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Public expenditure on agriculture and economic growth: a case study of Meghalaya

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Abstract This paper assesses the impact of government expenditure on agriculture and allied activities on economic growth (GSDP) in Meghalaya during the period 1984-85 to 2013-14. We find a significant positive impact of agricultural expenditure on crop husbandry on GSDP growth. On the other hand, the impact of public expenditure on forestry, dairy and irrigation is found out to be negative. These findings conclude that although crop husbandry happens to have a significant positive impact of economic growth, the need for strengthening its linkages with other sectors cannot be undermined given the small and declining size of landholdings in the state.

Keywords Public expenditure, Agriculture, Economic growth, Meghalaya

JEL classification H72, O49

1 Introduction

Public expenditure contributes to capital accumulation and supports long-run economic growth (Oriakhi & Arodoye 2013). When investment is made in the rural sectors, it not only contributes to employment and wages, but also helps improving the overall economy by releasing the surplus labour and providing affordable food to urban population (Fan & Rao 2008). A number of studies have examined the relationship between agriculture and economic growth using different approaches. Wagner's law emphasizes economic growth as the fundamental determinant of public expenditure (Wagner 1883), while the Keynesian approach states that public expenditure is a fundamental determinant of economic growth (Keynes 1936). The studies of Salih (2012) in Sudan; Srinivasan (2013) in India; Wang et al. (2016) in Romania support the Wagner's law. On the other hand, studies by Okezie et al. (2013) and Guandong & Muturi (2016) in South Sudan support the Keynesian principle. Loizides & Vamvoukas (2005) show that government expenditure Granger cause economic growth both in short and long run. Liu et al. (2008) conclude that Keynesian hypothesis exerts greater influence than Wagner's law.

Potential contribution of agriculture to economic growth has been a subject of controversy among development economists (Awokuse 2009). Much of the early works on this issue coincides with the debate on the role of agriculture in economic development in developing countries (Lewis 1954; Fei & Ranis 1961; Jorgenson 1961; Johnston & Mellor 1961; Schultz 1964). The advocates of agriculture-led growth contend that investment in agriculture and development of infrastructure and institutions are prerequisite for economic growth (Schultz 1964; Timmer 1995). These studies suggest that agricultural growth is a catalyst for overall economic growth via its effect on rural incomes and provision of resources for structural transformation (Dowrick & Gemmell 1991; Datt & Ravallion 1998; Thirtle et al. 2003).

A number of studies have shown a positive relationship between public expenditure on agriculture and economic growth (Shuaib et al. 2015; Chandio et al. 2016; Guandong & Muturi 2016; Akarue & Eyovwunu

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2017). Some studies have further analyzed the effect of sub-sectors of agriculture on economic growth. Mogues et al. (2012) report that investment on research and development yields the largest impact on agricultural growth. Odetola and Etumnu (2013) have reported that crop production contributes most to agricultural growth. Enu (2014) identifies crops and livestock to impact economic growth positively in Ghana. Oyetade and Dewi (2014) also reported that fishery and food sectors have a positive significant effect on economic growth in Nigeria (Akarue & Eyovwunu 2017). These contradictions on the association between agricultural expenditure and economic growth could be due to differences in the methods and variables used in the analyses. In case of Meghalaya, there is hardly any study that has analyzed relation between public agricultural expenditure and economic growth. This study is an attempt to fill this gap and examines nexus between agriculture investments and economic growth. An increase in public expenditure is expected to have a positive effect on economic growth (Macatta 2016), but it does not seem to have happened in Meghalaya (Bhattacharjee 2014). In fact, a gap exists between quantum of expenditure in agricultural sector and its share in real Gross State Domestic Product (GSDP). It could be due to non-growth-enhancing expenditures that crowd-out outlays that are meant to foster economic growth.

