



*Full Length Research Paper*

# Analysis of government rural infrastructural spending and its effects on output of cereals in Benue State Nigeria: 1990-2012

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This study analyzed effects of government rural infrastructural spending on output of cereals in Benue state of Nigeria for 23years using vector error correction model (VECM). The result revealed that, Government spending on health in the previous year was positive to output of maize and significant with a coefficient of 3.39% in the long-run. However, this contrasted with educational and Road infrastructures with negative coefficients of -3.38 and -1.01 respectively. This was exclusive of output of millet with a negative coefficient of (-2.3095) for health and a positive coefficient of (0.84 and 0.38) for road and educational infrastructures respectively. The long-run effects of rural infrastructure on output of Sorghum revealed same response with that of millet for both government spending on, Education, health and Roads with negative coefficient of (-2.6039, -0.1826, -0.7189) respectively. Short-run analysis of rural infrastructural spending on output of maize revealed that, the coefficient [-0.54] of maize output in the previous year was negative and significant at 10%. Short-run effect of infrastructural spending on output of millet revealed that, coefficient [0.053] of government spending on roads two years ago was positive and significant at 5% probability level. In contrast, the coefficient [-0.507] of output of millet in the previous year was negative contrary to the a priori expectation and significant at 5% probability level. Short-run analysis of sorghum revealed that government spending on health in the previous year and two years ago were positive and significant at 1% with coefficients [0.397, 0.516] respectively. In contrast, spending on both education and road in previous year and two years ago gave a negative coefficients at 1% significant level as [-0.5070, -0.53, -0.1823, -0.36770] respectively. Based on findings of empirical analysis, the study recommends; that, policy makers should pay closer attention to improved spending on rural infrastructures.

**Keywords:** Rural Infrastructural Spending, Output of Cereals, empirical analysis

## INTRODUCTION

The centrality of government rural infrastructural spending as an important instrument in the development process has long been acknowledged by development economist worldwide as supported by African Development Bank (2010) and recognized that, rural infrastructures play a central role in the development agenda of any nation, particularly Nigeria. Thus, Nigeria

National Infrastructure Target and Investment Report (2013) highlighted that, the backbone and growth of any nation like Nigeria largely depends on the stock of its rural economic development infrastructures. However, the state of existing rural infrastructure in Nigeria and Benue state has remained precisely low and a matter of concern, given the importance of rural infrastructures in

the growth and development of agriculture in the rural areas of Benue state which is typically agrarian.

According to [Abumere (2002)] and [Adeoye *et al.* (2011)] all of the opinion that, the infrastructural facilities that must be a catalyst for encouragement of increased agricultural production in the rural areas are grossly inadequate. Moreover, the inadequacy of these infrastructures that can cause rural socio-economic transformation has contributed immensely to the low the quality of life of the rural people as well as slows economic growth rate.

In [Ale *et al.* (2011)], [Calderon, (2009)] and [Egbetokun, (2009)] these authors were also of the views that, adequate rural development infrastructures can bring about economic recovery, poverty alleviation via increase agricultural productivity and diversification.

In Nigeria, several government policies have led to infrastructure decay, which has been characterized by erratic power supply, inefficient telecommunication services, poor urban and rural road networks which has resulted in a near stagnant economic performance (Bureau of public enterprise (BPE), 2003). Therefore, a country with poorly developed infrastructure has a potential of increasing its gross output if it improves upon its infrastructural facilities Investment as opined in [Blejer and Khan (1984)]; [Greene and Villarueva (1999)], [Solano (1983)] other advantages associated with adequate rural infrastructural provision include; stimulate or crowds in private investment, reduces cost and opens new markets thereby engendering profits and employment.

However, investment in rural infrastructure particularly in rural settings; the habitat of rural farmers in developing economics and Nigeria precisely has been reported to be suboptimal [(Haller and Diamond, 1990 and World Bank, 1994)]. This sub-optimal investment prevalence situation in Benue State has been established in the work of Ater *et al.* (2014), who pointed out that Benue state government rural infrastructural spending with low emphasis particularly on agricultural subsector. The existing inadequate government rural infrastructural spending provided and inadequacy of empirical studies on analysis of government rural infrastructural spending on crop output in Benue state Nigeria provided the need and justification for the study to be carried out given the essential nature of government rural infrastructural spending on the overall development of agriculture, particularly in Benue state Nigeria. The broad objective of this study is to; analyze the effects of government rural infrastructural spending on crop output in Benue state of Nigeria: 1999-2012. The study therefore is set out with the following specific objectives to;

i. assess the effect of government spending on Roads, Health, and Education on output of maize in Benue state Nigeria.

ii. assess the effect of government spending on Roads, Health, and Education on output of millets in Benue state Nigeria.

iii. assess the effect of government spending on Roads, Health, Education on output of sorghum in Benue state Nigeria.

