. N. Joe-Nkamuke

[1]Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, P. O. Box 2, MOUAU Post Office Umudike, Nigeria

[2]National Root Crops' Research Institute, Umudike, P. M. B. 7005, Umuahia, Abia State, Nigeria

kayce_chima@yahoo.com

+2348039445464

Abstract

The research work analyzed the supply response of maize producers in Nigeria and its implication for agricultural trade. The period covered was 1987-2007 (20 years) and data were collected on import quantity and value, export quantity and value, price of maize, price of its substitute, output and hectarage within the time period. FAO statistics data base was the source of data. The result showed that the trade balance for maize is negative ₦ – 2,453,550 indicating that most of the maize consumed was imported. Exchange rate used was 150 naira to 1 dollar. Hectarage decreased at the rate of $5.0 \times 10^3\%$ while import quantity, export quantity and price increased at a compound rate of $3.82 \times 10^2\%$, $4.68 \times 10^2\%$ and $3.0 \times 10^3\%$ respectively. A deceleration in export quantity was observed as the t^2 value was negative, the coefficients for hectarage was also negative showing a deceleration. However, there was acceleration in maize price as the t^2 value was positive and significant at 5% probability level. The R^2 value was 77% indicating that 77% of the variation in maize supplied was explained by the estimated values. It was also significant at 1% level of probability indicating goodness of fit of the regression line. Due to the increased demand for and increased use of maize, it is recommended that maize producers should be provided with essential input at subsidized rate so as to increase their output to meet the demand. In addition, maize import should therefore be reduced to strengthen local production and high yielding maize varieties should be developed.

Keywords*: producers; Agricultural Trade; Export Quantity; Maize price*

Introduction

Agriculture is one of the most important sectors of the Nigerian economy. This is because it contributes more than 30% of the total annual GDP, employs about 70% of the labour force and accounts for over 70% of the non oil export and perhaps most importantly, provides 80% of the food needs of the country (Adegboye,2004). Of all crops grown in Nigeria, maize (*Zea Mays*) is one of the most important cereal crops in sub-Sahara Africa. Along with rice and wheat, it has been acclaimed the most important cereal crop in the world and the land mass devoted to its production has been increasing over time steadily. According to FAO data, the land areas planted to maize in west and Central Africa alone increased from 3.2million in 1961 to 8.9 million in 2005. This phenomenal expansion of land area devoted to maize cultivation resulted in increased production from 2.4 million metric tones in 1961 to 10.6 million metric tones in 2005.

Maize is produced by both small and large scale farmers in Nigeria. It is a very important food crop for human and livestock as it provides energy, vitamins and negligible amount of protein. It is widely consumed as a staple by poor rural and urban households (Benjamin *et al*, 2005). The

[1]K.C. Igwe, [2]B.C. Okoye and [1]U.J.N. Joe-Nkamuke

estimated area of land utilized for maize production in Nigeria is about 1 million hectares out of the 9 million hectares used for its production in Africa.

In Nigeria, maize is one of the most widely consumed cereal crops and a staple of great socio-economic importance. Ironically, the demand for maize as a result of various domestic uses sometimes outstrips supply (Babatunde and Eniola, 2008).

Similarly, the unfolding performance of maize can be attributed to the fact that bulk of the country's farm (over 90%) is dependent on small holder farmers with rudimentary farming system, low capitalization and low yield/hectare. Additionally, other factors like price fluctuation, diseases and pest, poor storage facilities have been associated with low maize production in the country (Iken and Amusa, 2004).

There has also been a fluctuating trend in maize production over the last decades, which threatens household food security and income sources (Ogunbodede and Olakojo*., 1999). While the average yield of maize in developed countries is 8.6tonnes/hectare, production per hectare in many sub-Sahara Africa countries is still very low (1.3tonnes/hectare) (Babatunde and Eniola*, 2008). Moreover, year round grain availability is low in Nigeria owing to a combination of low productivity and high post harvest losses.

