RESEARCH REVIEW JOURNALS
Volume-04
Issue-05
May-2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com[UGC Listed Journal]

Essential Determining factor of Private Investment in Indian Agriculture: A Statistical analysis

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ARTICLE DETAILS

Article History
Published Online: 15 May 2019

Keywords
public investment, agriculture, institutional credit, Terms of trade, private investment, OLS approach.

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ABSTRACT

A declining trend in the momentum of public investment in agriculture after the decade of 80s was considered as a major factor in agricultural slowdown in the 1990s.This paper has explored the determinants of private investment in Indian agriculture, applying the general to specific OLS approach. The analysis of the determinants of private investment has been done through the multiple regression analysis. The estimated coefficients for all independent variables are positive and significant revealed that private investment in agriculture is positively and significantly affected by public investment, institutional credit and terms of trade. The nature of relationship between dependent and independent variables can be estimated by running regressions including different combinations of independent variables. Impact of institutional credit is positive and significant on private investment with public investment and terms of trade. Terms of trade was positive but not significant with public investment while it was positive and significant with institutional credit. Impact of public investment with TOT and credit turned out to be negative and significant at national level. Terms of trade induced private investment in agriculture in the short run and institutional credit in the long run. Public investment in agriculture was a positive determinant of private investment in India. This is an indication that public investment in agriculture, particularly in infrastructure, leads to increases in private investment in agriculture. The study suggests that larger development agenda is not expected to be addressed by private sector, and that continues to be the domain of public sector investment.

1. Introduction

The major interest on capital formation in Indian agriculture was raised in late 1980s, bringing out the issues of fall in public investment in agriculture, echoing neglect of agriculture in public resource allocation and its adverse impact on private investment in agriculture in the context of complementarity between public and private investment in agriculture. Public and private investments series in agriculture were moving in the same direction and rising till 1980-81. After that they showed disparate movement. The series on the private sector continued to show a rising trend as in the past, but the series on public investment in agriculture followed a declining trend. This decline in the momentum of public sector investment was considered as a major factor in agricultural slow down in the 1990s. Subsequently the debate turned to several other issues like determinants of public and private investment and definitional and measurement aspects of public sector capital formation in agriculture. Various empirical studies on private investment have identified several factors like favorable terms of trade, technology, rural savings, institutional credit, and input subsidy, infrastructural investment like rural roads, regulated markets and rural electrification etc. as determinants of private investment (Gandhi, 1990; Binsawnger*et.al*, 1993; Wagle, 1994; Dhawanand Yadav, 1995; Chand, 2001; Roy and Pal, 2002). There has been considerable debate among economists about the specific role and importance of different factors in this context. In order to arrive at a quantitative measurement of the influence of various factors such as public investment, institutional finance, and favorable terms of trade, etc. on private investment in agriculture in India have been analyzed.

The paper is divided into four sections. The determinants of private investment in agriculture are defined and discussed in section I, so as to provide better understanding of their relationships examined later. The analytical framework, the model and estimation of various equations and the expected relationships of the variables in Indian agriculture is estimated and presented in section II and III. Section IV summarized the major findings and suggestions of the paper.

2. Major Determinants of Private Investment in Agriculture

One of the major controversies surrounding capital formation in agriculture is what factors influence the investment behaviour of private investment in agriculture. Like any other sector, private investment in agriculture depends upon all those factors that increase the capability of investors to invest. Most of the studies have considered public sector capital formation, amount of institutional credit supplied to agriculture, terms of trade for agriculture and technology as the major determinants of private sector capital formation. This study also estimated the impact of public investments, institutional flow of credit provided for medium and long-term and terms of trade (TOT) for agriculture on private investment in agriculturefor the period 1980-81 and 2015-16 at 2004-05 prices.

1. Public Investment

Public investment was considered an important determinant of private investment in agriculture by several studies and raised the question of complementarity between private and public investment and inducement effect. The debate on complementarity hypothesis has led to different conclusions on complementarity.The studies by Chakravarthy (1987), Rath (1989), Shetty (1990), Dhawan(1998), Gulati and Bathla (2002) have confirmed complementarity between public and private investment.

But after 1980-81 both the series started moving in opposite direction as declining trend in public sector investment and continuous increase in private investment. This movement of both the investment series in the opposite direction has raised question about the validity of complementarity hypothesis (Mitra, 1997, Chand, 2001, and Roy and Pal, 2001). They found negative and non-significant impact of public sector investment on private investment and lack of complementarity between the two.