### Study Hypothesis

**Ho:** Government rural infrastructural spending has no significant effects on output of Cereals (maize, millets and sorghum) in Benue state Nigeria.

## METHODOLOGY

### The Study Area

The study was conducted in Benue state Nigeria. The State is popularly known as “*food baskets of the nation*” has a geographical coordinate of latitudes 6° 25' and 8° 08' N, and between longitudes 7° 47' and 10° 00' E in the central part of Nigeria called 'Middle belt' (Nyagba, 1995). The State has a population of 4,253,641 people according to 2006 Census (NPC, 2006) and has a land mass of 32,518sqkm and is made up of 23 LGAs. The study was therefore limited to government spending on 3 rural infrastructures and output of 3 cereals crops namely; Maize, Millet, Sorghum and uses a time series data from 1990-2012.

### Data collection techniques

The technique of data collection were through Secondary sources such as; Review of relevant material relating to the study as journals, technical documents, government gazettes, CBN Annual Reports, and published material from National Bureau of Statistics, BNARDA, and Ministry of Finance: Budget Office and Benue state house of assembly.

### Data analysis techniques

Vector error correction models (VECM), Johansen co-integration test, unit-root test (ADF) were the techniques used for data analysis and F-statistics was used for the testing of the relevant hypotheses.

### Model specification

#### long-run relationship

**(i) Model Specification for the long run analysis of government infrastructural spending effects on output of maize, millet and sorghum**

$$\ln QMAZ_t = \alpha + b_1 \ln GOVSHLTH_{t-1} + b_2 \ln GOVSEDU_{t-1} + b_3 \ln GOVSRDS_{t-1} + e_i \dots \dots \dots (1)$$

$$\ln QMilt_t = \alpha + b_1 \ln GOVSHLTH_{t-1} + b_2 \ln GOVSEDU_{t-1} + b_3 \ln GOVSRDS_{t-1} + e_t \dots (2)$$

$$\ln QSorg_t = \alpha + b_1 \ln GOVSHLTH_{t-1} + b_2 \ln GOVSEDU_{t-1} + b_3 \ln GOVSRDS_{t-1} + e_t \dots (3)$$

**Equation for Short-run Relationship:**

**(ii) short-run analysis of government infrastructural spending effects on output of Maize, Millets and Sorghum**

$$\ln QMAZ_t = \alpha_0 + b_1 Maz_{t-1} + b_2 Maz_{t-2} + b_3 GOVSEdu_{t-1} + b_4 GOVSEdu_{t-2} + b_5 GOVSHlth_{t-1} + b_6 GOVSHlth_{t-2} + b_7 GOVSRd_{t-1} + b_8 GOVSRd_{t-2} + e_t \dots (4)$$

$$\ln QMilt_t = \alpha_0 + b_1 Mil_{t-1} + b_2 Mil_{t-2} + b_3 GOVSEdu_{t-1} + b_4 GOVSEdu_{t-2} + b_5 GOVSHlth_{t-1} + b_6 GOVSHlth_{t-2} + b_7 GOVSRd_{t-1} + b_8 GOVSRd_{t-2} + e_t \dots (5)$$

$$\ln QSorg_t = \alpha_0 + b_1 Sorg_{t-1} + b_2 Sorg_{t-2} + b_3 GOVSEdu_{t-1} + b_4 GOVSEdu_{t-2} + b_5 GOVSHlth_{t-1} + b_6 GOVSHlth_{t-2} + b_7 GOVSRd_{t-1} + b_8 GOVSRd_{t-2} + e_t \dots (6)$$

Where;  
 QMAZ, QMIL, QSORG = output of maize, millets and sorghum all in (kg)  
 Maz<sub>t-1</sub> and Maz<sub>t-2</sub> = Output of maize in the previous year and two years ago.  
 Mil<sub>t-1</sub> and Mil<sub>t-2</sub> = Output of millet in the previous year and two years ago.  
 Sorg<sub>t-1</sub> and Sorg<sub>t-2</sub> = Output of sorghum in the previous year and two years ago.

GOVSEdu<sub>t-1</sub> and GOVSEdu<sub>t-2</sub> =government spending on educational infrastructure of the previous year and two year ago.

