Shanlax International Journal of Arts, Science and Humanities

Vol. 5 No. 2 October 2017 ISSN: 2321-788X UGC Approval No: 43960 Impact Factor: 2.114

INFLUENCE OF IRRIGATION PROJECT ON THE OUTPUT OF FOOD CROPS: A STUDY OF PIP

Article Particulars

Received: 1.8.2017 Accepted: 29.8.2017 Published: 30.9.2017

Dr.M.V.SURESH
Head and Assistant Professor of Economics,
NSS Hindu College, Changanasserry,
Kerala, India

Abstract

Many major and minor irrigation projects have been implemented in India with the intention of enhancing the area under cultivation, besides increasing the productivity of existing lands.In response to the urgency in augmenting the production of paddy, a number of major, medium and minor irrigation projects have also been implemented in Kerala.The PIP, the focus of our study, was started as back as far in 1964 after the formation of the State on linguistic grounds, originally envisaged to accelerate the production of paddy in its rich catchment area by bringing additional land under cultivation and by enhancing the supply of water to existing cultivated areas. The PIP had expected that with its completion, the area under cultivation of paddy would be increased to 20400 hectares, and the paddy farmers would be able to have three paddy growing seasons viz. autumn (Virippu), winter (Mundakan), and summer (Puncha). Thus, since the thrust of the PIP was on augmenting the area under the paddy cultivation, it is worthwhile to deeply examine the influence that the area under cultivation has made on the yield of paddy. Therefore, the next move is to have a regression analysis for paddy in three catchment areas separately. The study analyzed the influence of PIP upon the yield of paddy by fitting a multiple regression model. The output value of paddy (yield of paddy time's market price) has been taken as the only dependent variable given the reason that augmenting the yield of paddy is the prominent purpose for which PIP was implemented. The independent variable entered in the model is the area under the cultivation since the objective of PIP was to strengthen the supply of irrigated water in the catchment area, thereby encouraging the farmers to bring more land under cultivation of paddy. From the analysis of the impact of the PIP we know the impact of the PIP on the area available for cultivation of different crops, cropping patterns and land use pattern. However, the study does not claim that these changes have been brought about only because of the PIP, but other factors like change in the employment structure, vertical movement of education level and the impact of Gulf migration might have influenced the aforesaid changes which were not properly envisaged by the authorities of the PIP at the time of implementation.
Keywords*: irrigation projects, paddy, cultivation, catchment area, cropping patterns, PIP*

Many models describing the agricultural production function have considered irrigation as an indispensable input determining the quantum of output in the agricultural sector. Admittedly, the PIP was implemented to expedite the supply of water through canals aiming at increasing the area under paddy cultivation. The analysis done in the preceding section has found that the PIP's influence in determining the area under cultivation of paddy is different across three regions of the catchment area, namely, the head, middle and tail. Area of paddy and the monetary value of inputs of paddy cultivation are taken as the predictor variables of the regression model. In addition to that, to find whether the different catchment areas have any influence upon the output value of paddy, the study employed a dummy variable regression model in which different catchment areas are taken as the dummy variables while considering the tail catchment area as the base category. The cropping type has also been added as a second qualitative variable to the model while taking the 'paddy cultivated as food crop' as the base category. The following dummy variable model was used to regress the output value of paddy.

Y_i = $\beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 D_{3i} + \beta_4 X_{1i} + \beta_5 X_{2i} + u_i$

Y_i = Output value of paddy

β_0 = Intercept

D_{2i} = 1 (if mixed crop)

= 0 (other wise = Food Crop)

D_{3i} = 1 (if head area)

= 0 (other wise)

D_{4i} = 1 (if middle)

= 0 (other wise)

X_{2i} = Monetary Value of inputs of paddy cultivation

X_{3i} = Area of paddy field

u_i = Stochastic error term

The model summary is given in the following tables.

Table No. 5.59 Model Summary

Model Summary					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error ofthe Estimate**	**Durbin-Watson**
1	0.972	0.945	0.944	25.36488	1.13

Anova						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	2187929.543	5	437585.909	680.139	.000
	Residual	127388.667	198	643.377		
	Total	2315318.210	203			

Source: survey data

The model summary reports the strength of relationships between various predictor variables and the dependent variables. There is some correlation between error terms but since the Durbin-Watson statistic is greater than 1, it does not create much concern.