2. Terms of Trade

Terms of trade affect private investments indirectly by affecting income from agriculture. The movement of TOT in favour of agriculture will make agriculture more profitable and thus attract more investment, while adverse TOT for agriculture makes the sector less profitable. Hence, TOT is expected to have a positive impact on private sector capital formation, though there are also controversies on the measurement of terms of trade in agriculture (Mungekar, 1993). The early studies examining the trend and determinants of investment in Indian agriculture (Mujumdar and Menon, 1986; Shetty, 1990; Malliick, 1993; and Dev, 2004) indicated unfavorable agricultural terms of trade to be one of the reasons for declining private investment in agriculture. Several recent studies also have been concerned about the influence of changing terms of trade after economic reforms on private investment in India (Mishra and Hazell, 1996; Misra 1998, Chand, 2001; Gulati and Bathla 2001; Roy and Pal 2002. They concluded that the impact of TOT remained significantly positive during all the periods of studied. To analyze the impact of TOT on the private capital formation, index based on the ratio of prices received to prices paid by agriculture sector has been used.

3. Institutional Credit

Institutional credit is directly related to private investment as medium and long-term loans are given for the creation of assets. The impact of availability of institutional credit is found to be significant by several researchers.Adequate, appropriate and cost effective credit availability certainly encourages private investment in agriculture.

Table 1: Trends in Dependent and Independent Variables (India) (Rs. Crore) (At 2004-05 prices)

Years	Dependent Variable	Independent Variables		
	GCFagPvt	GCFagPU	TOTBase : TE 1990-91=100	Credit
1980-81	6932	7301	87.9	1346
1981-82	6949	7130	88.7	1557
1982-83	7437	7092	91.4	1469
1983-84	7529	7196	91.6	1766
1984-85	8027	6921	93.9	2435
1985-86	7919	6213	93.6	2629
1986-87	7844	5864	95.7	3207
1987-88	8204	6045	97.4	3682
1988-89	9063	5699	98.3	3497
1989-90	8452	4972	99.4	4080
1990-91	7301	6932	101.9	4209
1991-92	7130	6949	105.6	4587
1992-93	7092	7437	103.9	4824
1993-94	7196	7529	103.6	5261
1994-95	6921	8027	106.6	6840
1995-96	6213	7919	105.3	8699
1996-97	5864	7844	103.1	9413
1997-98	6045	8204	105.6	11316
1998-99	5699	9063	105.2	12957
1999-00	4972	8452	102.7	17303
2000-01	4992	11424	100.9	19513
2001-02	4376	10589	102.6	21536
2002-03	4539	11602	103.6	23974
2003-04	4918	10331	101.0	32004
2004-05	5397	11388	100.7	36187
2005-06	4849	10841	101.3	37668
2006-07	4668	11508	103.2	39980
2007-08	3979	11963	105.4	39324
2008-09	3870	11025	107.8	40112
2009-10	4756	13083	110.1	41823
2010-11	4435	12980	110.5	43562
2011-12	5488	12250	111.2	44346

2012-13	4760	13881	112.3	45642
2013-14	5923	15261	112.6	44532
2014-15	6051	19668	114.3	46531
2015-16	6385	22424	113.3	46783

Sources: National Account Statistics; various year C.S.O.; Government of India.Commission for Agriculture Costs and Prices, 2015, Govt. of India Agricultural Research Data Book 2014, Indian Council of Agricultural Research & Ministry of Agriculture, Govt. of India

3. Analytical Framework and the Model

In this section, we have discussed the conceptual framework upon which the determinants of private investment have been evaluated. The experimental framework used in this analysis involves the regression of private investment in agriculture on selected independent variables. The analysis of the determinants of private investment has been done through the approach of multiple regression analysis as explained below –

Multiple Regression Analysis

Multiple regression can establish that a set of independent variables explains a proportion of the variance in a dependent variable at a significant level (through a significance test of R^2), and can establish the relative predictive importance of the independent variables by comparing beta coefficients. The multiple regression equation takes the form

$$\mathbf{Y = a + b_1 X_1 + b_2 X_2 + ... + b_n X_n . + \varepsilon}$$

The $\mathbf{b_1}$, $\mathbf{b_2}$ and $\mathbf{b_n}$ are the regression coefficients, representing the amount the dependent variable y changes when the corresponding independent changes 1 unit. The **a** is the constant, where the regression line intercepts the y axis, representing the amount the dependent y will be when all the independent variables are 0. But results from these models may be spurious given problems associated with time series data. A large number of macroeconomic time series data are characterised by unit root non-stationary processes. Under these circumstances, the conventional t and Ftests based on these estimation methods are no longer valid, giving misleading inferences. To avoid spurious result test of stationarity is very useful (Harris, 2000).