GOVSHlth<sub>t-1</sub> and GOVSHlth<sub>t-2</sub> = government spending on health care infrastructure in Naira (₦) of the previous year and two year ago.

GOVSRd<sub>t-1</sub> and GOVSRd<sub>t-2</sub> = government spending on road infrastructure in Naira (₦) of the previous year and two year ago.

e<sub>t</sub> = time lag.

**RESULTS AND DISCUSSION**

**Unit root test**

The augmented Dickey-fuller (ADF) test was employed to test for the stationarity and non-stationarity of the time series data. The result revealed that, all the variables were not stationary at level but became stationary at first difference in order of 1(1) at 5% critical value as shown below. This result was similar to the finding of Amadi *et al.*, (2013) in a journal titled “Public spending on transport infrastructure and economic growth in Nigeria from 1981-2010”. The result from the unit roots (ADF) test showed that, all the variables of interest were stationary at first difference in order of 1(1).

**Table 1:** Result of Unit Root Test

ADF RESULTS						
Variables	ADF test statistics at Levels	Critical value	ADF at First difference	Critical value	Order of integration	
GOVSRDS	-0.6030	1% -3.7856	-4.2134	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		
GOVSHLTH	-2.2258	1% -3.7856	-5.5287	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		
GOVSEDU	-2.3865	1% -3.7856	-3.9765	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		
QMAZ	-3.33022	1% -3.7856	-3.6449	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		
QMIL	-2.5512	1% -3.7856	-4.6653	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		
QSORG	-3.3022	1% -3.7856	-5.0200	1% -3.8067	1(1)	
		5% -3.0114		5% -3.0199		
		10% -2.6457		10% -2.6502		

\*, \*\*, \*\*\* indicate Stationarity at 10%, 5%, and 1%

**JOHANSEN CO-INTEGRATION TEST OF LONG-RUN EQUILIBRIUM RELATIONSHIP**

**Johansen co-integration test of government rural infrastructural spending on output of maize in Benue state**

The Johansen co-integration of governments spending on rural infrastructure on output of maize as summarized in Table 2, which indicated the presence of one (1) unit co-integration. The trace statistic (97.37644) being greater than critical value (47.85613) at 5% confirms the presence of long run relationship between the variables GOVSRDS, GOVSHLTH & GOVSEDU on QMAZ in Benue state of Nigeria.

**Johansen co-integration test of government rural infrastructural spending on output of millet in Benue state**

The Johansen co-integration test of long-run relationship between governments rural infrastructural spending on output of millet is summarized in Table 3. One co-integration equation indicated that the trace statistic (83.68868) was greater than critical value of (47.85613) at 5%. These results confirm the presence of long run relationship between GOVSEDU, GOVSHLTH, GOVSRDS, on QMIL in Benue state of Nigeria.

**Table 2:** Johansen co-integration test of government rural infrastructural spending on output of maize in Benue state

Hypothesized No. of CE(s)	Eigenvalues	Trace statistics	0.05 critical value	Probability **
None*	0.965555	97.37644	47.85613	0.0000
At most 1	0.648124	26.64014	29.79707	0.1107
At most 2	0.195369	4.706124	15.49471	0.8392
At most 3	0.006707	0.141330	3.841466	0.7070

Trace test indicate 1 Co-integrating equation(s) at 0.05level  
 \*denote rejection of hypothesis at 0.05 levels  
 \*\* Mackinnon- Haug-Michelis (1999) p-values

**Table 3:** Johansen Co-integration Test of Long-Run Relationship between Governments Rural Infrastructural Spending (GOVSEDU, GOVSHLTH, GOVSRDS) On Output of Millet (QMIL)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.961058	83.68868	47.85613	0.0000
At most 1	0.380694	15.52949	29.79707	0.7448
At most 2	0.228470	5.467210	15.49471	0.7574
At most 3	0.000963	0.020229	3.841466	0.8868

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*MacKinnon-Haug-Michelis (1999) p-values

**Johansen co-integration test of government rural infrastructural spending on output of sorghum in Benue state**

The Johansen co-integration test of long-run relationship between governments spending on rural infrastructure on output of sorghum is summarized in Table 4. One co-

integration equation was found indicating that the trace statistic (108.5366) was greater than critical value of (47.85613) at 5%. Thus confirms the presence of long run relationship between GOVSEDU, GOVSHLTH, GOVSRDS) on agricultural output of sorghum (QSORG) in Benue state Nigeria.

