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ARTICLES

Farmers' Investment on Productive Assets in Rural India: Composition and Determinants

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ABSTRACT

Investment in agriculture is widely recognised as crucial for economic growth, poverty reduction and improved food and nutrition security. In India, investment in agriculture as a share of total capital formation in the economy continue to decline for both public and private investments. The present study attempts to find out the composition and determinants of farm household investment on productive assets using recent NSSO situational assessment survey data. Composition of average monthly expenditure on productive assets indicated that nearly 33 per cent was spent on agricultural machinery and implements, 18 per cent was on livestock and poultry and another 42 per cent was on 'other assets in farm businesses. Average monthly expenditure on productive assets used in farm business indicated that less than one-third of the all-India average in the lowest size class of land (<0.01 ha.) compared to more than nine times of the all-India average in case of agricultural households with more than 10 ha of land. The Heckman (1979) selection model, sometimes called the Heckit model has been used to explore the determinants of farmers' investment and the results indicated that sex, caste, credit availed, household size, crop income, education and possessed land were the significant variables which determines the investment decision of farm households and the extent investment on productive assets.

Keywords: Investment, Agriculture, Productive assets, Determinants, Composition .

JEL.: D24, E24, O16, Q12

I

INTRODUCTION

Investment is simply a change in capital stock or fixed inputs used in a production process (Harrod, 1939 and Domar, 1946). Investment means making an addition to the stock of goods in existence" and it is the part "of the production not merely replacing past sales, but is directed to increasing the rate of output in the future" (Robinson, 1956). The terms 'capital formation' and 'investment' are often used interchangeably. As per the National Accounts Statistics (NAS), capital formation refers to the accounting value of the additions of non-financial produced assets to the capital stock less the disposals of these assets. It implies an addition to the existing stock of assets like equipment, building, etc., for enhancing the productivity capacity. Investment is a broader concept that includes the purchase of all kinds of capital assets, it could be in the form of physical property or financial assets, which yield an income in the future. Investment therefore is a flow and involves the formation of capital. It does not represent the stock of capital in an economy, but rather the changes in that stock of

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capital that are intended to increase future production, output or income. Farmers and governments invest in order to build capital, which allows the agricultural sector to become more productive in the future.

Investment in agriculture is widely recognised as crucial for economic growth, poverty reduction and improved food and nutrition security (World Bank, 2008; G8, 2009). The most important pre-requisite in the agricultural sector is the need to encourage farmers to make long-term investment (Government of India, 2017). The relationships between capital formation and labour productivity, as well as the “crowding in” effects of public investment on private investments, are well established (Bisaliah and Dev, 2012; Chand and Parappurathu, 2012). Nevertheless, the trends of both public and private investments as a share of total capital formation continue to decline in India. The prevalence of lower public GCFA has been explained by the diversion of expenditure towards the input subsidies, low preference by the government for spending on agriculture, population density, and procurement of foodgrains (Mishra and Chand, 1995; Misra and Hazell, 1996; Bathla, 2014). High public expenditure priority in India enabled public capital formation in agriculture and input subsidies to grow at a higher rate (Bathla *et al.*, 2017). Private investment is found to be positively influenced by technology and institutional credit and negatively impacted by the incidence of rural poverty and percentage area under marginal holdings (Bisaliah and Dev, 2012). Singh *et al.* (2015) stated that investment in rural public goods is complementary to private on-farm investment.

