An Econometric Analysis of Public Expenditure and Agriculture Output: An Evidence from India

Duragesh Pujari
Research Scholar
Department of Economics
Karnatak University, Dharwad
pkduragesh@gmail.com

R R Biradar
Professor
Department of Economics
Karnatak University, Dharwad.

Abstract

In the present era, the agricultural sector played a significant role in the development of the nation by creating jobs for rural people and developing of agriculture sector needed to labour intensive nation like India. Hence, the study examined the relationship between public expenditure on agriculture and economic growth in the context of India. Therefore, the study used advanced econometrics and time series tools such as Unit root test, Cointegration test, Var, and ECM for analysis. The results show that there is no cointegration vector between public expenditure and economic growth and found that negative relationship between public expenditure and economic growth. But, the study reveals that there is a cointegration vector between public expenditure and agriculture output. Significant error correction term (ECt-1) indicates that 85.2 percent of total disequilibrium in public expenditure on agriculture and agriculture output is corrected each year in India. The coefficient of the EC2t-1 term is statistically insignificant. short-run coefficients are insignificant, which concludes that there is no short-run causality between public Expenditure and agriculture output in any direction. Unidirectional causality exists from public expenditure to agriculture output in the long run.

Keywords: *Agriculture, Expenditure, Economic Growth, Cointegration, VECM*

JEL Classification: *H6, Q1, C4, C5,*

Introduction

Indian Government used Five Year plans as a Strategy for the upliftment of the Agriculture sector from a traditional to a modern well-developed sector. Under the Five Year Plans, the government has increased agricultural production and rural employment by setting up community development programs and agricultural extension services throughout the country, expansion of irrigation facilities, fertilizers, and pesticides, distributing high-yielding varieties of seeds, and expansion of transportation, power, marketing, and providing institutional credit. Another side, the government set up agro-based industries and handicrafts in rural areas, and encourage the movement of people from agriculture to industries and service sectors. For to reduce the pressure of the population on land. Finally, to create equality and justice in rural India, the government used a land reforms strategy which included the removal of intermediaries,

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like the Zamindars, tenancy legislation, the ceiling of land holding, and the distribution of surplus land among landless laborers and small and marginal farmers. Selvaraj (1993) found that instability in agricultural government expenditure is inversely related to the growth of the sector in India. Zhi HL and Wong KKS (2020) are focused on the determination of the important factors that have affected agriculture production in Malaysia. The result of the Engle-Granger (EG) co-integration test stated that all the factors were cointegrated with agriculture productivity. Conversely, the GE2 and interest rate are the only factors that showed a negative relationship. All the factors are significantly affecting agricultural productivity in the long run, while the interest rate is insignificant to determine agriculture production. Abdul Azeez1, N.P, et al (2021) review and analyze the head-wise budgetary and actual expenditure on the various centrally sponsored scheme for rural development of India. The results of Maiga et al (2021) study show that public expenditures have positive and significant effects on agricultural growth, but agricultural expenditure has negative effects. In this context, the study attempts to analyze the trends of public expenditure in India, in different budgets over the years. More specifically, some issues were examined here are:

- To know the relationship between public Expenditure on agriculture and Economic growth and also agriculture output.
- What is the impact of public expenditure on agriculture on Economic growth and agricultural output in India?

Materials and Methodology

The study used secondary data on government expenditure on Agriculture and Allied Activities, Agriculture output, Gross domestic product from RBI and Indian economic survey reports. The study examines the relationship between government expenditure on Agriculture and Allied Activities and economic growth by using Johansen's maximum likelihood cointegration procedure and Vector Error Correction Model (VECM) as developed by Granger (1969) and (1986), Engel & Granger (1987). Several test are available for testing whether a series is stationary. The study used the PP (Phillips-Perron) test for stationarity, which is designed to be robust for the presence of autocorrelation and heteroscedasticity (Ramphul,2012). The Phillips-Perron test equation:

$$X_t = \mu_t + b_1 t + \rho \sum_{i=1}^{n} X_{\text{t-n}} + \text{u}_\text{t} \qquad (1)$$

Where,

X = the series

t = Time

u_t = I(0)

n = number of optimal Newey West bandwidth chosen by using the Bartlett Kernel Criterion.

