An ARCH-M Analysis of Liberalization and Rice Price Distribution in Nigeria

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Abstract: Market liberalization is regarded as a major aspect of the structural economic policy reforms embarked upon by most developing countries. The policy was introduced in the Nigerian economy in 1986. The study examines the determinants of real price distribution of rice in pre-liberalized and post-liberalized period in Nigeria using Autoregressive Condition of Heteroskedastic in mean (ARCH-M) method. Lagged prices, trend and regional variation significantly determined the prices of rice while border parity price and real exchange rate were not significant in both periods. However, regional price differences were small in the pre- liberalization years than post-years. The real price distribution of rice decline in the pre- liberalization years while it dampened in the post-years due to the absence of stabilization programme by the government. Market support services, coordination of market information system and price stabilization programmes are therefore recommended.

Key words: Liberalization, distribution, economic, ARCH-M, SAP

INTRODUCTION

Market liberalization means allowing market forces of demand and supply to determine what to produce, for whom to produce and the method of production to be used in an economy. These forces, therefore determines the product prices. Market liberalization is regarded as a major aspect of the structural economic policy reforms embarked upon by most developing countries (Yusuf and Falusi, 1999; Golleti and Minot, 2000). Studies have shown that market liberalization is expected to benefit net exporter countries, particularly those that were highly open to trade (Todaro, 1977; Barret, 1997; Wilson, 2002). Deininger and Olinto (2000) however, observed that liberalization of Zambia economy significantly opened the economy but failed t o alter the structure of production or help realize efficiency gains. Market liberalization becomes ineffective in the absence of sound monetary and fiscal policies, stable exchange rate and controlled rate of inflation (Lowell and Bendor, 1995). Burniaux *et al.* (1990) suggests that trade liberalization in the context of agriculture in developing countries will have a negative impact on the food situation in these countries is a short-run. This was corroborated by studies of Okunmadewa *et al.* (1999) which indicated that though trade liberalization has fostered a better resource allocation in agriculture and increased productivity; food security however remained poor because the trade liberalization policies also led to general price increases.

The policy was introduced in the Nigerian economy in 1986 as a major component of Structural Adjustment Programme (SAP). This led to the abolition of the marketing boards, subsidy withdrawal, trade liberalization, export tax reduction, tariff reduction and demonopolisation of domestic trade channels, exchange rate deregulation, etc. Consequently, the economy result to adopt a market- determined exchange rate for the Naira, substantial reduction in complex price and administrative controls and more reliance on market forces as major determinants of economic activity (CBN, 2002).

In the 1960s, agriculture contributed 70% of the Nigeria's Gross Domestic Product (GDP). The contribution dropped to between 34.7 and 43.3% in 1980s and later dropped further to 37.9% in 1995. The bulk of agriculture's contribution to the GDP in this period has been from crop sub-sector which was between 73 and 80% (Badmus, 2000).

Rice significance as a staple food is increasing in Nigeria. The average retail price grows from 73K per kg in 1980 to about N50.27 k per kg in the year 2000 (FOS, 2000). In addition, local prices have encouraged the demand shift towards rice due to poor harvest and consequent higher prices of the local staples such as yam and garri (Oryza, 2002). The introduction of the New Rice for Africa variety (NERICA) in this period has demonstrated a resistance to the African rice Gaul midge disease which in recent years has significantly reduced Nigeria crop yield. However rice import accounts for approximately one-third

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of Nigeria rice supplied. Nigeria moves from self sufficiency in rice in 1960s to importing one-million tons in 1999 at a staggering cost of US $ ½ billion (WARDA, 2002). It should be noted further that prior to the reform period, Nigeria was a net importer of rice until it was banned in 1985 as such the value of import was as low as 130tons compared to 800,000 tons in 1999 (FAO, 2000).

The structural adjustment process no doubt, results in overall re-organization of the society. Hence there is need to examine the consequences of these macroeconomic imperatives on the economy in a developing country like Nigeria. This becomes more expedient as not much research work has been done in Nigeria based market liberalization with specific reference to its impact on price distribution for rice from 1980 to 2000.

The objective of the study is therefore to analyze the determinants of rice price distribution before and the after market liberalization. To this end, it is hypothesized that the impact of the determinants of price of rice in the pre-liberalized period is significantly different from impact in the post-liberalized period.

MATERIALS AND MATHODS

The data used in the study were mainly from secondary sources. These include Central Bank of Nigeria (CBN), Federal Office of Statistics (FOS), International Financial Statistics (IFS), Food and Agricultural Organization (FAO) and National Data Bank (NDB). Monthly time series data on rice price from 1980-2000 for five agricultural enumeration regions in Nigeria was used. These were Borno (Northeast zone), Kaduna (Northest zone), plateau (Middle belt zone), Enugu (southeast zone) and Oyo (Southwest zone). Information on exchange rate, border parity price, consumer price index, were also sought for the respective years. The time period for the study took into consideration the pre and post-liberalization periods. The first six years (1980-1985) represented the pre-liberalized years while 1986-2000 represented the post-liberalization periods.