The value of adjusted R square (0.944) implies that 94.4% variation in the output value of paddy is explained by the model. The model is statistically significant at 1% level (F = 680.139, df = 5, p value = 0.00).

Table No. 5.60 Coefficients

Coefficients							
	Un standardized Coefficients		**Standardized Coefficients**	**T**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
(Constant)	12.535	4.754		2.637	0.009		
Paddy (area)	0.697	0.03	0.868	23.017	0.00	0.196	5.113
Paddy(inputs)	25.038	7.394	0.124	3.386	0.001	0.207	4.823
Tail Vs Head	3.017	6.339	0.008	0.476	0.635	0.929	1.076
Tail_Vs_Middle	-4.516	3.868	-0.021	-1.168	0.244	0.884	1.131
Food_Vs_Mixed	2.295	4.348	0.01	0.528	0.598	0.837	1.194

In this model, multicollinearity is *only* a *potential* problem as the tolerance statistic is near to 0.2. Variance inflation factor for all the variables are lower than 10 and it also points that multicollinearity is not a big issue. The residual statistics have been computed and for all the cases the 'Cook's distance' statistic is sufficiently lower than, one which implies that there is no influential case in the model.

The coefficients of monetary value of inputs of paddy cultivation and area of paddy field are statistically significant at 1% level. But the differential intercept coefficients of the dummy variables used in the model are not significant. It implies that the expected output value of paddy is same for all the catchment areas and the cropping types when adjusted for all the other predictor variables. Put otherwise, there is no evidence to state that the catchment areas and cropping types influence the output value of paddy when the other predictor variables are controlled (have same values).

However, it does not imply that the different catchment areas have no influence upon the relationship between predictor variables (area of paddy and input value of paddy) and the dependent variable (out value of paddy). In fact, it is pointed out that even when the qualitative variables have no influence upon the differential intercept of the regression model, they can influence the slope coefficients of the sub-group regression of different catchment areas. Geometrically speaking, even when the intercept of the different regression lines is the same, the slope of the regression lines could be different. Theoretically speaking, there can be a concurrent regression in the relationship between different catchment areas. Concurrent regressions are defined as regression lines with the same intercept, but with different slope coefficients. This can be ascertained by running a regression analysis with multiplicative dummy variables. The following model has been fitted for this purpose.

Y_i	=	$\beta_0 + \beta_1 He$ + β_2 Middle + β_3 Input Value + β_4 Area+ β_5 (Head x Input Value) + β_6 (Head x Area) + β_7 (Middle x Input Value) + β_8 (Middle x Area) $+u_i$]
Y_i	=	Estimate of mean output value of paddy
β_0	=	Estimate of the mean output value in tail area
β_1 , β_2	=	Estimate of differential intercepts for the head and middle
$\beta_3 + \beta_4 + \beta_5 + \beta_6$	=	Estimate of slope of regression line for the head
$\beta_5 + \beta_6$	=	Estimate of the difference between the head and the tailregression line slopes
$\beta_3 + \beta_4 + \beta_7 + \beta_8$	=	Estimate of slope of regression line for the middle
$\beta_7 + \beta_8$	=	Estimate of the difference between the middle and tail regression line slopes
β_3 , β_4	=	Estimate of the association between the predictor variables and dependent variable for the tail area
u_i	=	Stochastic error term

The results of the regression analysis are given below:

Table 5.61Model Summary

Model Summary									
R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
				R Square Change	F Change	df1	df2	Sig. F Change	
.979	.959	.958	20.14706	.959	553.4	8	188	.000	1.545

Anova					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	1797016.71	8	224627.089	553.400	.000
Residual	76309.95	188	405.904		
Total	1873326.67	196			

Table 5.62 Coefficients

Coefficients							
	Unstandardized Coefficients		Standardi-zed Coefficient s	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Toleranc e	VIF
(Constant)	11.644	4.203		2.771	.006		
Div_Paddy	.650	.041	.841	15.90 7	.000	.078	12.90 2
Paddy	33.618	8.923	.177	3.768	.000	.098	10.22 9
Tail_V_Head	71.646	28.387	.195	2.524	.012	.036	27.51 2