**Table 4:** Johansen Co-Integration Test of Long-Run Relationship between Government Rural infrastructural Spending (GOVSEDU, GOVSHLTH, GOVSRDS,) On Output of Sorghum (QSORG)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.986641	108.5366	47.85613	0.0000
At most 1	0.413786	17.90902	29.79707	0.5728
At most 2	0.268668	6.693558	15.49471	0.6135
At most 3	0.005836	0.122920	3.841466	0.7259

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level, \* denotes rejection of the hypothesis at the 0.05 level, \*\*MacKinnon-Haug-Michelis (1999) p-values

## THE VECM MODEL OF LONG-RUN AND SHORT-RUN RELATIONSHIP BETWEEN GOVERNMENT RURAL INFRASTRUCTURAL SPENDING ON OUTPUT OF CEREALS CROPS IN BENUE STATE

### VECM model of long-run and short-run relationship between government rural infrastructural spending on output of maize in Benue state

The vector error correction model of long-run relationship between governments Rural Infrastructural spending is summarized in Table 5. The result revealed that, government spending on education in the previous year [(GOVSEDU<sub>-1</sub>)], government spending on health care facilities in the previous year [(GOVSHLTH<sub>-1</sub>)] and government spending on roads infrastructure in the previous year [(GOVSRDS<sub>-1</sub>)] have effects on output of maize [(QMAZ<sub>-1</sub>)] in the long-run.

Specifically the coefficient of government spending on health in the previous year (GOVSHLTH<sub>-1</sub>) was positive and significant at 1 percent probability level implying that, a unit increase in government spending on healthcare infrastructure in the previous years (GOVSHLTH<sub>-1</sub>) resulted into the output of increase of maize in the previous year (QMAZ<sub>-1</sub>) by 3.39 in the long-run. This result may be attributed to the fact that, the healthcare facilities were readily available and accessible to the farmer's households because sound health of farmers may determine high output. This result agrees with that of Nuruden and Usman (2010) that rising government expenditure on health care facilities resulted into increase in economic growth. The result is suggestive of the fact that, increase health spending by government increases agricultural productivity.

In contrast, the coefficients of government spending on educational infrastructure in the previous year and government spending on road infrastructure in the previous year were negative and contrary to a priori expectations with coefficient of (-3.36 and -1.02) for Education and Road respectively. thus, a unit increase in government spending on educational infrastructure [(GOVSEDU<sub>-1</sub>)] and government spending on road in the previous year (GOVSRDS<sub>-1</sub>) will decrease output of

maize in the previous year (QMAZ<sub>-1</sub>) by -3.36 and -1.02 respectively in the long-run. This may be attributed to the fact that government spending on roads and educational infrastructure were microscopically small compared to the actual requirement, and roads which ordinarily would have served as an avenue for input and output delivery to stimulate the rural farm and non-farm growth and vitalize the rural households are simply not available year round or in a bad state. Likewise, Increase in government spending on education decreased output of maize. It means that educational facilities which would have also served as avenue for transfer of knowledge on up-to-date information on how to grow crops efficiently, economically and adopt new innovations on improved varieties are also not available. This result contrasts to the finding of Antle (1984) who documented evidence of positive linkages between various type of infrastructure and agricultural output growth. The author reported positive and significant correlation between road and aggregate crop output. Also, Adewara and Oloni (2012) both explored the relationship between the composition of public expenditure and growth in Nigeria Between 1960-2008 using the vector autoregressive model (VAR). The finding shows that expenditure on education has failed to enhance growth.

The estimate of the short run effect of government spending on rural infrastructure on output of maize (QMAZ) is summarized in table 5. In the short-run the multiple coefficient of determination ( $R^2$ ) was 0.42 implying that, 42% of the variation in the output of maize is explained by the explanatory variable such as: agricultural output of maize in the previous year (QMAZ<sub>-1</sub>), output of maize two year ago (QMAZ<sub>-2</sub>), government spending on educational facilities in the previous year (GOVSEDU<sub>-1</sub>) and government spending on educational facility two years ago (GOVSEDU<sub>-2</sub>), government spending on health care infrastructure in the previous year (GOVSHLTH<sub>-1</sub>), and government spending on healthcare infrastructure two years ago (GOVSHLTH<sub>-2</sub>), government spending on road infrastructure in the previous year (GOVSRDS<sub>-1</sub>) and government spending on road infrastructure two year ago (GOVSRDS<sub>-2</sub>). The remaining 58% may be attributed to the variable not

included in the model. The result also shows that the F-statistics (0.82) is positive and insignificant implying that, all explanatory variables have no significant relationship on agricultural output of maize in the short run. Therefore the null hypothesis which stipulates that, there is no significant effect between governments spending on rural infrastructure on output of maize is accepted.