Efforts to increase maize production through maize seed multiplications are channeled through an out grower scheme being implemented by state and local extension units. However, this scheme is constantly threatened by fertilizer shortages and lack of protection for the out growers. It is thus pertinent to examine the supply response of maize producers in Nigeria and its implications for agricultural trade. This could specifically be approached by determining the trade balance for maize; estimating the growth rate of maize as well as confirming acceleration, deceleration and stagnation of maize and possibly estimating supply response coefficients for maize.

Methodology

Study Area and Data Collection

The area used for this study is Nigeria. It is a country which is located between latitude 9^0 4N of the equator and longitude 7^0 29E of the Greenwich meridian (GMT). It has a landmass of about 923,768 km^2 and a population of 158,259,000 with a population density of 167.51persons/km^2 (2009 estimate). The currency used is naira (₦).

Nigeria is divided into 36 states and its federal capital territory (FCT), Abuja. It is located in West Africa and shares land borders with Benin republic in the west, Chad and Cameroun in the east, and Niger in the north. The 3 largest and most influential ethnic groups in Nigeria are the Igbo, Hausa and Yoruba.

This study collates values on different factors concerning maize, over 20 years (1987-2007). The objective is viewed from a macro-development perspective.

Data on output, prices, quantity and price of import and export, hectare (area) were elicited from secondary sources.

The data were generated from food and agriculture organization statistics (FAO Stat) for different variables over the years ie 1987-2007.

Analytical Procedure
Different tools were used to analyze the data generated.

Descriptive statistics such as means, standard deviation, simple linear regression as well as the quadratic equation were used for analysis of the time series data of the maize farmers.

$Y=f(X_1)$

Y = maize output

X_1 = time

The implicit form of the quadratic equation is expressed thus:

$Y = a + bt + ct^2$

Where Y = yield

t = time.

a and b = the unknown parameters to be estimated

t^2 = allows for the possibility of acceleration, deceleration or stagnation in growth of maize in Nigeria.

The implicit form of the function for the regression is expressed thus:

$Yt = f (Pt, Pt^s, At, Ut)$

Where   Y = Maize output in tonnes

Pt = Price of maize

Pt^s = Price of substitute.

At = Acreage or hectarage

Ut = error term.

Results and Discussion

Table 1 shows the average statistics of some selected indices for maize in Nigeria.

[1]K.C. Igwe, [2]B.C. Okoye and [1]U.J.N. Joe-Nkamuke

Table 1: Mean of Selected Indices for Maize in Nigeria

Variable	($ 1000) Mean	Standard deviation	Minimum	Maximum	t – value
Import quantity	2749.29	5599.08	0	18105.00	2.25**
Import value	397.67	711.03	0	2525.00	2.56**
Export quantity	3501.43	5594.57	0	20273.00	2.87***
Export value	234.10	386.92	0	1400.00	2.77***
Hectarage	4084590.48	832292.08	3159000.00	5472000.00	22.49***
Production	5623666.67	818591.98	4107000.00	7100000.00	31.48***
Price	22990.90	20166.12	611.00	62670.00	5.22***
Price of substitute	28880.52	22185.80	1415.00	71.550.00	5.17***

*,** and*** are significant at 10%,5% and 1% respectively.

Trade balance = mean export value – mean import value = 35,115,000 – ₦ 59,650,500 = ₦ -24,535,500.

Exchange rate of naira to dollars used is-₦150 to 1 dollar. The average import quantity, standard deviation and t-values were 2749.29, 5,599.08 and 2.25 respectively. The t-value was significant at 5% level of probability indicating significant differences between the minimum and maximum values. The standard deviation was also very high indicating wide variations with the period under study.

The average import value, standard deviation and t-value were 397.67, 711.03 and 2.56 respectively. The t-value was also significant at 5% level of probability with a high standard deviation indicating wide variations within the period under study.