Model Estimation

This section develops the model to be estimated. The model selected to analyze determinants of private investment in agriculture includes three independent variables. The multiple regression equation can be written as:

$$\mathbf{GCFpvt}_t = a + b_1\mathbf{GCFpb}_{t-n} + b_2\mathbf{TOT}_t + b_3\mathbf{Credit}_t$$

Where GCFpvt, the dependent variable is the level of private capital formation in agriculture (Rs. Crore, at 2004-05 prices) and the explanatory variables are;

GCFpb = Public investment in agriculture (Rs. Crore at 2004-05 prices)

TOT =Terms of trade for agriculture (Ratio of prices received to prices paid by

agriculture sector based on triennium ending 1990-91=100)

Credit =Institutional credit to agriculture for long and medium term (Rs. Crore at 2004-05 prices)

(The subscript 't' represents the t-th year and 'n' is the length of lags for public investment in agriculture)

In order to determine both the long run and short run behaviour of investment with regard to explanatory variables, a private investment function is developed and estimated at levels to determine the long-run behaviour and, then re-estimated on lagged and differenced terms. The estimation on differenced terms is used to determine the short-run behaviour and the adjustment mechanism by which short-run dynamics adjust towards equilibrium.

4. Empirical Analysis and Results

Correlations in Variables

The association between private investment in agriculture and other relevant variables for the period 1980-81 to 2015-16 can be seen from the correlation coefficients presented in Table2. Private investment in agriculture shows significant positive association with institutional term loans for agriculture as well as with the terms of trade for agriculture in India. Correlation between public investment and the private investment was negative and statistically significant at national level. This shows the greater importance of state public investment in rural infrastructure to induce private investment in agriculture. At all India level coefficient was positive but significant at the 5% of significance level.

Table 2: Correlation coefficients between Private Investment and Other Variables in India

	GCFagPU	**TOT**	**Credit**	**GCFagPvt**
GCFagPU	1			
TOT	-.897(**)	1		
Credit	-.274	.420(*)	1	
GCFagPvt	-.462(*)	.630(**)	.914(**)	1
N	25	25	25	25

The correlation between institutional credit flow to agriculture has highly positive correlation (+0.91 at all India level) with private investment in agriculture and significant at 5% significance level. There was a high correlation between credit and private investment but it was not in the one to one ratio. It means some part of the term loan has spent as consumption expenditure or in other uses. Similarly, the

different variables used as independent variables are having significant correlation among them.

Multiple Regression Analysis

The relationship of variables has been tested by multiple regression analysis. In order to see the effect of independent variables on private investment in agriculture the equations are presented below:

$GCFpvt_t = -24979.5 + 0.702 GCFpb_{t-3} + 290.295\ TOT_t + 0.269\ Credit_t$ ..... (1)
(-2.288)* (1.701) *** (3.3) **** (9.61)
R^2 =0.903 Adjusted R^2 =0.886 N=22

$GCFpvt_t = 10706.951 - 0.391\ GCFpb_{t-3} + 0.235\ Credit_t$ ..... (2)
(5.767) (-1.331) *** (3.324) ****
R^2 =0.844 Adjusted R^2 =0..827 N=22

$GCFpvt_t = 22358.005 - 1.714\ GCFpb_{t-3} + 18.061\ TOT_t$ ..... (3)
(1.9522)** (-2.214) * (1.091)
R^2 =0.592 Adjusted R^2 =0.528 N=22

$GCFpvt_t = -7574.507 + 159.468\ TOT_t + 0.239\ Credit_t$ ..... (4)
(- 2.050)** (4.210) (3.115) ****
R^2 =0.909 Adjusted R^2 =0.901 N=25

$GCFpvt_t = 20222.412 - 1.658\ GCFpb_{t-3}$ ..... (5)
(8.000) (-3.166) ****
R^2 =0.522 Adjusted R^2 =0.486 N=22