The study used the Granger causality test via error-correction modeling (ECM) to examine the relationship. ECM included the long-run relationships with the short-run dynamic of the model. The Cointegrated error-correction Granger causality test for GDP and government expenditure Agriculture and Allied Activities is

$$\Delta \mathbf{ln}(\mathbf{gdp})_t = \mathbf{a_1} + \sum_{i=1}^{n} \boldsymbol{b}_\text{i} \Delta \mathbf{ln}(\mathbf{gdp})_{t-i} + \sum_{i=1}^{m} \boldsymbol{d}_\text{i} \Delta \mathbf{ln}(\mathbf{AEXP})_{t-j} + \boldsymbol{r}_i(\boldsymbol{EC}_l)_{\text{t-1}} + \mathbf{e}_1 \qquad \mathbf{(2)}$$

$$\Delta \mathbf{ln}(\mathbf{AEXP})_t = \mathbf{a_2} + \sum_{i=1}^{n} \boldsymbol{c}_\text{i} \Delta \mathbf{ln}(\mathbf{AEXP})_{t-i} + \sum_{i=1}^{m} \boldsymbol{g}_\text{i} \Delta \mathbf{ln}(\mathbf{gdp})_{t-j} + \boldsymbol{l}_i(\boldsymbol{EC}_2)_{\text{t-1}} + \mathbf{e}_1 \qquad \mathbf{(3)}$$

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The Cointegrated error-correction Granger causality test for government expenditure Agriculture and Allied Activities and Agriculture Output is

$$\Delta \mathbf{ln}(\mathbf{AEXP})_t = \mathbf{a_1} + \sum_{i=1}^{n} \boldsymbol{b}_i \Delta \mathbf{ln}(\mathbf{AEXP})_{t-i} + \sum_{i=1}^{m} \boldsymbol{d}_i \Delta \mathbf{ln}(\mathbf{AO})_{t-j} + \boldsymbol{r}_i(\boldsymbol{EC_l})_{t-1} + \mathbf{e_1} \quad (4)$$

$$\Delta \mathbf{ln}(\mathbf{AO})_t = \mathbf{a_2} + \sum_{i=1}^{n} \boldsymbol{c}_i \Delta \mathbf{ln}(\mathbf{AO})_{t-i} + \sum_{i=1}^{m} \boldsymbol{g}_i \Delta \mathbf{ln}(\mathbf{AEXP})_{t-j} + \boldsymbol{l}_i(\boldsymbol{EC_2})_{t-1} + \mathbf{e_1} \quad (5)$$

Where,

Δ = First Difference

AEXP= Agriculture and Allied Activities Expenditure

AO = Agriculture Output

u_t and e_t = White noise error terms

s n m = lag lengths

EC_{1t-1} and EC_{2t-1} = error correction term

Δln(AEXP) and Δln(AO) = Short-run parameters

The study also used diagnostic test such as VEC residual heteroscedasticity test, VEC residual serial correlation LM test and Jarque-Bera normality test.

Empirical Results Analysis

Descriptive Statistics

Table 1 shows the descriptive statistics of variables. Standard deviation measures the dispersion in the series, which is very low for all variables. The skewness is nearer to zero in all four variables, which measures the asymmetry of the distribution of the series. Kurtosis also is less than 3 in all variables, indicating that the distribution of all four series under consideration is flat or platy kurtic relative to the normal distribution. According to the Jarque-Bera statistic, there is no evidence to reject the null hypothesis of normal distribution.