As far as private investment is concerned, the trend reflects a revealed preference for investment outside the sector, perhaps driven by higher returns or by an inadequate enabling environment for investment in agriculture (Singh, 2011). Gross capital formation (GCF) in agriculture and allied sector as percentage of gross value added (GVA) witnessed a rise to 17.7 per cent in 2013-14 but declined thereafter to 15.2 per cent in 2017-18 (Government of India, 2019). Most of the studies related to investment in agriculture used CSO data that include largely major and minor irrigation capital expenditures, which is a much narrower definition (Singh, 2011), and in fact there is no study which focus on determinants of investment on productive assets by the agricultural households in the country. NSSO survey report defined productive assets are the assets representing all the things owned by the household which had money value, for example; land, buildings, livestock, agricultural machinery and implements, etc. Assets which are used repetitively for producing goods or providing services are treated as productive assets. These are the assets used by the agricultural households both in farm business and non-farm business. Assets considered for farm business included various agricultural machinery and implements, livestock among others. The immovable assets like land and building were separately accounted for farm business and non-farm business. With this backdrop, the present study attempts to find out the composition and determinants of agricultural household investment on productive assets in India.

II

DATA AND METHODOLOGY

The present study being completely relied on the data obtained from Situation Assessment Survey of Agricultural Households in the National Sample Survey Office (NSSO) 70th Round (January, 2013 and December, 2013) (Government of India, 2013). It was a repeat survey of Situation Assessment Survey of farmers conducted in 59th round.¹ The survey tried to capture the condition of agricultural households in the country in the context of policies and programmes of Government of India. The survey had a coverage of 4529 villages and 35200 farm households. The survey schedule was designed for collection of various information related to farming and other socio-economic characteristics of agricultural households along with information on household consumer expenditure, their indebtedness, income and productive assets, farming practices and preferences, resource availability, their awareness of technological developments and access to modern technology in the field of agriculture, information on crop loss, crop insurance and awareness about Minimum Support Price (MSP) was also collected during 70th round.

The present paper is organised in two major sections, (i) composition of household investment on productive assets and (ii) determinants of household investment on productive assets. In order to describe the composition of productive assets, we used summarised data available in "Key indicators of situation of agricultural households in India" published by NSSO based on the 70th Round. The Heckman (1979) selection model, sometimes called the Heckit model has been used to identify the determinants of investment on productive assets. The regression equation could be specified as follows;

$$Y_j = \beta X_j + \varepsilon_i \quad \dots(1)$$

where, Y_j is extent of investment in monetary value and X_j is the vector of independent variables.

The corresponding selection equation is given as;

$$\check{D} = Z_j \gamma + u_j \quad \dots(2)$$

where, \check{D} is the investment decision of the farm household and observed only if $Z_j \gamma + u_j > 0$

Also, we have the following assumptions;

1. $\varepsilon_j \sim N(0, \sigma)$
2. $u_j \sim N(0, \sigma)$
3. $\text{Corr}(\varepsilon_j, u_j) = \rho$

When $\rho \neq 0$, standard regression techniques applied to the first equation yield biased results whereas Heckman provide consistent, asymptotically efficient estimates for all the parameters in such models.

Rationale for the Model Selection

The present study aims to explore the determinants which influence the extent of farmers' investment on productive assets. However, there are two categories of farm households in the sample – (1) Investors on productive assets (64.5 per cent) and (2) non-investors (35.51 per cent). In such situations, sample selection bias could arise and as a result of which standard regression equation yield biased results (Heckman, 1976 and 1979). Therefore, Heckman selection model has been used in this study since it assumes that there is an underlying regression relationship between the extent of investment (regression equation) and investment decision of the farmer (selection equation). This model provides consistent, asymptotically efficient estimates for all the parameters.

III

RESULTS AND DISCUSSION

Composition of Household Investment on Productive Assets

The all India level average monthly expenditure distribution has been depicted in Figure 1. This clearly indicated that, around 93 per cent of the average monthly expenditure on productive assets was spent on productive assets used in farm business (agricultural machinery and implements (33 per cent), livestock and poultry (18 per cent) and other assets in farm business (42 per cent)). Only 7 per cent of the monthly expenditure was spent on productive assets required to run the non-farm business.

