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Dynamics of Farmers Income Growth: Regional and Sectoral Winners and Losers from Three-Time SAS Data

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ABSTRACT

An attempt is made in this paper to find out whose (state) and which (source) farm income increases in India by using SAS data of three-time points, namely 2002-03, 2012-13 and 2018-19. It shows that although the total annual income per farmer household has increased over time, significant changes have taken place in the share of different sources of income. Between 2002-03 and 2018-19, the share of wage income increased in 12 out of 18 states, while the same declined in 16 out of 18 states in crop production income. Strikingly the share of income from farming of animals has increased significantly in all the states, including the most advanced agricultural states. The analysis of the growth rate shows that among different sources of income, the income from farming of animals has registered the highest growth rate; 13 out of 18 states have registered a growth rate of over 5 per cent, which is not observed in any other source of income. Assam, J&K, WB and Jharkhand have registered a poor growth rate (less than one per cent) in the total annual of income of farmer households. The Univariate Regression Analysis shows that the factors determining each source of income are different. While the variables such as RELE (percentage of villages electrified), PIRA (percentage of irrigated area to cropped area), MECP (monthly expenditure of crop production) and ROAD (percentage of villages having pucca road) have positively and consistently determined the crop production income, RELE, HPLO (share of agricultural households possessing land less than 1.00 ha) and ROAD seem to be the important determinants of wage income. RELE, PIRA and ROAD seem to be the important determinants of the income from farming animals, while the total income of farmers is mainly determined by variables such as RELE, PIRA, MECP and ROAD.

Keywords: crop income; farm households; farm income; growth rate; literacy rate

JEL: Q12, Q13, Q15, Q18

1

INTRODUCTION

This paper is an extension of the earlier work by Narayanamoorthy and Sujitha (2021), which studied the trends and determinants of farmers' income, particularly on the Total Monthly Income (TMIA) and Monthly Net Crop Production Income (MICP) of farmer households only by using the SAS data 2018-19. Between 2002-03 and 2018-19, the farmers' income from other three important sources namely (1) income from wages, (2) net receipt from farming of animals and (3) net receipt from the non-farm business have increased substantially. But, the determinants of these sources of income were not studied by Narayanamoorthy and

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Sujitha (2021). Despite knowing the fact that the determinants of farmers' income vary from time to time due to various factors, they failed to analyse the changes in the determinants of farmers' income by source using all the three-time points data. While analysing whose (state) and which (source) farm income increases or decreases over time, this paper attempts to capture the changes in the determinants of farmers' income by source across all three-time points of SAS data using 114 univariate regression results. The univariate regression analysis is expected to reveal the important variables that consistently and significantly determine the farmers' income from different sources over time.

The issue of farmer income has been an important point of discussion in India for over two decades now. Since Independence, the focus of the agricultural sector has been on increasing productivity and production of foodgrain crops (Deshpande *et al*., 2004; Narayanamoorthy, 2021). The issue of farm income was not considered seriously in any forum or committee reports (Deshpande and Arora, 2010; Narayanamoorthy and Suresh, 2012; Narayanamoorthy, 2021). But the widespread farm suicides that occurred in different parts of the country during the late 1990s and 2000s forced the researchers to study the issue of farm income seriously (see, Sainath, 2010). Unfortunately, the researchers could not study the issue of farm income comprehensively due to the absence of data on farm income from any source published by the Government of India including the Central Statistical Organisation (Narayanamoorthy, 2017; Chand, 2017).

Now, we have data on farmer income for three-time points namely 2002-03, 2012-13 and 2018-19 published by NSSO (NSSO-SAS, 2005; 2014; 2021). This data is popularly known as the Situation Assessment Survey (SAS) of farm households, which not only contain data on income but also many other vital aspects of farmer households. Using the SAS data for the year 2002-03 and 2012-13, many studies have been carried out to find out the state of farmer income and other aspects (Deshpande and Prabhu, 2005; Narayanamoorthy, 2006; Birthal *et al*., 2014; 2015; Satyasai, 2016; Chandrasekhar and Mehrotra, 2016; Sendhil *et al*., 2017; Das, 2017). Narayanamoorthy (2017) found a wide variation in income levels across the states using data from 2002-03 and 2012-13. Bathla and Kumar (2017) studied the differences in farm income of agricultural households in 20 major states of India with the help of SAS data from 2002-03 and 2012-13. With the help of unit-level SAS data of 2002-03, Agarwal and Agarwal (2017) made a rigorous analysis to find out the answer to the question: What distinguishes farmers who like farming from those who do not?