The result further shows that, output of maize in the previous year (QMAZ<sub>-1</sub>) was the variable that affected output in the short-run. Specifically, the coefficient of output in the previous year (QMAZ<sub>-1</sub>) was negative contrary to the a priori expectation and significant at 10 percent level of probability implying that, unit increase in output of maize (QMAZ<sub>-1</sub>) will decrease output of maize by -0.54. This may be attributed to the fact that, storage facilities that

would have served as means of preserving the maize for the next cropping season were un-available to the farmer's households.

Also, Output of maize two years ago (QMAZ<sub>-2</sub>), government spending on educational infrastructure in the previous year (GOVSEDU<sub>-1</sub>), government spending on education infrastructure two years ago (GOVSEDU<sub>-2</sub>), government spending on road infrastructure in the previous year (GOVSRDS<sub>-1</sub>), government spending on road infrastructure in two years ago (GOVSRDS<sub>-2</sub>), government spending on health care facilities in the previous year (GOVSHLTH<sub>-1</sub>), government spending on healthcare infrastructure two years ago (GOVSHLTH<sub>-2</sub>), were all not significant, implying that all the variable have no effect on Output of maize (QMAZ) in the short-run. This implies that long-run measures may be most appropriate for maize production improvement.

**Table 5:** Result of The VECM model for long-run and short-run relationship between government rural infrastructural spending on output of maize in Benue State

LONG-RUN		QMAZ <sub>(-1)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSRDS <sub>(-1)</sub>	C				
COINEq1		1.000000	-3.375077 (0.77434) [-4.35867***]	3.389432 (0.90374) [3.75044***]	-1.015091 (0.16232) [-6.255355***]	1.90E+09				
SHORT-RUN	QMAZ	QMAZ <sub>(-1)</sub>	QMAZ <sub>(-2)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSEDU <sub>(-2)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSHLTH <sub>(-2)</sub>	GOVSRDS <sub>(-1)</sub>	GOVSRDS <sub>(-2)</sub>	C
COINEq1	0.01581 (0.0271) [0.5831]	- 0.539035 (0.30594) [-1.76189*]	-2.277573 (0.33964) [-0.81726]	0.112331 (0.09928) [1.13142]	0.094598 (0.08780) [1.07743]	-0.053439 (0.09808) [-0.54483]	-0.023993 (0.09153) [-0.26213]	-0.000541 (0.02477) [-0.02185]	0.010980 (0.03592) [0.30565]	70559372 (4.9E+07) [1.43472]
<b>R-squared</b>	0.424343	<b>Adj. R-squared</b>	-0.093748	<b>Sum sq. resids</b>	8.14E+16	<b>S.E. equation</b>	90195918	<b>F-statistic</b>	0.819050	
<b>Log likelihood</b>	387.7972	<b>Akaike AIC</b>	39.77972	<b>Schwarz SC</b>	40.27759	<b>Mean dependent</b>	53547695	<b>S.D. dependent</b>	86243856	

Source: E-view computation \*\*\*, \*\*, \* significant at 1%, 5% and 10% respectively

### The VECM model of long-run and short-run relationship between government rural infrastructural spending on output of millet in Benue state

The estimate of vector error correction model of long-run relationship between government rural Infrastructural spending on output of millet (QMIL) is summarized in [Table 6](#). The result revealed that, government spending on educational infrastructure in the previous year (GOVSEDU<sub>-1</sub>), government spending on health care infrastructure in the previous year (GOVSHLTH<sub>-1</sub>) and government spending on roads infrastructure in the previous year (GOVSRDS<sub>-1</sub>) have effects on output of millet (QMIL<sub>-1</sub>) in the long-run.

Government spending on educational infrastructure (GOVSEDU<sub>-1</sub>) in the previous year was not significant, had no effect on output of millet (QMIL) in the long-run. Also, the coefficient of government spending on health care infrastructure in the previous year was negative contrary to the a priori expectations and significant at 1 percent probability level implying that, unit increase in government spending on health care facilities in the previous year (GOVSHLTH<sub>-1</sub>) decreased output of Millet (QMIL<sub>-1</sub>) by -2.3095 in the long-run. This may be attributed to the fact that, there is inadequate existence of primary health care facilities in the rural area of Benue state. The result is in agreement with the earlier findings of Nurudeen, and Usman (2010) who established a negative relationship between increased government expenditure on health care facilities on economic growth in Nigeria.