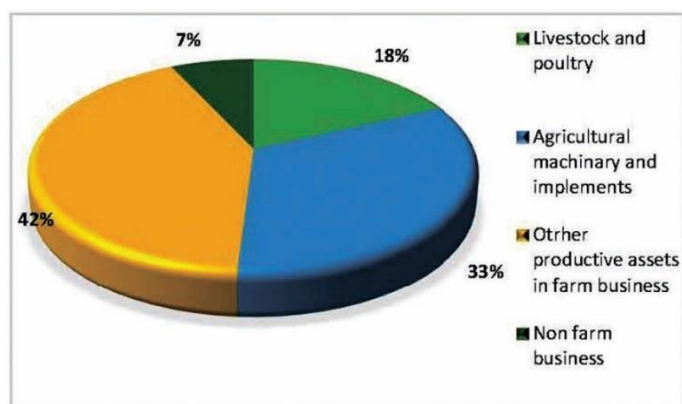


Figure 1. Per cent Distribution of Monthly Expenditure on Different Classes of Productive Assets.

The average monthly expenditure on productive assets used for farm and non-farm business per agricultural household during the agricultural year July 2012- June 2013 was ₹1087 (Table 1). Out of which, farm business was ₹1013 and non-farm business was ₹74. As size of land class increases, average expenditure on productive assets also

increased and it was less than one third of the all-India average in the lowest farm size category (marginal) and more than nine times of the all-India average in case of agricultural households possessed more than 10 ha of land (large farm category).

TABLE 1. LAND CLASS WISE DISTRIBUTION OF MONTHLY EXPENDITURE (₹) ON PRODUCTIVE ASSETS PER AGRICULTURAL HOUSEHOLD

Size class of land possessed (ha.)	Farm business			Total	Non-farm business	All
	Livestock and poultry	Agricultural machinery and implements	Other productive assets			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<0.01	237	20	23	281	74	355
0.01 - 0.40	170	46	70	287	65	352
0.41 - 1.00	142	371	324	837	60	897
1.01 - 2.00	206	303	1233	1741	118	1860
2.01 - 4.00	372	794	500	1667	73	1740
4.01 - 10.00	428	1625	752	2805	68	2873
10.00+	584	4462	4522	9568	180	9748
All size	198	357	457	1013	74	1087

Season wise average monthly expenditure on productive assets per agricultural household is given in Table 2. It depicts that farmers' investment during *khari*f season has been the highest (₹7152) as compared to *rabi* season (₹4423). Also, in terms of expenditure under different heads of farm business investment, *khari*f season recorded considerable headway than that of *rabi* season and overall, it was around 1.6 times higher.

TABLE 2. SEASON WISE AVERAGE MONTHLY EXPENDITURE (₹) INCURRED ON PRODUCTIVE ASSETS PER AGRICULTURAL HOUSEHOLD

Season	Farm business			Total	Non-farm business	All
	Livestock and poultry	Agricultural machinery and implements	Other productive assets			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Khari</i> f	1146	2054	3193	6393	759	7152
<i>Rabi</i>	828	1455	1686	3969	454	4423

Average monthly expenditure per agricultural household incurred on productive assets used for farm and non-farm business exhibited a wide variation among the major States (Table 3). The expenditure was as low as less than one-tenth of the all-India average in the case of Jharkhand (₹99) and as high as more than twelve times in the case of Haryana (₹13694). The states of Chhattisgarh, Assam, West Bengal and Bihar reported to have incurred the low expenditure on productive assets used in farm and non-farm business during this period. It is worth-while to note that the states of Haryana and Kerala reported very large monthly expenditure on productive assets. However, their major share of expenditure came from the 'other productive assets' used for farm business which *inter alia* included land and building also.