2 Data and methodology

2.1 Data

Secondary data for the period 1984-85 to 2013-14 obtained from *Reserve Bank of India Publications and* Directorate of Economics and Statistics, Meghalaya are used for analysis. Annual time series data on GSDP are used as a proxy for economic growth and have been obtained from Directorate of Economics and Statistics, Meghalaya. The public expenditure on agricultural activities that include crop husbandry, soil and water conservation, animal husbandry, dairy development, fisheries, forestry and wild life, agricultural research and education, and irrigation and flood control, has been obtained from RBI publications- *State Finances: A Study of Budgets*. The data on production of principal crops are obtained from Directorate of Economics and Statistics, Meghalaya. To neutralize the impact of changes in prices, all the time series have been deflated using GDP deflator and are expressed in lakh rupees at constant 2004-05 prices.

The economy of Meghalaya is relatively small, with the gross state domestic product (GSDP) in 2011-12 at constant (2004-05) prices being Rs 11141 crores. From 2002-03 to 2011-12 the GSDP (at constant 2004-05 prices) grew at an annual growth rate of 7.9%. The total expenditure in agriculture sector was Rs 14431.26 lakhs in 1984-85 that increased to Rs 38679.46 lakhs in 2013-14 (at constant 2004-05 prices). Despite the increase in expenditure, the contribution of agricultural sector to GSDP has declined from 7.29% in 1984-85 to 2.90% in 2013-14.

From the perspective of rural livelihood, agriculture remains an important economic sector, despite its declining share in GDP. Hence, the significance of this investigation originates from the role of agriculture in the economy of Meghalaya. Since a greater part of the population is employed in farming, the economic development is practically difficult to accomplish without building up this sector. Research on this issue is, therefore, essential to help policy decisions with regard to allocation of public expenditure.

Public expenditure in India is highly decentralized with funds flowing from the central government to the state governments. The central government may also spend directly on economic and social services through several programs (Bathla et al. 2017). Side by side, the state governments also spend on development of agriculture by distributing subsidized seeds and fertilizers and supporting small irrigation, machinery, etc. However, the responsibility of spending on agriculture and irrigation and flood control lies squarely with the states. Public expenditure on agriculture and allied sectors is a part of the economic services that include components like crop husbandry, soil and water conservation, animal husbandry, dairy development, fisheries, forestry and wild life, agricultural research and education, cooperation, and irrigation and flood control. To avoid double counting, the expenditure by the central government and loans and advances are not taken into consideration in this paper.

2.2 Empirical procedure

Stationarity and unit roots tests

All the variables used in the model are tested for stationarity using the Augmented Dickey Fuller Test (ADF).

$$\Delta Y_t = B_1 + B_2 t + ZY_{t-1} + \sum_{i=1}^{m} a_i \Delta Y_{t-i} + e_t \quad \ldots(1)$$

Where, ΔY_t is the first difference of the series Y, e_t is a stochastic error term, B_1 is a constant, t is the time, and B_2 and Z are the parameters. The null hypothesis is that the variable has a unit root or it is not stationary.

Model specification

The econometric model has been chosen after examining the correlation among independent variables. This is done to avoid multicollinearity. Therefore, the variables having high correlation (i.e., soil and water conservation, fishery, and animal husbandry) are excluded. The model is then specified as :

$$LnGSDP = C + A_1 LnCROP + A_2 LnDAIRY + A_3 LnFOREST + A_4 LnIRRI + A_5 LnRES + u \quad \ldots(2)$$

Where,

LnGSDP = logarithm of GSDP

LnCROP = logarithm of expenditure on crop husbandry

LnDAIRY = logarithm of expenditure on dairy development

LnFOREST = logarithm of expenditure on forestry and wild life

LnIRRI = logarithm of expenditure on irrigation and flood control

LnRES = logarithm of expenditure on agricultural research and education

Causality tests

Granger causality test is performed to check causal relationship between GSDP and public expenditure. Granger causality analysis is done to test the hypothesis of prediction of future values of a particular variable(s) while incorporating the past lags of other variables in the model. In other words, a time series variable X_t is said to granger cause of another time series variable Y_t if the former contains useful information to predict future values of the latter. If the F-test of the included lagged variables is significantly different from zero, then there is a causal relation from X_t to Y_t.