Although many studies have been carried out on farmer income using SAS data, studies are seldom available on whose (state) farm income increases in India? SAS data provides income data for farm households for five sources namely (1) income from wages, (2) income from leasing out of the land, (3) net receipt from crop production, (4) net receipt from farming of animals and (5) net receipt from the non-farm business. The income from these five sources may not have increased at the

same pace. Some studies have shown that the rate of increase in wage income is higher than that of the income received from crop production (Narayanamoorthy, 2021; Narayanamoorthy and Sujitha, 2021). In this context, one needs to study the question: which source of farm income increases in India? It is well known that the factors determining the farmer income tend to vary from time to time and from region to region because of various reasons. Factors such as irrigation and productivity of crops may have significantly influenced the income of farmer in a year, whereas the price of produce and market factors may have influenced the farmer income in another year. Studies are not available on whether the determinants of farmer income are the same for all three-time points of SAS data. In this study, therefore, an attempt is made to understand the dynamics of famers' income with the following objectives: (1) To study whose (state) and which (source) income increases or decreases over time by covering three-time points SAS data. (2) To study how the ranks of states are changing in different sources of income in terms of growth rate between 2002-03 and 2018-19. And (3) To study whether the determinants of farmers' income changes in each source of income over time using regression analysis.

II

DATA AND METHOD

The entire analysis of the study has been carried out using SAS data of farmer households available for three-time points namely 2002-03 (59th Round), 2012-13 (70th Round) and 2018-19 (77th Round) (NSSO-SAS, 2005; 2014 and 2021). For the years 2012-13 and 2018-19, farmer households' income-related data and its has been published for 28 states, but the same data for the year 2002-03 has been published only for 18 states. In view of this, the analysis has been carried out using the data of 18 states to have a meaningful comparison. The averages of the variables used in the study are presented in Table 1.

To find out whose (state) farm increases over time, the percentage change in share of income for 2018-19 over 2002-03 has been computed by source across 18 states. To study how the ranks of states are changing in different sources of income and to find out which source of income increases at a faster pace, annual compound growth rate (ACGR) has been computed between the period 2002-03 and 2018-19. All the income and expenditures related-data has been changed into constant prices using the deflator of Consumer Price Index of Agricultural Labourers (CPIAL) with 2004-05 as a base year to make meaningful comparison between the periods considered for the analysis.

Whether the determinants of farmers' income changes in each source of income over time is another important question that we attempt to probe in this study. Among the five sources of farmers' income, except for the income from the leasing of land that accounts for a very less share in the total income (1.31 per cent in 2018-19), we attempt to study the determinants of all the other four sources of income specifically to find out: (a) which factor consistently determines of farm income over

TABLE 1: DESCRIPTIVE STATISTICS OF VARIABLES USED IN THIS STUDY

(values in Rs. are at 2004-05 prices)