Table 1 : Summary of Statistics

Descriptive Statistics	LNAEXP	LNAO	LNGDP
Mean	10.53383	14.51913	16.40137
Median	10.44821	14.51038	16.28611
Maximum	11.92848	14.71417	17.06589
Minimum	9.189627	14.27073	15.82106
Std. Dev.	1.011245	0.141131	0.419898
Skewness	0.180011	-0.096571	0.171228
Kurtosis	1.492418	1.819750	1.526590
Jarque-Bera	1.401411	0.834339	1.334791
Probability	0.496235	0.658909	0.513043
Sum	147.4737	203.2678	229.6192
Sum Sq. Dev.	13.29401	0.258933	2.292088
Observations	14	14	14

Eviews-9 Results

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Unit Root Test

Phillips-Perron unit root test on each variable, used to investigate whether each series have stationary or not, and presented its results in Table 2, Results reveal the at level cannot reject the null hypothesis(p=0), i.e. is both intercept and trend with intercept have non-stationary. But, at the first difference, the study rejected the null hypothesis (p=0), and concluded, that each series have stationery. All these variables are integrated to the order of one, i.e. I(1). These results indicate that the series may be co-integrated. The study used one lag based on Akaike Information criterion (AIC).

Table 2 : Phillips-Perron Unit Root Results

Variable	Level		First Difference		Order of Integration
	Intercept	Trend & Intercept	Intercept	Trend & Intercept	
LNAEXP	-0.2138	-1.8110	-3.6455**	-4.2541**	I(1)
LNAO	-2.1969	-3.8106	-6.4305***	-5.6856***	I(1)
LNGDP	0.1941	-1.9792	-2.9979*	-2.9210	I(1)

a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant

b: Lag Length based on SIC

c: Probability based on MacKinnon (1996) one-sided p-values

Table 3 : Johansen Co integration Results

Variable	Trace Test			Maximum Eigen value Test		
	Hypothesis No. of CE(s)	Test Statistic	Critical Value for 5% Confidence interval	Hypothesis No. of CE(s)	Test Statistic	Critical Value for 5% Confidence interval
LNAEXP& LNGDP	h=0	17.57742	20.26184	h=0	12.82440	15.89210
	h=1	4.753019	9.164546	h=1	4.753019	9.164546
LNAEXP & LNAO	h=0*	21.66215	20.26184	h=0*	17.17873	15.89210
	h=1	4.483424	9.164546	h=1	4.483424	9.164546

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Co integration Test

Johansen Co-integration test presented in Table 3, these results can be interpreted in two ways. One is trace statistics (ιTrace) and maximum eigenvalue (ιMax) statistics and used one optimal lag based on the Akaike Information Criterion (AIC). Table 3, shows that for H0: h=0 and h=1, the 5 percent critical values are greater than the calculated values in both the trace statistics test and Maximum Eigenvalue Test. Therefore, the study fails to reject the null hypothesis of no cointegration or equation no long-run relationship between Agriculture and Allied Activities Expenditure and Economic growth. The null hypothesis of h=0, there is no evidence to accept it because 5 percent critical values are lesser than the calculated values. Suggested, there is one cointegrating vector in the model, that shows the long-run relationship between Agriculture and Allied Activities Expenditure and agriculture output. The study found that there is no long-run relationship between total government expenditure on Agriculture and

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Allied Activities and economic growth but there is a long-run relationship between total government expenditure on Agriculture and Allied Activities and agriculture output.

VECM: Government Total Expenditure on Agriculture and Allied Activities and Economic Growth

Table 4 presents the information of the granger causality test based on the error-correction model for the causal relationship between government expenditure on Agriculture and Allied Activities and Economic growth. The coefficient of the ECt-1 term examines the causality between economic growth and government expenditure on Agriculture and Allied Activities. The coefficient has an expected sign negative and is statistically significant (T-test value is greater than 2). Therefore, fails to accept the null hypothesis that Economic growth does not cause government expenditure on Agriculture and Allied Activities. Government expenditure on Agriculture and Allied Activities increased by an increase in Economic growth in the long run. Significant error correction term indicates that 1.16 percent of total disequilibrium in Economic growth and government expenditure on Agriculture and Allied Activities is corrected each year in India. The coefficient of the EC2t-1 term is statistically insignificant. Therefore, there is no evidence to reject the null hypothesis, i.e. government expenditure on Agriculture and Allied Activities does not cause Economic growth, and short-run coefficients are insignificant, which concludes that there is no short-run causality between economic growth and government expenditure on Agriculture and Allied Activities in any direction. Unidirectional causality exists from economic growth and government expenditure on Agriculture and Allied Activities in the long run.