The average export quantity, standard deviation and t-value were 3501.43, 5594.37 and 2.87 respectively. The t-value was highly significant at 1% as noted with the very high standard deviation value also indicating wide variation within the period under study. The export value followed the same trend with mean value, standard deviation and t-value of 234.10, 386.92 and 2.77. The t-value also was highly significant at 10% level probability.

The average hectarage, standard deviation and the t-value for hectarage were 4,084,590.48, 832,292.08 and 22.49 respectively. The t-value was highly significant at 1% level of probability implying wide variations corroborated by a high standard deviation. The mean, standard deviation and t-value for production was 5,623,666.67, 818,591.98 and 31.48 respectively as well as 28,880.52, 22,185.80 and 5.17 for mean, standard deviation and t-value respectively for price of substitute.

The trade balance for maize was – ₦ 2,435,550 indicating a negative balance. The average export and import values were 234.10 and 397.67 respectively.

39
[1]K.C. Igwe, [2]B.C. Okoye and [1]U.J.N. Joe-Nkamuke

The computed growth rates of output, hectarage, import quantity, export quantity and price of maize are shown in table 4.

Table 2: Estimates of the Growth Equation of Maize Output, Import Quantity, Export Quantity and Price

Dependent variable	Constant	Coefficient	R^2	F
Output	15.4944***	0.0035	0.0217	0.42
Hectarage	4640610***	-5055*	0.1420	3.14*
Import quantity	-1462.7429	382.9117*	0.1801	4.17*
Export quantity	-1655.3000	468.79351*	0.2703	7.04*
Price	-11062**	3095.7013***	0.9073	185.88***

*,** and *** are significant at 10%, 5% and 1% respectively.

There was a significant decrease in hectarage during the period under study. Hectarage of maize decreased at a compound rate 5.0×10^3% within the period. This may be as a result of non-implementation of the land use decree of 1978 of redistribution of land to farmers to make more land available for farming. The computed growth rates for import quantity, export quantity and price increased at a compound rate of 3.82×10^2%, 4.68×10^2% and 3.0×10^3% per annum respectively. This is due to the effect of policy effectiveness with the period understudy. According to Ogbonna *et al* (2007), it can also be attributed to the policy effect of the structural adjustment programme (SAP) introduced in 1986 which lingered up to 1996. The t-ratios were also significant. The computed growth rate for output was positive but not significant.

Table 5 shows the estimated quadratic equations of time variable for maize output, heactarage, import quantity, export quantity and price.

Table 3: Estimates of Quadratic Equation in Time Variables for Maize Output, Hectarage (Area), Import Quantity, Export Quantity and Price

Dependent variable	Constant	Parameters		R^2	F
		B	C		
Output	15.53366***	-0.0068	4.6591e-4	0.0331	0.31
Hectarage	3992718***	118468	-7682.5136	0.2376	2.80*
Import quantity	280.9639	-71.9683	20.6764	0.1954	2.19
Export quantity	-2784.0406	763.2476	73.3843	0.2767	3.44*
Price	-1657.2406	642.3355	111.5166**	0.9416	145.01***

*,** and *** are significant at 10%, 5% and 1% respectively.

[1]**K.C. Igwe**, [2]**B.C. Okoye** and [1]**U.J.N. Joe-Nkamuke**

There is an establishment of acceleration for maize price as the t^2 was positive and significant at 5% level of probability. This may be as a result of high cost of input. The coefficients for hectarage and export quantity were negative showing a deceleration but were not significant. The coefficients for output and import quantity were positive indicating acceleration but were not significant even at 10% level of probability.

Table 4 shows factors that determine supply response of maize in Nigeria.