$$\Delta GSDP = \sum_{i-1}^{n} \alpha_i \Delta TOTALAGRI_{t-i} + \sum_{i=i}^{n} \beta_j \Delta GSDP + U_{1t} \quad \ldots(3)$$

$$\Delta TOTALAGRI = \sum_{i-1}^{n} \lambda_i \Delta TOTALAGRI_{t-i} + \sum_{i=i}^{n} \gamma_j \Delta GSDP + U_{2t} \quad \ldots(4)$$

Where, α, β, λ and γ are the respective coefficients of the variables, t represent time while i and j are their lags, u_{1t} and u_{2t} and are uncorrelated white noise error term.

3 Results and discussion

3.1 Trend and composition of expenditure

The trend (three-year moving average) in public expenditure on agriculture and allied sectors in Meghalaya at constant 2004-05 prices (in Rs lakhs) is depicted in figure 1. We find that the revenue expenditure (RE) is higher than the capital expenditure (CE). The revenue expenditure steeply increased in

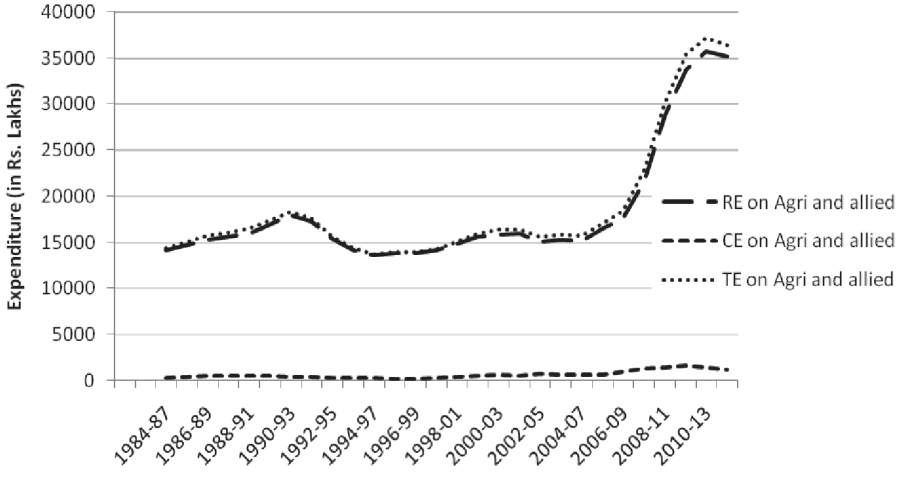

Figure 1. Trends in public expenditure on agriculture and allied sector in Meghalaya
Source: Authors' estimates from RBI Publications; State Finances: A Study of Budgets

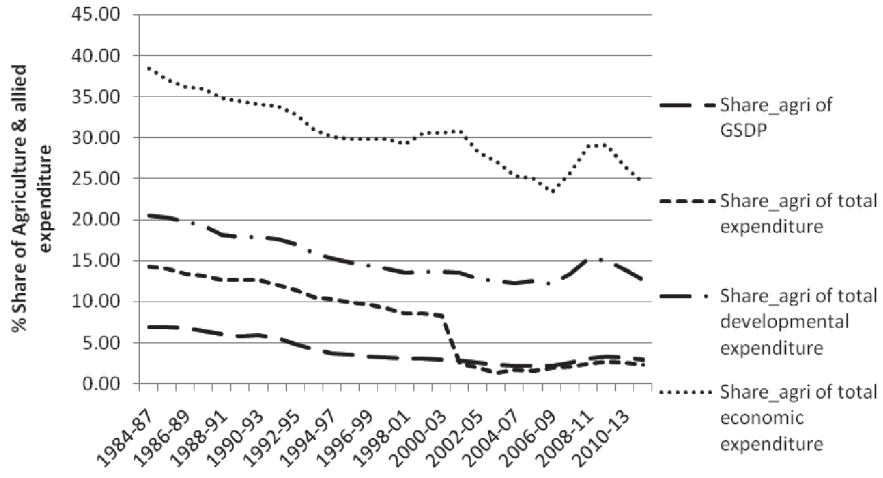

Figure 2. Share of agriculture and allied sector expenditure as a percentage of GSDP, Total expenditure, total economic expenditure and total developmental expenditure

Source: As for figure 1.