In contrast, the coefficient of government spending on road infrastructure in the previous year (GOVSRDS<sub>-1</sub>) was positive with a coefficient of 0.84 conforming to the a priori expectations and significant at 1 percent probability level implying that, unit increase in government spending on roads infrastructure in the previous year (GOVSRDS<sub>-1</sub>) increased the output of millets (QMIL) by 0.84 in the long-run. This may be attributed to the fact that roads network in the rural areas of Benue state facilitated the transportation of agricultural inputs in-form of improved seedling and agrochemicals. The result is in conformity with the result of Oyinlola (1993) and Nurudem, *et al.* (2010), that expenditure on roads is important determinant of economic growth. The implication of the study is that expenditure made by government on road will accelerate economic growth in Nigeria.

Short-run analysis of government Rural Infrastructural spending (GOVSEDU, GOVSHLTH, GOVSRDS) on output of millet (QMIL) is summarized in [Table 6](#). The coefficient of determination ( $R^2$ ) 0.61 was established implying, that 61% of variation in the output of millet is explained by output of millet in the previous year (QMIL<sub>-1</sub>), output of millet two years ago (QMIL<sub>-2</sub>), government spending of education in the previous year (GOVSEDU<sub>-1</sub>) and government spending on education two years ago

(GOVSEDU<sub>-2</sub>), government spending on health in the previous year (GOVSHLTH<sub>-1</sub>) and government spending two years ago (GOVSHLTH<sub>-2</sub>), government spending on roads in the previous year (GOVSRDS<sub>-1</sub>) and government spending on roads two year ago (GOVSRDS<sub>-2</sub>). The result also shows that the F-statistics (1.75) was positive and significant at 10% probability level implying that, all explanatory variable have significant relationship between government spending on rural infrastructures (GOVSEDU, GOVSHLTH, GOVSRDS,) on output of millet (QMIL) in both the long-run and short-run. Therefore, the null hypothesis, which stipulates that, there is no significant relationship between Government Rural Infrastructural spending (GOVSEDU, GOVSHLTH, GOVSRDS,) on output of millets (QMIL), is rejected. The result also revealed that output of millet in the previous year (QMIL<sub>-1</sub>) and government spending on roads two years ago (GOVSRDS<sub>-2</sub>) were variables that significantly affected output of millet in the short-run.

Specifically, government spending on roads two years ago (GOVSRDS<sub>-2</sub>) had a coefficient of 0.0529 and positive conforming to the a priori expectations. It was also significant at 5 percent probability level implying that unit increase in government spending on roads two year ago (GOVSRDS<sub>-2</sub>) increased output of millet (QMIL) by 0.0529. This may be attributed to the fact that access to good roads will encourage the production of more millet because, good roads bring about easy transportation of farm produce from one rural area to the other and even urban centers thereby encouraging flow of inputs, exchange of improved varieties of millet and agrochemicals. This result is in agreement with the earlier finding of Khandker (1989) who found that government investment on roads had positive effects on crop output, rural non-farm employment and agricultural wages which benefited the poor in India.

In contrast, the coefficient of output of millet in the previous year (QMIL<sub>-1</sub>) was negative contrary to a priori expectation and significant at 5 percent probability level implying that, unit increase in output of millet in the previous year (QMIL<sub>-1</sub>) decreased output (QMIL) by -0.51 in the short-run. This result may be attributed to the fact that storage facilities are absent in the rural areas of Benue state, the implication of this absence of storage facilities in most rural areas hinder the preservation of excess harvest for the next cropping season which lowers output prices ultimately decreased the output of maize following a bumper harvest in Benue state.

Furthermore, the analysis revealed that, output of millet two years ago (QMIL<sub>-2</sub>), government spending on education in the previous year GOVSEDU<sub>-1</sub>, government spending on education two years ago GOVSEDU<sub>-2</sub>, government spending on health in the previous year (GOVSHLTH<sub>-1</sub>), government spending on health two

**Table 6:** Result of The VECM model of long-run and short-run relationship between government rural infrastructural spending on output of Millet in Benue State