TABLE 3. INTER-STATE VARIATIONS IN AVERAGE MONTHLY EXPENDITURE (₹) PER HOUSEHOLD ON PRODUCTIVE ASSETS

State (1)	Farm business			Total (5)	Non- farm business (6)	All (7)
	Livestock and poultry (2)	Agricultural machinery and implements (3)	Other productive assets (4)			
Andhra Pradesh	560	325	157	1043	53	1096
Assam	119	45	77	241	29	270
Bihar	61	75	191	327	24	351
Chhattisgarh	32	106	73	212	25	237
Gujarat	167	545	99	811	15	826
Haryana	553	563	12565	13681	13	13694
Jharkhand	46	44	4	94	4	99
Karnataka	193	357	657	1208	163	1370
Kerala	277	191	8797	9264	1557	10821
Madhya Pradesh	150	455	153	757	64	821
Maharashtra	615	457	305	1377	218	1595
Odisha	215	1490	49	1754	14	1768
Punjab	486	1257	1923	3666	51	3717
Rajasthan	218	382	140	739	99	838
Tamil Nadu	191	617	355	1163	46	1209
Telangana	316	335	124	776	12	788
Uttar Pradesh	133	225	89	446	39	485
West Bengal	53	66	148	267	34	301
All India	198	357	457	1013	74	1087

Determinants of Household Investment on Productive Assets

Description of Variables used in the Model

Table 4 provides detailed description about the variables used for the model estimation so as to identify the determinants of household investment on productive assets. Logarithmic transformation was done for dependent variables. Independent variables like age, gender, caste, education, income from crop, credit availed etc. are used in the model after reviewing various related literatures. Further, in order to check the normality of dependent variables, Kernel density plot has been drawn. The Figure 2 evidently depicts that, the raw data do not assume normal distribution whereas if transforming the same into logarithmic form, it would approximate to normal distribution. Therefore, Log transformed values of investment has been used as the dependent variables in the model estimation.

Profile Analysis of Invested and No-Invested Farmer Respondents

It is inevitable to test whether there is any significant difference in these selected variables between two groups of sample respondents, i.e., investors and non-investors. Accordingly, student t test and χ^2 test were used respectively for continuous variables and categorical variables (Table 5). The results show that the mean difference in age between invested and non-invested household head is negatively significant ($\chi^2=-2.53$,

TABLE 4. DESCRIPTION OF VARIABLES USED IN THE MODEL

Variable (1)	Variable label (2)	Description (3)
A) Dependent		
Ln total investment	Ln_total_investment	Log of total investment by the households on productive assets
Ln farm business investment	Ln_farm_business_investment	Log of farm business investment by the households
Ln non-farm business investment	Ln_non_farm_business_investment	Log of non-farm business investment by the households
Investment dummy	d_invet	If household invested=1, Otherwise=0
B) Independent		
Age	Age	Age of the household head
Age square	age_sq	Age square of the household head
Gender of the household head	Sex	Gender of the household head (Male=1, female=0)
Literacy	literacy	literacy of the household head (literate=1, illiterate=0)
Caste		
ST	caste_ST	Caste of the household (ST=1)
SC	caste_SC	Caste of the household (SC=2)
OBC	caste_OBC	Caste of the household (OBC=3)
General	caste_General	Caste of the household (General=4)
Crop as principal source of income	crop_income	Main household income source (Crop cultivation=1, Otherwise=0)
Migrant income	Remittance income	Main household income source (Migrant=1, Otherwise=0)
Household Size	Household Size	Number of members in the household
Total Land possessed	Land possessed	Household land holding in ha
Credit availed	credit	If household availed credit=1, Otherwise=0

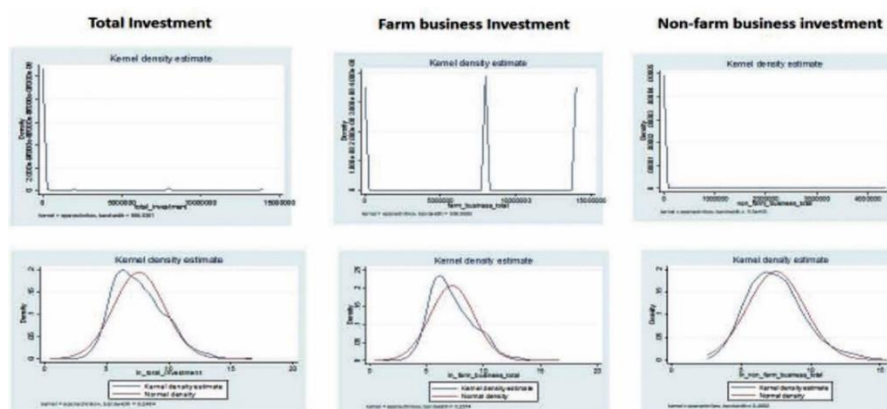


Figure 2. Kernel Density Plot of Dependent Variables.