The analysis involved the use of Autoregressive Conditional Heteroskedastic in Mean (ARCH-M) methods. The method is not only interested in the determinants of prices as reflected in the mean conditional and various regressors but also in the factors that explain price risk an reflected in series conditional variance and the interaction between the mean and variance of food prices, that is, the price risk premium prevailing in food market (Gujarati, 1995). The model was decomposed into two equations for the commodity price series both before and after

market liberalization. The choice of the independent variables is based on Barret (1997) and Oyeleke (2000). The basic model expressed as:

$$P_{it} = \beta_0 + \beta_1 P_{it-1} + \beta_2 TREND + \beta_3 ERt - 1 + \beta_4 BP_t + \sum_{i=I}^{r} \Phi_i R_i + U_1$$

$$\mu_{it} \sim \quad iidN\,(0, h_{it})$$

$$h_{it} = \alpha_0 + \alpha_1 U_{it2-1} + P_{it-1} + \gamma_2 TREND_t + \gamma_3 ER_t + \sum_{i=I}^{r} \phi_i R_i$$

P_{it} = The observed price for a given region (i) and month (t) in pre liberalized era

α_0 and

β_0 = constants

P_{it-1} = Lagged level of price for region (i) and month (t)

h_{it} = The observed price for a given region (i) and month (t) in post liberalized era

$Trend_t$ = 't' is a unit time index whose coefficient represents a linear monthly trend.

ER = The real exchange rate

BP = The contemporary border parity price.

μ_t = Stochastic error term of the conditional means

R_1 = Represents each of the 'r' regions (Bond, Kadd, Yod, Platd, Engd)

The model specification proceeded by first testing for staionarity of the rice price distribution. This was achieved through the use of Augmented Dickey-Fuller tests (ADF). According to Thomas (1996), this is one of the best known and most popular tests for stationarity.

RESULTS AND DISCUSSION

The Augmented Dickey-fuller results showed that the ADF statistics were -5.378441 and -6.400256 for pre-SAP and post-SAP period respectively hence were statistically significant at 5percent level. The real price distribution for both periods was therefore stationary. The results of the ARCH-M analysis are shown in Table 1 and 2 for the pre-SAP and post-SAP-period, respectively.

For the pre-liberalized years (Table 1), real price distribution for rice was found to be determined by lagged prices, trend variable and regional variation represented by dummies as they were all significant at one percent level. However, the border parity price and real exchange rate were observed to be insignificant at all levels.

Lagged prices induced a positive change on real price distributions for rice. Trend variable was found to have affected real price distributions only in one region (Kaduna) while result in the other four regions remained

Table1: ARCH-M result for pre-liberalization years (1980-1985)

Mean equation

Variable	Coefficient	Std. Error	t-Statistics	Prob.
Garch	3.803948	3.754690	1.013119	0.3117
Rprc (-1)	0.701857	0.059846	11.72777	0.0000
Bdp	-0.575751	0.790643	-0.728206	0.4670
Rexc	-0.001415	0.002005	-0.706015	0.4807
Trend	0.000190	0.000117	1.628630	0.1043
Bond	0.039381	0.046815	0.841211	0.4008
Engd	0.064844	0.040128	1.615947	0.1070
Kadd	0.092445	0.029258	3.159669	0.0017
Oyod	0.073716	0.037937	1.943142	0.0528
Platd	0.050808	0.051104	0.994195	0.3208
Conditional variance equation				
Arch (1)	0.144475	0.070399	2.052237	0.0409
Garch (1)	0.522047	0.164009	3.183034	0.0016
Rprc (-1)	0.002575	0.002179	1.181386	0.2383
Bdp	0.074069	0.036056	2.054274	0.0407
Rexc	-0.000240	9.91e-05	-2.426083	0.0158
Trend	-1.13e-05	3.74e-06	-3.022677	0.0027
Bond	0.937149	0.069201	13.54238	0.0000
Engd	0.936397	0.069085	13.55418	0.0000
Kadd	0.934948	0.068941	13.56156	0.0000
Oyod	0.935943	0.069081	13.54845	0.0000
Platd	0.937581	0.069192	13.55035	0.0000
R-Squared	0.705832	Mean dependent var		0.279614
Adjusted R-squared	0.687501	S.D. dependent var		0.07622
S.E. of regression	0.042665	Akaike info criterion		-6.249408
Sum squared resid	0.613455	Schwarz criterion		-6.011433
Log likelihood	682.391	F-statistics		38.50490
Durbin-Watson stat	1.916049	Prob (F-statistics)		0.000000