LONG-RUN		QMIL <sub>(-1)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSRDS <sub>(-1)</sub>	C				
<b>COINEq1</b>		1.000000	0.381454 (0.58130) [ 0.65621]	-2.309503 (0.77122) [-2.99463***]	0.838182 (0.13404) [ 6.25323***]	2.05E+08				
SHORT-RUN	QMIL	QMIL <sub>(-1)</sub>	QMIL <sub>(-2)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSEDU <sub>(-2)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSHTH <sub>(-2)</sub>	GOVSRDS <sub>(-1)</sub>	GOVSRD <sub>(-2)</sub>	C
<b>COINEq1</b>	-0.045845 (0.0278)	-0.506602 (0.28261)	-0.100990 (0.30637)	-0.023193 (0.05306)	-0.019559 (0.05382)	-0.110883 (0.07317)	-0.093804 (0.06499)	0.017040 (0.02500)	0.052916 (0.02614)	11832990 (3.7E+07)
	[-1.64756*]	[-1.79260**]	[-0.32964]	[-0.43713]	[-0.36339]	[-1.51544]	[-1.44331]	[ 0.68159]	[ 2.02471**]	[ 0.32166]
<b>R-squared</b>	0.611558	<b>Adj. R-squared</b>	0.261960	<b>Sum sq. resids</b>	8.13E+16	<b>S.E. equation</b>	90165402	<b>F-statistic</b>	1.749318	
<b>Log likelihood</b>	-387.7904	<b>Akaike AIC</b>	39.77904	<b>Schwarz SC</b>	40.27691	<b>Mean dependent</b>	28628200	<b>S.D. dependent</b>	1.05E+08	

Source: E-view computation \*\*\*, \*\*, \* significant at 1%, 5% and 10% respectively

years ago (GOVSHLTH<sub>2</sub>), government spending on road in the previous year (GOVSRDS<sub>1</sub>) were all not significant and had no significant effects on output of millet (QMIL) in the short-run.

**The VECM model of long-run and short-run relationship between government rural infrastructural spending on output of Sorghum in Benue state**

The estimate of the Vector Error Correction Model of Long-Run relationship between Government Rural infrastructural Spending on Output of Sorghum (QSORG) is summarized in Table 7 below. The result revealed that, government spending on education in the previous year (GOVSEDU<sub>1</sub>) and government spending on roads in the previous year (GOVSRDS<sub>1</sub>) are variables that significantly affected output of sorghum (QSORG) in the long-run.

Specifically, the coefficient of government spending on education in the previous year (GOVSEDU<sub>1</sub>) and government spending on roads in the previous year (GOVSRDS<sub>1</sub>) were all negative contrary to the a priori expectation and significant at 1 percent probability level implying that unit increase in government spending on education in the previous year

(GOVSEDU<sub>1</sub>) and government spending on roads in the previous year (GOVSRDS<sub>1</sub>) decreased Output of sorghum (QSORG) by -2.6039 and -0.7189 in the long-run respectively. This may be attributed to the signaling under-investment in both roads and educational facilities in Benue state. This result is in disagreement with the result of Binswanger *et al.* (1993) that investment in rural infrastructure such as road and education has resulted in phenomenal growth in agricultural production and productivity. However the opposite as found in the research may also hold if government spending status is infinitely small compared to the investment portfolio necessary to infuse a positive minute effect, rather disgusted negative socio-economic outcomes may emerge.

The coefficient [0.3971] of government spending on health care infrastructure in the previous year (GOVSHLTH<sub>1</sub>) was very low and had no significant effects on Output of sorghum in the previous year (QSORG<sub>1</sub>) in the long-run. This may be attributed to the fact that most government healthcare programmes do not cover the entire rural areas in Benue state as at when due according to plans.



Short Run Relationship between Government Spending on Rural Infrastructure (GOVSEDU, GOVSHLTH, GOVSRDS,) On Output of Sorghum (QSORG) is summarized in table 7. Coefficient of determination (R2) 0.8607 was established, implying that, 86 percent of the variation of output of sorghum is explained by the fitted variables such as; output of sorghum in the previous year (QSORG-1), output of sorghum two years ago (QSORG-2), government spending on education in the previous year (GOVSEDU-1), government spending on education two years ago (GOVSEDU-2), government spending on health in the previous year (GOVSHLTH-1), government spending on health two year ago (GOVSHLTH-2), government spending on road in the previous year (GOVSRDS-1) and government spending on roads two years ago (GOVSRDS-2) were variables that significantly affected output of sorghum (QSORG) in the short-run. The result with the F-statistics 6.8607, positive and significant at 1% implied that, all the explanatory variables had effects on output of sorghum both in the short-run and long-run. Therefore, the null hypothesis which stipulates that, there is no significant relationship between government rural infrastructural spending (GOVSEDU, GOVSHLTH, GOVSRDS) and output of sorghum (QSORG) is rejected.