2006-09 while the capital expenditure remained almost constant. The steep increase in total expenditure is due to the increase in revenue.

The share of agriculture and allied sector expenditure as proportions of GSDP, total developmental expenditure, total economic expenditure and total expenditure are shown in figure 2 at constant 2004-05 prices. The share of agriculture and allied sector expenditure as a percent of total economic expenditure and total developmental expenditure has been slowly decreased over time, but increased in 2006-09 and declined again in 2009-12. Its share in total expenditure has also declined until 2000-03 and but remained constant from 2002-05 onwards. The share of agriculture and allied sector expenditure as a percent of GSDP has been slowly declining. The average agriculture and allied sector expenditure was only 4.02%, whereas the average agriculture and allied sector expenditure as a percent of total economic expenditure was 30.45%. Share of agriculture and allied sector expenditure in the total developmental expenditure and total expenditure was 15.34% and 7.65% respectively.

The public expenditure on agriculture and allied sector and GSDP is shown in table 1. There is an increasing trend in expenditure for all the components of agriculture. Expenditure on crop husbandry has increased at a rate of 4.46% per annum during 1984-94 to 12.48% during 2004-14. The rate of growth in expenditure on soil and water conservation, animal husbandry, dairy development, forestry & wild life and irrigation & flood control initially decreased and then increased. However, for fisheries, and agricultural research & education the rate of growth in expenditure has been increasing.

3.2 Effect on growth

Stationarity of the variables has been tested by ADF test. ADF test statistic of all the variables at level is less than the critical value (table 2). Therefore, the null hypothesis is accepted. This indicates that the time series variables are not stationary at level. However, at first difference the absolute value of ADF test statistics of all the variables is greater than the absolute critical value, which confirm that the variables are integrated of order one.

On the basis of the correlation matrix, the variables are selected for multiple regression analysis. From table 3, we find a high degree of correlation of crop husbandry with animal husbandry, fishery, soil and water conservation. Fishery has also a high correlation with animal husbandry. Therefore, to avoid multicollinearity these variables (soil and water conservation, fishery, and animal husbandry) are excluded from the analysis. Finally, we estimate the following equation:

$$LnGSDP = C + A_1LnCROP + A_2LnDAIRY + A_3LnFOREST + A_4LnIRRI + A_5LnRES + u \quad \ldots(5)$$

Table 1. Composition of public expenditure (agriculture & allied sector), GSDP (Rs Lakh) and annual rate of growth (2004-05 Prices)

Years	Crop Husbandry	Soil & Water Conservation	Animal Husbandry	Dairy	Fisheries	Forestry & Wild Life	Irrigation & Flood Control	Agril. Research & Education	GSDP
				Public Expenditure and GSDP (in Rs. Lakhs)					
1984-89	2523.81	2623.58	1533.50	346.46	339.31	5393.82	1466.90	378.03	218309
1989-94	3479.68	3350.32	2170.16	469.55	449.56	5659.04	2422.31	339.05	304510
1995-99	3557.92	2764.20	2240.63	525.36	445.08	2930.85	2405.56	360.63	390723
2000-04	4298.03	2682.91	2622.17	501.02	479.77	3515.83	2327.87	466.47	550666
2004-09	4917.21	3085.16	2449.80	441.06	611.30	4197.79	2353.19	387.63	764677
2009-14	10995.72	8084.24	4575.40	983.91	2411.92	6215.15	7343.22	621.81	1144535
				Growth Rate (%)					
1984-94	4.46	4.14	5.18	5.27	3.55	5.40	6.12	1.87	5.65
1994-04	4.18	0.52	3.26	1.86	3.94	0.93	1.60	4.77	7.00
2004-14	12.48	14.43	10.50	15.45	18.15	7.66	5.91	6.93	8.21

Source: Authors' compilation from CSO, *EPW Research Foundation, RBI Publications and* Directorate of Economics and Statistics, Meghalaya.