Berndt-hall-hall-hausman methd, arch//dependent variable is real price for price, Sample (adjusted): 2 360, Included observations: 359 after adjusting endpoints, Bollerslev-Wooldrige robut standard errors and covariance, Source: F.O.S (1980-2000); I.F.S. (1980-2000), N.D.B (1996-2000)

Table2: ARCH-M result for post-liberalization years (1986-2000)

Mean equation

Variable	Coefficient	Std. Error	T-Statistics	Prob.
Garch	-0.274646	2.317855	-0.118491	0.9057
Rprc (-1)	0.767075	0.028678	26.74761	0.0000
Bdp	0.031882	0.024973	1.276649	0.2021
Rexc	7.16e-06	7.32e-05	0.097755	0.9221
Trend	-0.00019	05.08e-0	5-3.59269	70.0003
Bond	0.174669	0.041384	4.220665	0.0000
Engd	0.143812	0.033035	4.353366	0.0000
Kadd	0.080451	0.017114	4.700855	0.0000
Oyod	0.112139	0.025021	4.481764	0.0000
Platd	0.204558	0.051514	3.970911	0.0001
Conditional variance equation				
Arch (1)	0.187620	0.086654	2.165166	0.0306
Garch (1)	0.486183	0.324004	1.500549	0.1338
Rprc (-1)	0.000323	0.001229	0.262562	0.7929
Bdp	0.00555	0.000288	0.192035	0.8478
Rexc	-2.15e-0.6	2.89e-06	-0.744364	0.4569
Trend	-3.58e-06	4.25e-06	-0.840763	0.4007
Bond	0.498055	0.069979	7.117238	0.0000
Engd	0.497677	0.070498	7.059431	0.0000
Kadd	0.496878	0.071304	6.968434	0.0000
Oyod	0.497255	0.070917	7.011814	0.0000
Platd	0.498463	0.069595	7.162158	0.0000
R-Squared	0.728784	Mean dependent var		0.250080
Adjusted R-squared	0.728784	S.D. dependent var		0.082356
S.E. of regression	0.043400	Akaike info criterion		-6.250421
Sum squared resid	1.651887	Schwarz criterion		-6.132926
Log likelihood	1615.291	F-statistics		112.2182
Durbin-Watson stat	2.098645	Prob (F-statistics)		0.000000

Berndt-hall-hall-hausman method, arch//department variable is real price for price, Sample (adjusted): 2 900, Included observations: 899 after adjusting endpoints, Bollerslev-wooldrige robut standard errors and covariance, Source: f.o.s (1980-2000); i.f.s. (1980-2000), n.d.b (1996-2000)

insignificant at all levels to spatial differences, the reason for this mishap in the pre-liberalized period could possibly be due to facilitative activities such as transportation and scarcity of rice (limiting sales volumes) thus forcing consumers to make spot (parallel) market purchases above fixed prices at some point. Moreover the likelihood of parastatal presence varies enormously across regions as the cost of maintaining a depot and transport network expand exponentially with geographical scope.

Also for post liberalization period, the result revealed that lagged prices, trend variable, regional variations were the determinants of real price distributions but border parity price and real exchange rate were found to be insignificant to real price distribution for rice.

Lagged price was observed to be significant and induced a positive change on real price distribution. Trend variable showed that real price distributions had dampened in this period due to the discontinuation of the state administered pricing system, however according to Barret (1997), there was no basis for continued growth in real price distributions for a country undergoing a recessionary period. In addition, it was observed that real price distributions of rice in all regions were affected by spatial differences. It is noteworthy to mention that regional price differences which were generally smaller prior to reforms were generally more pronounced in the post liberalization period. The implication for this was that abandonment of government system of fixed pricing led to more dispersion in spatial mean prices in this period since marketing boards which were to stabilize food prices across regions had been abolished to allow forces of demand and supply to come into play.

The result revealed that border parity price and real exchange rate for both sub-periods were insignificant; one is thus led to infer that real exchange rate policy seemed not to have worked as was anticipated in the case of rice in Nigeria. According to Barret (1997), the statistical insignificance of the real exchange rate and border parity price variables in each of the equation illustrates the non-tradability of Nigerian rice in the world market, therefore an increase or decrease on both variables does not affect the real price distribution for rice in Nigeria.

CONCLUSION

Real price distribution for rice was found to be determined by lagged prices, trend and regional variation in the pre and post-liberalization periods. Border parity price and the exchange rate in both periods did not have significant effect on real price distribution for rice. However, rice price distribution was negatively affected in liberalized period both in the nominal and

real terms, simply because trade liberalization policies led to general price increases. Price stabilization programmes such as stocks management and commodity exchange programmes are therefore recommended in future policy reforms. These should be complemented by improve market support services through increased public and private investments, improved networks and transportation systems, storage, credit and insurance facilities.

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