Variables	Description	Unit	Average of 18 States		
			2002-03	2012-13	2018-19
(1)	(2)	(3)	(4)	(5)	(6)
AICP	Share of agricultural households involved in crop production	Per cent	37.16 (10.84)	34.22 (10.37)	64.24 (12.50)
ESFP	Share of expenditure on seeds, fertiliser and plant protection in the total monthly expenditure on crop production	Per cent	47.06 (8.58)	42.57 (6.65)	35.62 (6.65)
HPLO	Share of agricultural households possessing land less than 1.00 ha	Per cent	70.62 (11.40)	78.63 (12.13)	70.12 (15.16)
LTAH	Literacy rate of agricultural households among persons age 7 years above	Per cent	59.89 (10.22)	68.87 (7.86)	74.12 (8.30)
MECP	Monthly expenditure on crop production	Rs.	819.61 (495.46)	1396.41 (1392.32)	1689.23 (1396.95)
MICP	Monthly income (net receipt) from crop production	Rs.	1211.59 (694.65)	1796.45 (1223.76)	1546.26 (1069.14)
MIFA	Monthly income (net receipt) from farming of animals	Rs.	111.11 (183.70)	475.21 (327.58)	677.67 (437.24)
MINF	Monthly income (net receipt) from non-farm business	Rs.	284.57 (184.32)	326.25 (297.21)	307.19 (264.14)
MIWA	Monthly income from wages per agricultural household	Rs.	1059.09 (485.90)	1374.89 (810.77)	1937.32 (993.29)
PIRA	Share of irrigated area to cropped area	Per cent	39.67 (26.14)	45.66 (25.75)	48.48 (25.55)
RELE	Percentage of village electrified	Per cent	49.57 (27.28)	63.27* (27.92)	63.27* (27.92)
ROAD	Percentage of villages having pucca road	Per cent	62.93 (22.82)	67.62* (26.66)	67.62* (26.66)
SCST	Share of agricultural households belonging to SC and ST	Per cent	30.23 (12.81)	28.84 (14.13)	29.42 (12.70)
TMIA	Total monthly income per agricultural household	Rs.	2666.36 (1298.73)	3972.85 (1988.35)	4566.64 (2224.65)

Sources: NSSO-SAS (2005; 2014; 2021); Census of India (various years); Government of India (various years).
Notes: Figures in parentheses are standard deviation; *- relates to the year 2010-11.

time and (b) which is the most important determinants of farm income using univariate regression analysis. Here, we prefer to use univariate regression instead of multiple regression analysis as most variables used in the study are closely related to each other, causing serious multicollinearity problems. Therefore, the following five separate univariate regressions (OLS method) have been estimated separately for each source of income and for all three-time points:

$$TMIA = \beta_0 + \beta_1 X_1 + \mu \quad \text{.... (1)}$$
$$MIWA = \beta_0 + \beta_1 X_1 + \mu \quad \text{.... (2)}$$
$$MICP = \beta_0 + \beta_1 X_1 + \mu \quad \text{.... (3)}$$
$$MIFA = \beta_0 + \beta_1 X_1 + \mu \quad \text{....(4)}$$
$$MINF = \beta_0 + \beta_1 X_1 + \mu \quad \text{.... (5)}$$

Where,

TMIA = Total monthly income per agricultural household (Rs.)

MIWA = Monthly income from wages per agricultural household (Rs.)
MICP = Monthly net receipt from crop production per agricultural household (Rs.)
MIFA = Monthly net receipt from farming of animals per agricultural household (Rs.)
MINF = Monthly net receipt from the non-farm business per agricultural household (Rs.)
β_0,……., β_1 = Parameters to be estimated
X1 = Independent variable used for the estimation
μ = Error term

Altogether, a total of 114 univariate regressions have been estimated for the analysis. For estimating each univariate regression, the following independent variables are used for all the three-time points.

SCST = Share of agricultural households belonging to SC and ST (per cent)
HPLO = Share of agricultural households possessing land less than 1.00 ha (per cent)
AICP = Share of agricultural households involved in crop production (per cent)
LTAH = Literacy rate of agricultural households (per cent)
ESFP = Share of expenditure on seeds, fertiliser and plant protection in the total monthly expenditure on crop production (per cent)
MECP = Monthly expenditure on crop production (Rs.)
PIRA = Share of irrigated area to cropped area (per cent)
ROAD = Villages having pucca road facility (per cent)
RELE = Villages electrified (per cent)

A total of nine independent variables have been used for estimating the univariate regressions. They are SCST, HPLO, AICP, LTAH, ESFP, MECP and PIRA, all of which are one way or the other are expected to influence the farmers' income. The data for the variables included in the regression model have been compiled from different SAS reports except for ROAD, ELEC and LITE. Data on road facility (ROAD), percentage of villages electrified (ELEC) and percentage of rural literacy (LITE) have been compiled from the publications of the *Census of India* (published by the Ministry of Home Affairs, Government of India, New Delhi). Data on PIRA (percentage of irrigated area to cropped area) variable has been compiled from the source of 'Land Use Statistics at a Glance' (Government of India, various years) published by the Ministry of Agriculture and Farmers Welfare, Government of India.