P<0.05). Chi-square statistics indicate that male headed household invested on productive asset than female headed households ($\chi^2=83.5$, $P<0.01$). Similarly, the test statistic values obtained clearly indicated that all the selected variables viz. educational status, household size, social group, land possessed etc. in the model were found significantly different between investor and non-investor groups.

TABLE 5. PROFILE OF INVESTED AND NON-INVESTED FARMER RESPONDENTS

Variables (1)	Non-investors		Investors		Test statistics (6)	p value (7)
	N (2)	Per cent/ mean (3)	N (4)	Per cent/ mean (5)		
Age	12500	50.42	22700	50.80	-2.53	0.0112
Gender of the household head					83.50	0.0000
Male	11,220	34.80	21,017	65.20		
Female	1,280	43.20	1,683	56.80		
Education					5.21	0.023
Illiterate	8,722	35.33	15,964	64.67		
Literate	3,778	35.93	6,736	64.07		
Household size	12500	4.96	22700	5.57	-20.74	0.0000
Social Group (caste)					71.37	0.0000
ST	2481	37.17	4194	62.83		
SC	1833	39.34	2826	60.66		
OBC	5023	35.39	9170	64.61		
General	3161	32.70	6510	67.30		
Total land possessed	12478	1.28	22692	1.62	-16.52	0.0000
Credit availed					152.56	0.0000
Availed	5900	32.46	12275	67.54		
Non availed	6600	38.77	10425	61.23		
Primary income source					232.62	0.0000
Crop income	7459	32.65	15386	67.35		
Non-crop income	5041	40.80	7314	59.20		
Remittance income					32.15	0.0000
Main income source	378	44.73	467	55.27		
Not Main income source	12122	35.28	22233	64.72		

Notes: For continuous variables t-test was applied and for categorical variable χ^2 was used.

Determinants of Investments on Productive Assets

Results of model estimation are given in Table 6. Firstly, the Heckman selection model was estimated with log of total investment on productive assets as dependent variable. Significance of Likelihood ratio (LR) test confirmed the rightness of the model fit. The results revealed that, the male headed households are more likely to take investment decision and farmers belonging to general category are more likely to invest in comparison with base category (ST). Variable education was negatively significant with respect to investment decision while coefficient corresponds to variables like household size, total land possessed, credit and crop income were positive and significant. In case of regression equation, all the selected variables except SC were significant with respect to the extent of investment by the farm household. Secondly, the determinants of investment on productive assets used in farm business were identified. For that, log of farm business investment was used as dependent variable. The results revealed that, the male headed households are more likely to take farm investment decision and farmers belong to general category are more likely to invest in comparison with base category (ST). Variable education was negatively significant with respect to the investment decision while coefficient corresponds to variables like