$GCFpvt_t = 7938.042 + 0.277\ Credit_t$ ..... (6)
(2.511)* (10.803)
R^2 =0.835 Adjusted R^2 =0.828 N=25

$GCFpvt_t = -22857.142 + 336.350\ TOT_t$ ..... (7)
(-2.650)* (3.089) ****
R^2 =0.607 Adjusted R^2 =0.571 N=25

(Figures in parentheses are 't' values and ****, ***, ** and * indicate the t value is significant at 0.1 , 10, 5 and 1 % level (2 tailed) respectively)

All the three independent variables are considered in the regression equations showed significant and positive impact on private capital formation in agriculture at country level. However, when each of these variables is used alone as independent variable, impact of each of the three variables turned out to be significant at 0.2% (equations 5 to 7). It was quite notable that impact of public investment on private investment at country level turned out to be negative. Public investment in infrastructure development in agriculture is considered as state matters so it is important in this context.

The nature of relationship between dependent and independent variables can be estimated by running regressions including different combinations of independent variables. The sets of regression equations 2 to 4 are an attempt in this direction, to recognize the determinants and influence of these determinants on private investment. Impact of institutional credit is positive and significant on private investment with public investment and terms of trade. Terms of trade was positive but not significant with public investment while it was positive and significant with institutional credit. Impact of public investment with TOT and credit turned out to be negative and significant at national level.

The above equations revealed that public sector capital investment have positive and significant impact with other variables on private investment at national level during the period 1980-81 to 2015-16. The estimated coefficients for all independent variables are positive and significant revealed that private investment in agriculture is positively and significantly affected by public investment, institutional credit and terms of trade.

So the absence of long run relationship between terms of trade and private investment would suggests that favourable terms of trade alone may not be effective in sustaining higher agricultural investment at country level as well as state level. It was quite notable in the analysis that Public sector and Private sector GCF in agriculture at constant prices were moving in opposite directions but pace of rise in GCF in private account was slower in the 1980s and 1990s.

5. Conclusion

The determinants of private investment in developing countries have been widely investigated by a number of studies This study has investigated the determinants of private investment in India over the period of 1980-81 to 2015-16, in the short run and long run perspective. Applying the general to specific OLS approach, our statistical results suggested the existence of stable long run relationships between macroeconomic variables and private investment in agriculture. The variables that affect private investment are consistent with the hypothesised signs and most of them were also found to be statistically significant.

The results of this study provided support for the proposition that private investment in agriculture in India has been affected by important macroeconomic variables such as public investment in agriculture, institutional flow of credit to agriculture sector and terms of trade in agriculture. The results showed that macroeconomic factors affect private investment, both in the short term and in the long-term. Terms of trade induced private investment in agriculture in the short run and institutional credit in the long run in the context of India. Public investment in agriculture was a positive determinant of private investment in India in the long run and in the short run. This is an indication that public investment in agriculture, particularly in infrastructure, leads to increases in private investment in agriculture.

The empirical evidence suggested that there would be a reduction in the level of private investment in agriculture when the sector is squeezed for credit. This finding confirmed the importance of the links between the financial sector and private investment in agriculture. The importance of credit implied a need for a well-functioning financial system that can transfer resources from savers to investors.

Since the magnitude and productivity of investment is an issue of critical importance, it therefore needs immediate attention of policy makers. While arguing that private sector investment may increase even under the situation of declining public sector investment, one has to keep in view the compositional differences as between public and private sector investment, and the difference in their investment objective function. Public sector investment portfolio is expected to be a part of broader development agenda like equity, conservation of environment, and poverty alleviation, enhancing competitive capacity of Indian agriculture both in domestic and international markets, The investments in rural roads, big irrigation projects, rural power supply, storage facilities and rural markets may have to be considered under public sector investment to induce private sector investment in agriculture. Certain types of public sector investments are necessary even to induce corporate sector to invest for agriculture.

Private investment cannot be always a substitute for public investment, mainly because of differences in their investment portfolio. Public investment is more of a complement to private investment. There are areas like watershed, rural roads, rural electrification, large irrigation schemes, agricultural research and extension, markets, which still continue to remain primarily in the public sector domain. The larger development agenda is not expected to be addressed by private sector, and that continues to be the domain of public sector investment. Further, not only the quantum but also the quality of public expenditure influences the level of investment in agriculture.

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