III

RESULTS AND DISCUSSION

Before getting into the objectives of the study, let us briefly understand the state of farm income of the agricultural households across three-time points of SAS data. At the all-India level, the average annual income (in current prices) per agricultural household from all sources has increased from Rs. 25,380 in 2002-03 to Rs. 1,22,616 in 2018-19. In terms of constant value (at 2004-05 prices), it increases from Rs. 26,971 to to Rs. 45,829 during the same period. The annual income of agricultural household also varies considerably across the states over time. During 2002-03, the lowest annual income was observed in Madhya Pradesh and the highest income was observed in Jammu and Kashmir. During 2012-13, the lowest income was observed in Bihar, while the highest income was observed in Punjab (Rs. 1,09,321). During 2018-19, the lowest income was noticed in Jharkhand and the highest income was noticed in Punjab. The same kind of variation was also observed in the income of agricultural households received from different sources. This clearly reveals that the income level of the farmer households varies considerably among different states over time. More details on the trends in farmers' income across states over time can be seen from Narayanamoorthy and Sujitha, (2021).

3.1 Changes in the Share of Farmer Income by Source

To study the issue of which (source) farm income increases in India, we have compared the per cent change in the share of farmer income by source across the states by comparing the data of 2002-03 with 2018-19. Among the four major sources of farmer income, the wage income (at constant prices) per farmer household has increased from Rs.10,444 in 2002-03 to Rs. 18,223 in 2018-19, while the net receipt from crop production per agricultural household increased from Rs. 12,357 to Rs. 17,034 at all India level. Surprisingly, the net income from farming of animals has increased over six times between the two periods, from Rs. 1,160 to Rs. 7,095. Against the expectation, the non-farm business income declined from Rs.3,010 to Rs. 2,875 during this period. Here our aim is not to study the income in absolute terms but to study the changes in the share of different sources of income.

It is clear from the data presented in Table 2 that the share of income from different sources for agricultural households between 2002-03 and 2018-19 has changed considerably across the states. At the all-India level, the net receipt from crop production accounted for a major share (45.82 per cent) in the total annual income of the farmer households in 2002-03, but it declined to 37.17 percent in 2018-19. During the same period, the share of wage income and the income from the farming of animals has increased at the all-India level. The same picture has also been observed across the states. For instance, the percentage change in the share of wage income between 2002-03 and 2018-19 has increased in 12 out of 18 states considered for the analysis. In states like Andhra Pradesh, Assam, Bihar, J&K,

Jharkhand and West Bengal, the percentage increase in wage income is in the range 20-71 per cent between the two periods.

Unlike wage income, the share of crop production income declined considerably in most states. Out of 18 states, 16 states (except Karnataka and Rajasthan) have recorded a negative change in their share of income. Shockingly, the agriculturally advanced states like Punjab, Haryana, UP, Andhra Pradesh and Tamil Nadu have also recorded a larger reduction in the share of crop production income. But, contrary to the crop production income, the share of net income from the farming of animals has increased significantly in all the states except MP, which recorded a negative change of 2.14 per cent between the two periods. Interestingly, 12 out of 18 states, including the most advanced agricultural states like Punjab and Haryana have recorded a more than 100 percent increase in the share of income from farming of animals. This suggests that among the various sources of income of farmer households, only the source of income from farming of animals has increased consistently in most states. The reduction in the share of cultivation income and the increased share of wage income and the income from the farming of animals seems to suggest that the farmer households are increasingly becoming farm labour households in India.