Table 2. Unit roots tests of the variables

Variable	Level			First Difference		
	ADF test statistic	Prob	Decision	ADF test statistic	Prob	Decision
LnGSDP	-1.821	0.668	Not Stationary	-6.149 *	0.000	Stationary
LnCROP	1.875	0.641	Not Stationary	-5.752*	0.000	Stationary
LnANIMAL	-0.958	0.934	Not Stationary	-5.114*	0.002	Stationary
LnDAIRY	-1.081	0.915	Not Stationary	-4.659*	0.005	Stationary
LnFISH	-0.005	0.994	Not Stationary	-12.862*	0.000	Stationary
LnFOREST	-1.828	0.664	Not Stationary	-6.746*	0.000	Stationary
LnIRRI	-2.369	0.386	Not Stationary	-3.489***	0.060	Stationary
LnRESEARCH	-2.742	0.228	Not Stationary	-7.385*	0.000	Stationary
LnSOIL	-1.718	0.717	Not Stationary	-5.016*	0.002	Stationary

Source: Authors' calculation
Note: *, **, *** indicate the level of significance at 1%, 5% and 10% respectively.

Table 3. Correlation matrix of the independent variables

Variables on expenditure	Crop Husba-ndry	Soil &Water Conserv-ation	Animal Husba-ndry	Dairy	Fishery	Forestry & Wild Life	Irrigation & Flood Control	Agril Res. & Edu.
Crop Husbandry	1							
Soil & Water Conservation	0.866	1						
Animal Husbandry	0.939	0.799	1					
Dairy Development	0.655	0.551	0.792	1				
Fishery	0.909	0.800	0.869	0.683	1			
Forestry & Wild Life	0.310	0.589	0.237	0.190	0.318	1		
Irrigation & Flood Control	0.840	0.825	0.814	0.481	0.795	0.291	1	
Agril Res. & Edu.	0.800	0.738	0.810	0.601	0.729	0.392	0.665	1

Source: Authors' calculation

Table 4. Regression results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnCROP	1.437	0.189	7.605	0.000***
LnDAIRY	-0.057	0.133	-0.429	0.672
LnFORESTRY	-0.363	0.124	-2.922	0.007***
LnIRRI	-0.286	0.122	-2.329	0.029**
LnRES	0.119	0.263	0.453	0.654
C	5.961	1.139	5.229	0.000***
R-squared	0.903	Adjusted R-squared		0.882
Durbin-Watson stat	1.531	F-statistic		44.726***

Source: Authors' calculation
Note: *, ** and *** indicate that the level of significance is at 10%, 5% and 1% level.

The results (table 4) reveal a significant positive relation of expenditure on crop husbandry with GSDP, a finding consistent with that in Faleyimu (2013), Enu (2014), Oyetade & Dewi (2014) and Ighodaro (2006). The regression coefficient indicates that for every 1% increase in the government expenditure on crop husbandry the real GSDP increases by 1.44%.

The expenditure on forestry is found to have significant negative impact on economic growth which contradicts the findings of Oyetade & Dewi (2014). A 1% increase in government expenditure on forestry causes GSDP to decrease by 0.36%, which agrees with the findings of World Bank (1992), Foster & Rosenzweig (2003), Faleyimu (2013), Enu (2014) and Akarue & Eyovwunu (2017).

There is also a negative relationship between government expenditure on irrigation and real GSDP which is inconsistent with the results of Elias (1981) and Fan et al. (2000). This is because most of the irrigation schemes are still being implemented and the farmers have yet to benefit from these. Public expenditure on dairying is found to have an insignificant impact on economic growth which contradicts the findings of Revoredo-Giha (2015), Chandio et al. (2017). Similarly, agricultural research and education expenditure has insignificant effect on economic growth in Meghalaya which is at variation with the findings of Alston et al. (2000) and Mogues et al. (2012).