Table 4 : Causality between Government Total Expenditure on Agriculture and Allied Activities and Economic growth based on Error-Correction Model

Independent Variables	**Dependent Variables**	
	ln(AEXP)t	**ln(GDP)t**
EC_{t-1}	-1.169835[-3.39448]*	-0.103976[0.97331]
$\Delta ln(AEXP)_{t-1}$	0.536371[1.878671]	0.001895[0.02142]
$\Delta ln(GDP)_{t-1}$	-1.085828[-0.95576]	0.166233[0.47204]
C	0.172178[1.22252]	0.079969[1.83177]
Diagnostic		
R^2	0.592609	0.162124
F-Stat	3.879045*	0.515982
LM-Stat	1.300819 (0.8612)	
Heteroscedasticity	15.90092 (0.5995)	

Note: * 1% significance level, [] t-Statistics, () Probability

VECM: Government Total Expenditure on Agriculture and Allied Activities and Agriculture Output

Table 5 presents the information of the granger causality test based on the error-correction model for the causal relationship between government expenditure on Agriculture and Allied Activities Expenditure and Agriculture output. The coefficient of the ECt-1 term examines the causality between agriculture output and government expenditure on agriculture and allied activities. The coefficient has an expected sign negative and is statistically significant (T-test value is greater than 2). Therefore, fails to accept the null hypothesis that agriculture output does not cause government expenditure on Agriculture and Allied Activities. Government expenditure on Agriculture and Allied Activities increased by an increase in agriculture output in the long run. Significant error correction term indicates that 0.85 percent of total disequilibrium in agriculture output and government expenditure on Agriculture and Allied Activities is

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corrected each year in India. The coefficient of the EC2t-1 term is statistically insignificant. Therefore, there is no evidence to reject the null hypothesis, i.e. government expenditure on Agriculture and Allied Activities does not cause agriculture output, and short-run coefficients are insignificant, which concludes that there is no short-run causality between agriculture output and government expenditure on Agriculture and Allied Activities in any direction. Unidirectional causality exists between agriculture output and government expenditure in Agriculture and Allied Activities in the long run.

Table 5. Causality between Government Total Expenditure on Agriculture and Allied Activities and Agriculture output based on Error-Correction Model

Independent Variables	**Dependent Variables**	
	ln(AEXP)t	**ln(AO)t**
EC_{t-1}	-0.852779 [-2.11796]*	-0.008859 [-0.44514]
$\Delta ln(AEXP)_{t-1}$	0.469522[1.487301]	0.039871[2.55515]*
$\Delta ln(AO)_{t-1}$	-5.794038[-1.34266]	-0.415528[-1.94806]
C	0.301353[1.60858]	0.036028[3.89065]*
Diagnostic		
R^2	0.497736	0.533441
F-Stat	2.642625*	3.048939*
LM-Stat	9.340148 (0.0531)	
Heteroscedasticity	26.24313 (0.5051)	

Note: * 1% significance level, [] t-Statistics, () Probability

Conclusions

The study found that there is no long-run relationship between total government expenditure on Agriculture and Allied Activities and economic growth but there is a long-run relationship between total government expenditure on Agriculture and Allied Activities and agriculture output. Government expenditure on Agriculture and Allied Activities does not cause Economic growth, and short-run coefficients are insignificant, which concludes that there is no short-run causality between economic growth and government expenditure on Agriculture and Allied Activities in any direction. Unidirectional causality exists from economic growth and government expenditure on Agriculture and Allied Activities in the long run. Government expenditure on Agriculture and Allied Activities does not cause agriculture output, and short-run coefficients are insignificant, which concludes that there is no short-run causality between agriculture output and government expenditure on Agriculture and Allied Activities in any direction. Unidirectional causality exists between agriculture output and government expenditure in Agriculture and Allied Activities in the long run. In India, the Agriculture sector is the major sector, which provides more employment opportunities to rural people as compared to the other two sectors in India. Therefore, there is a need for the development of the agriculture sector by the government through budget allocation as well as effective management of existing agricultural programmes in India.

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