Table 4: Factors that Affect the Supply of Maize

Variable	Linear	Exponential +	Cobb Douglas	Semi-log
Constant	1955578	14.8953	4.1786	-58851600
	(2.72[*])	(122.42[***])	(0.59)	(-1.41)
R^2	0.7431	0.7671	0.6861	0.6815
F	8.68[***]	9.88[***]	1.31	1.28
Import Quantity	4.7452	1.18E-6	0.0198	101646
	(0.18)	(0.26)	(0.71)	(0.62)
Export Quantity	-30.4763	-6.79E.6	0.0059	24237
	(-1.29)	(-1.70)	(0.09)	(0.06)
Hectarage	0.81699	1.43E-7	0.7653	4323082
	(5.29[***])	(5.45[***])	(1.42)	(1.37)
Price	55.4533	9.98E-6	0.2904	1647818
	(1.99[*])	(2.11[**])	(1.20)	(1.17)
Price of substitute	-29.4472	-5.37E-6	-0.3203	-1770323
	(-1.08)	(-1.16)	(-1.01)	(-0.96)

Source: Computed based on FAO Statistics Database, 2010

N/B: *, ** and *** mean significant at 10%, 5% and 1% respectively

+ – lead equation

Figures in parenthesis are t-values.

Among the four functional forms tried, the exponential form was chosen as the lead equation with a high R^2 value of 0.7671. This implies that 77% variability in maize supplied was explained by the independent variables. The F - ratio was also significant at 1% level of probability indicating goodness of fit of the regression line.

The coefficient of hectarage was positive and significantly related to quantity of maize supplied at 1% level of probability. This implies that any increase in hectarage will lead to a corresponding increase in maize supplied. This is in agreement with apriori expectation.

The coefficient for import quantity was positively signed but not significant as well as export quantity and price of substitute which were negative.

Thus, both price and non price factors are strategically important for promoting higher agricultural growth (Molua, 2008).

Conclusion

The research work was aimed at analyzing the supply response of maize producers in Nigeria and its implication for agricultural trade. The period covered was 1987-2007 (20 years) and data were collected on import quantity and value, export quantity and value, price of maize, price of its substitute, output and hectarage within the time period from FAO statistics data base. It has been found out that supply response is positive but weak. Demand for maize has increased significantly due to its use for various purposes which include food; feed formulation for animals, raw materials for industries etc. and domestic supply has not been able to meet the domestic demand which has lead to an increase in maize importation. Due to the increased demand for and increased use of maize, it is recommended that maize producers should be provided with essential input at subsidized rate so as to increase their output to meet the demand. In addition, maize import should therefore be reduced to strengthen local production and high yielding maize varieties should be developed.

References

Abdulrahman, A.A. and Kolawole, O. M. (2006) Traditional preparations and uses of maize in Nigeria *Ethnobotanical leaflets* 10:219-227.

Adegboye, R.O. (2004) Land, Agriculture and Food Security in Nigeria, 3rd Faculty Lecture, Faculty of Agriculture, University of Ilorin.

Adubi, A.A and Okunmadewa,F.(2000) Price, exchange rate volatility and Nigeria's Agricultural trade flows: A dynamic analysis, *Journal of food and Agriculture,* vol 7:145-154.

Ahmed,B and Omorerin R(1998) Maize marketing in northern Nigeria, *African Journal of Agricultural Research*,Vol.5:332-340.

Ajala S.O,Menkir A. and King J.G. (1999) Fertility requirements of open Pollinated and Hybrid Maize genotypes. Paper presented at the Sasakawa Global National maize Workshop,ABU,Zaria,Nigeria

Akinmitimi A.H, Ojewola G.S. and Nwoche G.N. (2009) Effects of Feeding varying levels of Rice milling waste on Performance, Nutrient Retention and Production Economy of Growing Local Turkeys. *Nigerian Agricultural Journal Volume 40*

Journal of Agriculture and Food Sciences
Volume 9, Number 1, April, 2011 pp. 35-43   [1]**K.C. Igwe, **[2]**B.C. Okoye and **[1]**U.J.N. Joe-Nkamuke**

42

Ayeni A.O(1999),Maize production in Nigeria: problems and prospects, *Journal of Food and Agriculture*: 2; 123-129

Babatunde R. and Eniola O. (2008) Food security and marketing problems in Nigeria: the case of maize marketing in Kwara State.