Tail_V_Middle	6.666	6.549	.034	1.018	.310	.199	5.020
Interaction_HeadXArea	-126.647	48.055	-.277	-2.635	.009	.020	51.102
Interaction_HeadXInput	.191	.119	.088	1.609	.109	.073	13.706
Interaction_MidddleXArea	5.370	13.160	.035	.408	.684	.029	34.372
Interaction_MiddleXInput	-.053	.055	-.083	-.963	.337	.029	34.215

Residuals Statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Mahal. Distance	.967	75.573	7.959	11.660	197
Cook's Distance	.000	.075	.004	.009	197

The Durbin-Watson statistic measuring auto correlation and the statistics measuring multicollinearity are within the tolerable limits. The residual statistics also show that the regression model has not been unduly distorted by any influential cases in the sample.

The model is statically significant at 1% level (*F statistic* = 553.4; *df* = 8, 188*; p value* = 0.00). The adjusted R^2 is 0.958 and it implies that 95.8% of variation in the output value of paddy has been explained by the predictor variables of the regression model. The coefficients of the input value and the area are significant at 1% level.

The coefficient of the dummy variable for the head area is also significant at 5% level *(p value* = 0.012) which implies that the relationship has a different intercept value at the head area compared to the tail area. The coefficients of interaction dummy variable for the head area is significant *(p value* = 0.009) at 1% level but for the interaction dummy variable for the head, the input value is just out of 10% significance *(p value* = 0.109) level.

In fact these coefficients together with the coefficients of input value and area, determine the slope of regression equation for the head area. These coefficients except the interaction dummy variable for head x input value (which is just out of 10% significance (*p value* = 0.109) level) are significant at 5% level. This suggests that the slope of the regression equation for the head area is different from that of the tail area. The intercept value has been found significant earlier. All these show that there is no evidence to conclude that the relationship between the output value of paddy and the predictor variables (area under paddy cultivation and input value of paddy) is the same for head and tail areas of PIP system. It implies that the relationship between predictor variables of output value of paddy in head and tail areas is different.

References

1. Bhalla, C. S. (2007). *Indian Agriculture since Independence.* New Delhi: National Book Trust.
2. Chopra, K. (1993). Sustainability of Agriculture. *Indian journal of Agricultural Economics, conference No.VO48, No.3* .

3. Coward Jr., E. (. (1980). *Irrigation and Agricultural Development in Asia: Perspectives for the Social Science*. Cornel University Press.
4. GOK. (1972). *Pampa Irrigation Project*. Trivandrum: Irrigation Department.
5. GOK. (2009). *Statistics for Planning*. Thiruvananthapuram: Departmernt of Economics and Planning.
6. Gujarati, D. N., & Sangeetha. (2007). *Basic Econometrics*. New York: Tata McGraw-Hill.
7. Gulati. A.R, M.-D. a. (1999, January 2). From Top Down to Bottom Up: Institutional Reforms in Indian Canal Irrigation. *Draft volume circulated for a National Workshop at Institute of Economic Growth New Delhi* . New Delhi.
8. Hooja, R. (2006). *Management of Water for Agriculture Irrigation, Watersheds and Drainage*. Jaipur: Rawat Publications.
9. ISAE. (2008). *Readings in Agricultural Economics*. Cornell University: Indian Society of Agricultural Economics.
10. Jairath, J. (1994). Technical and Institutional Factors in Utilisation of irrigation: A Case Study of Public Canals in Punjab. *Economic and Political Weekly Vol. XX No.13* .
11. Joshi, L. K. (1997). *Management of Irrigation: A New Paradigm-participatory Irrigation Management*. Ministry of Water Resources, Govt. of India.
12. Krugman, P., & Wells, R. (2009). *Macro Economics*. London: Worth Publishers.
13. Musgrave, R. A., & Musgrave, P. B. (1989). *Public Finance in Theory and Practice*. London: McGraw-Hill Book Co.