We also undertake the following diagnostic tests

i) Normality tests

H0: Residuals are normally distributed; H1: Residuals are not normally distributed

Jarque-Bera= 0.687; p = 0.709. Here, H_0 cannot be rejected, that means the residuals are normally distributed.

ii) Breusch-Godfrey serial correlation LM test

H0: Residuals are not serially correlated; H1: Residuals are serially correlated

Observation *R-squared = 1.237; p = 0.539. Therefore, H_0 cannot be rejected and residuals are not serially correlated.

iii) White heteroskedasticity test

Ho= Residuals are not heteroscedastic; H1: Residuals are heteroscedastic

Observations*R-squared=15.481; p = 0.115. Here, also residuals are found to be homoscedastic.

From these diagnostic tests, we observe that residuals are normally distributed, not serially correlated and are homoscedastic. Thus, the model passes the standard tests and we can say that the model possesses the characteristics of a good regression model.

We also perform Granger causality tests. To choose appropriate number of lags we use VAR Lag Order Selection Criteria (table 5). The sequential modified LR test statistic, Final prediction error (FPE), Final prediction error (FPE), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) support lag 1. Therefore, we use lag 1 for the pairwise Granger causality tests between public expenditure on agriculture and GSDP. The null hypothesis is rejected at 10% level.

Table 5. VAR lag order selection criteria

Endogenous variables: LNGSDP LNTOTALAGRI Exogenous variables: C , Sample: 1985 2014, Included observations: 24						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-13.53	NA	0.01	1.29	1.39	1.32
1	65.74	138.71*	2.37*	-4.98	-4.683*	-4.89*
2	67.28	2.45	2.93	-4.78	-4.28	-4.64
3	72.27	7.07	2.76	-4.86	-4.17	-4.67
4	76.63	5.45	2.80	-4.89	-4.00	-4.65
5	78.18	1.66	3.68	-4.69	-3.60	-4.39
6	87.05	8.14	2.74	-5.09*	-3.81	-4.75

Note: * indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.
Source: Authors' calculation

Table 6. Pairwise Granger Causality tests between public expenditure on agriculture and GSDP

Sample: 1985 2014, Lags: 1 Null Hypothesis:	Obs	F-Statistic	Probability
TOTALAGRI does not Granger Cause GSDP	29	0.041	0.840
GSDP does not Granger Cause TOTALAGRI	3.211	0.084	

Source: Authors calculation

Results of the causality tests (table 6) do no reject the null hypothesis that states that public expenditure on agriculture does not granger cause GSDP (p = 0.840), but we can reject the null hypothesis that GSDP does not granger cause public expenditure on agriculture (s p = 0.084). This supports the Wagner's law i.e.; economic growth is a determinant of public sector growth (Salih 2012; Srinivasan 2013; Wang et al. 2016). Furthermore, the lack of reverse causal flow from the agriculture to economic growth reveals that agricultural sector has been neglected in economic development.

4 Conclusions and policy implications

This paper has examined the impact of public expenditure on agriculture on economic growth in Meghalaya. Regression results show that there is a significant positive impact of expenditure through crop husbandry on GSDP and a significant negative impact of expenditure through forestry and irrigation. However, the expenditure on dairying and agricultural research does not have a significant impact. The coefficient on expenditure on crop husbandry suggests that a 1% increase in expenditure on crop husbandry causes 1.44% increase in GSDP. These findings are in accordance with the findings of Ighodaro (2006), Faleyimu (2013), Oyetade & Dewi (2014) and Enu (2014). It indicates requirement for an increase in agricultural spending. Farming in Meghalaya is traditional, yet development of this sector is distinguished as a driver of economic growth. Therefore, government should increase public expenditure on agriculture and allied sectors and in balanced manner, that reinforcing linkages among different segments through value chains. This would create income opportunities that would lead to economic development of the state. Additionally, the observations are in favour of the Wagner's theory and the outcome also supports Wagner speculation. Thus, the unnecessary non-developmental expenditures need thorough scrutinization and focus should be on activities which have larger developmental effect.

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