TABLE 6. DETERMINANTS OF DIFFERENT INVESTMENTS ON PRODUCTIVE ASSETS

Variables (1)	Log total investment		Log farm business investment		Log non-farm business investment	
	Coef. (2)	P>z. (3)	Coef. (4)	P>z. (5)	Coef. (6)	P>z. (7)
Age	.0175774	0.005	.0152742	0.010	-.0161789	0.537
Age_sq	-.0001389	0.017	-.0001259	0.024	.0002563	0.308
Gender of the household head	.2015869	0.000	.1976992	0.000	-.0426743	0.851
Caste						
SC	.035885	0.468	.1030389	0.030	.1004516	0.602
OBC	.4919792	0.000	.4914777	0.000	.5671405	0.000
General	.5617134	0.000	.514247	0.000	.6752828	0.000
Education	.1147624	0.000	.0934403	0.001	.1605728	0.131
Household size	.0241457	0.000	.0319708	0.000	-.0507995	0.029
Total land possessed	.3368344	0.000	.3521911	0.000	.2445931	0.000
Crop_income	-.32239	0.000	-.0333149	0.286	-.4828027	0.000
_cons	6.940372	0.000	6.35523	0.000	9.557791	0.000
Selection Equation (d_invest)						
Age	-.00542	0.099	-.0052811	0.113	.0165809	0.020
Age_sq	.0000289	0.353	.0000267	0.395	-.000198	0.004
Gender of the household head	.1051774	0.000	.1047495	0.000	.2250752	0.000
Caste						
SC	-.0031934	0.901	.0105195	0.686	-.1012953	0.059
OBC	.0300414	0.132	.0285754	0.158	.0808039	0.048
General	.1116215	0.000	.1156504	0.000	.1162523	0.008
Education	-.0412371	0.007	-.0419496	0.007	-.0036597	0.905
Household Size	.0498374	0.000	.0510402	0.000	.067364	0.000
Total land possessed	.0761878	0.000	.0868992	0.000	.0650713	0.000
Credit	.1720556	0.000	.1621298	0.000	.1276431	0.000
Crop income	.0745252	0.000	.1060388	0.000	-.3915775	0.000
Remittance income	-.0618357	0.197	-.0423965	0.388	-.6554547	0.000
_cons	.051448	0.566	-.0057227	0.950	-1.90203	0.000
Note:	LR test of indep. eqns. (rho = 0): chi2(1) = 30.15 Prob > chi2 = 0.0000		LR test of indep. eqns. (rho = 0): chi2(1) = 18.73 > chi2 = 0.0000	Prob	LR test of indep. eqns. (rho = 0): chi2(1) = 10.98 > chi2 = 0.0009	Prob

household size, total land possessed, credit and crop income were positive and significant. As far as regression equation is concerned, crop income found insignificant in determining the extent of investment on productive assets used in farm business unlike the total household investment. Lastly, the model was estimated using log non-farm business investment as dependent variable so as to identify its determinants. The results revealed that, the male headed households are more likely to take non-farm investment decision and farmers belongs to general category are more likely to invest in comparison with base category (ST). Variable education was found insignificant with respect to non-investment decision unlike farm investment decision while coefficient corresponds to variables like household size, total land possessed and credit were positive and significant. In case of regression equation, farmers belong to OBC

and general category found positively significant with respect to the extent of non-farm business investment. Also, the coefficient of the variable crop income exhibited negative significance whereas the coefficient for total land possessed showed a positively significant value in determining the extent of investment on productive assets used in non-farm business by the households.

IV

CONCLUSION

Farm household investment on productive assets is the major part of private investment in agriculture. The composition of average monthly expenditure on productive assets indicated that nearly 33 per cent was spent on agricultural machinery and implements, 18 per cent was on livestock and poultry and another 42 per cent was on 'other assets in farm businesses. Expenditure on productive assets used in non-farm business accounted for about 7 per cent of the total monthly expenditure only. Average monthly expenditure incurred on productive assets used in farm business showed a wide variation across the size classes of land possessed ranging from less than one third of the all-India average in the lowest size class (<0.01 ha.) of land possessed to more than nine times the all-India average in case of agricultural households possessed more than 10 ha land. Heckman's sample selection model results indicated that, sex, caste, credit availed, household size, crop income, education, land possessed were the significant variables which determines the investment decision of farm households and the extent investment on productive assets.

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NOTE

1. A comparative study at different points using SAS 2003 (NSS 59th round) and SAS 2013 (NSS 70th round) may bring new insights into the composition and determinants of productive assets investment. However, the present study is limited to the SAS 2013 (NSS 70th round) due to the change in coverage and difference in some important concepts and definitions followed in the two rounds, as explicitly cautioned in the key indicators report of SAS 2013 (NSS 70th round) (Government of India, 2014).

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