Specifically the coefficient of government spending on health infrastructure in the previous year (GOVSHLTH-1) and two years ago (GOVSHLTH-2) was positive conforming to the a priori expectation and significant at 1 percent probability level. This implies that unit increase in government spending of health care facilities in the previous year and two years ago (GOVSHLTH-1, and GOVSHLTH-2) increase agricultural output of (QSORG) by 0.3971 and

0.5158 respectively. Also, the coefficient of output of sorghum two years ago (QSORG-2) was positive and significant at 10 percent probability level implying that increase in output of sorghum two years ago increased output of sorghum (QSORG) by 0.3419. This may be attributed to the fact that increased on output provides enough for family food needs and seeds for the next cropping season. This result is in agreement with the earlier finding of Moctezuma (2008) that spending on health, roads and other economic infrastructure has positive relationship with real GDP in Nigeria. In contrast, the coefficient of government spending on education in the previous year and two years ago ((GOVSEDU-1, (GOVSEDU-2) Government spending on road in the previous year and two year ago (GOVSRDS-1, GOVSRDS-2) were negative and significant at 1 percent level of probability implying that increase in these variables decreased output of sorghum (QSORG) by -0.5070, -0.53, -0.1823 and -0.3677 respectively. This may be attributed to the fact that rural infrastructures that must be a catalyst for encouraging agricultural production in the rural areas of Benue state are simply not available. This result is in agreement with the earlier findings of Abumere 2002; Adeoye *et al.*, (2011) all of the opinion that, the infrastructural facilities that promote agricultural production in the rural area does not exist. However, the coefficient of output of sorghum in the previous year (QSORG-1) was not significant in determining the output of sorghum. Therefore, it has no effect on output of sorghum (QSORG) in the short-run. Thus, the supply of sorghum is clear and inelastic and needs to be improved via greater and better marked production incentives.

**Table 7:**Result of The VECM model of long-run and short-run relationship between government rural infrastructural spending on output of sorghum in Benue State

LONG-RUN		QSORG <sub>(-1)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSRDS <sub>(-1)</sub>	C				
<b>COINEq1</b>		1.000000	-2.603974 (0.26751)	-0.182554 (0.35151)	-0.718861 (0.04887)	5.29E+09				
			[-9.73415***]	[-0.51935]	[-14.7083***]					
SHORT-RUN	QSORG	QSORG <sub>(-1)</sub>	QSORG <sub>(-2)</sub>	GOVSEDU <sub>(-1)</sub>	GOVSEDU <sub>(-2)</sub>	GOVSHLTH <sub>(-1)</sub>	GOVSHLTH <sub>(-2)</sub>	GOVSRDS <sub>(-1)</sub>	GOVSRDS <sub>(-2)</sub>	C
<b>COINEq1</b>	-0.152592 (0.02450)	-0.068898 (0.14918)	0.341996 (0.17843)	-0.507064 (0.10051)	-0.529998 (0.09879)	0.397140 (0.05995)	0.515784 (0.08268)	-0.182284 (0.03417)	-0.367677 (0.06020)	4.27E+08 (6.2E+07)

Table 7 cont'd

	[-6.22806***]	[-0.46185]	[ 1.91666*]	[-5.04473***]	[-5.36508***]	[ 6.62497***]	[ 6.23836***]	[-5.33451***]	[-6.10750***]	[ 6.88503]
<b>R-squared</b>	0.860745	<b>Adj. R-squared</b>	0.735416	<b>Sum sq. resids</b>	1.37E+17	<b>S.E. equation</b>	1.17E+08	<b>F-statistic</b>	6.867865	
<b>Log likelihood</b>	-393.0275	<b>Akaike AIC</b>	40.30275	<b>Schwarz SC</b>	40.80062	<b>Mean dependent</b>	52342618	<b>S.D. dependent</b>	2.28E+08	

Source: E-view computation \*\*\*, \*\*, \* significant at 1%, 5% and 10% respectively

## CONCLUSION AND RECOMMENDATION

The study empirically analyzed the effects of government rural infrastructural spending on output of cereals in Benue State Nigeria. The findings of this study revealed that, government rural infrastructural spending exhibited a positive significant effect on output of millet and sorghum in the state, this effect was very low and non-significant for maize in both the short-run and long-run. Based on findings from the empirical analytical finding, the study recommends; That, policy makers should pay closer attention to rural infrastructures as a whole rather than a discrete component of infrastructure by increasing its yearly budgetary allocation to benefit from ecologically disadvantaged position of the state in cereals production.

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