Behrman, J. (1998) Supply Response in Underdeveloped Agriculture. North Hollandpublishing Company, Amsterdam

Benjamin A. and L. Rikko (2005) market institutions for maize in northern Nigeria, *Nigerian Agricultural Journal Volume,* vol 35:135-142

Central bank of Nigeria (CBN 2003) "Contributions of the Agricultural Credit Guarantee Scheme (ACGs) to Improved agricultural financing in Nigeria: Past, Present and Future"

Competitive Commercial Agriculture in Africa (CCAA) (2008): Nigeria a case Study by Aderigbigbe S.O

Food and Agriculture Organization (FAO) (2007) Database Result FAO(2000): Technical Background Document for the World Food Summit Rome, Italy

Helleiner G.K. (1996) Present Agricultural and Economic Growth in Nigeria, Homewood Publishers, United Kingdom

Idachaba,F.S(2004) Food security in Nigeria: Challenges under Democratic Dispensation, 9th ARMTI Annual Lecture, Ilorin

Ihimodu,I.I(2004) Marketing of Agricultural Products and Food security Programme in Nigeria. Paper presented at the 13th annual congress of the Nigerian rural sociological association at LAUTECH, Ogbomosho Nigeria

Iken, J.E and Amusa, N.A (2004), Maize Research and Production in Nigeria, *African Journal of biotechnology,* vol 3(66):302-307

International food policy research institute (IFPRI, 2009), Sustainable Solutions for ending Hunger and Poverty: Background Paper 6

Molua E. I. and Ekonde, R. L. (2008) Price Competitiveness and Supply Response of Rice Producers in Cameroun: implications for Agricultural Trade, African Economic Research Consortium

Nigerian Compass Newspaper (Oct 2010) Farmers Kick as Nigeria Imports 7,000 Tonnes of Maize

Ogbonna, M.C, Asumugha, G.N and Ikeogu J.G. (2007) Stagnation, Acceleration and Deceleration in trends in yam output,area and productivity in Nigeria,1975-2005 National Root Crops' Research Institute (NRCRI) Umudike Annual Report

Ogunbodede B.A and Olakojo, S.A. (1999) Development of *striga asiastica* tolerant Hybrid maize varieties: Tropical Agricultural Research and Extension 4(1)

Ogunsumi, L.O, Samuel, O.E, Adebiyi G.D (2008) Socio-economic impact Assessment of Maize production technology on farmers welfare in south west, Nigeria, *Journal of Central European Agriculture*, Vol 6: No. 1(15-26)

Oladejo, J.A. (2008) Transaction costs and agricultural household supply response of maize farmers in Oyo and Osun states of Nigeria. A PhD thesis submitted to the department of Agricultural Economics, LAUTECH, Ogbomosho

Olarindee, L.O, Manyong, V.M and Akintola, J.O (2007) Attitude towards risk Among maize farmers in the Dry Savanna zone of Nigeria: Some prospective policies for improving food production, *African journal of agricultural research*, Vol.2(8):399-408

Philip, D., Ephraim, N., John, P. and Omobowale, A.O (2001), Constraints to increasing agric productivity in Nigeria. A review. Nigerian strategy support programme (NSSP), background paper 6.

Tunji A. (2007) An overview of the Nigerian rice economy, *Journal of Food and Agriculture* vol 9:128-139

Rahman, S.A and Lawal, A.B (2003) Economics analysis of maize based Cropping System in Giwa Local Government Area of Kaduna State, Nigeria. Asset Series A 3(2); 139-148.

Rikko L, (2008) The role of credit in maize marketing in Jengre Bass Local Government Area, Plateau State, Nigeria. A paper presented at the Annual Agricultural Conference, Faculty of Agriculture, University of Jos.

UNCTAD (2005) " Trade development report, 2005". Geneva, 204 World bank (2004)" Getting agriculture in Nigeria: Framework for a national growth strategy", wikipedia.com.

World Bank (2002): Poverty Reduction and the World Bank, USA.