TABLE 2: PERCENTAGE CHANGE IN SHARE OF INCOME OF FARMERS HOUSEHOLDS BY SOURCE, 2018-19 OVER 2002-03

States	Wages	Cultivation	Farming of animals	Non-farm business	Total
(1)	(2)	(3)	(4)	(5)	(6)
1. Andhra Pradesh	17.59	-42.62	243.06	-33.40	125.58
2. Assam	69.85	-46.09	135.20	-21.56	18.78
3. Bihar	20.87	-22.29	57.51	-43.10	46.55
4. Chhattisgarh	4.79	-10.59	2747.37	-46.79	110.35
5. Gujarat	1.42	-21.17	62.42	-44.06	65.52
6. Haryana	-21.77	-23.21	114.90	-55.71	178.75
7. Jammu & Kashmir	71.39	-76.32	72.84	2.92	21.24
8. Jharkhand	27.30	-45.34	306.01	-67.70	-16.79
9. Karnataka	-15.26	5.08	146.91	-69.47	80.71
10. Kerala	13.27	-27.39	52.21	-10.39	57.37
11. Madhya Pradesh	-23.80	-25.81	-2.14	-67.28	105.09
12. Maharashtra	16.00	-19.44	129.06	-29.34	64.10
13. Orissa	-3.95	-3.00	439.07	-31.94	69.30
14. Punjab	-24.02	-17.08	250.63	-57.16	89.33
15. Rajasthan	-31.17	24.32	5603.03	-41.03	193.95
16. Tamil Nadu	2.18	-30.37	215.82	-37.24	102.40
17. Uttar Pradesh	5.11	-20.28	420.92	-57.63	73.61
18. West Bengal	29.00	-35.46	85.95	-23.93	14.39
All India	2.69	-18.88	260.00	-43.82	69.92

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021).

3.2 Growth in Farmer Income by Source

After studying the changes in the share of farmer income from different sources, an annual compound growth rate has been computed for different sources of income taking the data of 2002-03 and 2018-19 to study the issue of whose (state) farm income increases in India? Additionally, an attempt is also made to find out whether any relationship exists between the sources of income. The growth rates presented in

descending order in Table 3 show that they vary considerably across the states in each source of income. While the income from wages registered a growth rate of 3.14 percent at the all-India level, 11 out of 18 states have registered a growth rate more than the national average. States like AP, Chhattisgarh, Haryana, J&K and Tamil Nadu have registered a growth rate over 4 percent in wage income.

The all-India average growth rate of net income from crop production is relatively smaller (1.80 per cent) than the growth rate registered for wage income (3.14 percent). Out of 18 states, only 9 states have registered a growth rate more than the national average. The highest growth rate was registered by Rajasthan followed by Haryana, Karnataka, Chhattisgarh, etc. The agriculturally most advanced state of Punjab has registered a growth of only 2.54 per cent in crop production income. Shockingly, states like Kerala, Bihar, WB, Assam, Jharkhand and J&K have registered less than one percent or a negative growth rate in the crop production income.

TABLE 3: STATE-WISE ANNUAL COMPOUND GROWTH RATE OF TOTAL ANNUAL INCOME OF FARMER HOUSEHOLDS BY SOURCE

(per cent)

Growth rate in descending order between 2002-03 and 2018-19				
Wages (1)	Net-receipt from crop production (2)	Net-receipt from farming of animals (3)	Net-receipt from non-farm business (4)	Total annual income (5)
AP (5.57)	Rajasthan (7.47)	Rajasthan (32.83)	Rajasthan (3.10)	Rajasthan (6.17)
Chhattisgarh (4.49)	Haryana (4.32)	Chhattisgarh (25.71)	AP (2.29)	Haryana (5.86)
Haryana (4.43)	Karnataka (3.63)	Orissa (13.08)	Kerala (1.93)	AP (4.62)
J&K (4.15)	Chhattisgarh (3.57)	UP (13.02)	TN (1.34)	Chhattisgarh (4.22)
TN (4.12)	Orissa (2.79)	AP (12.04)	J&K (1.24)	MP (4.07)
Rajasthan (3.99)	Punjab (2.54)	Punjab (11.09)	Haryana (1.17)	TN (3.99)
Assam (3.98)	MP (2.36)	TN (10.86)	Maharashtra (0.82)	Punjab (3.61)
Maharashtra (3.64)	TN (1.93)	All India (10.58)	Orissa (0.79)	Karnataka (3.34)
UP (3.40)	UP (1.82)	Haryana (10.46)	Chhattisgarh (0.62)	UP (3.11)
Kerala (3.26)	All India (1.80)	Karnataka (8.67)	All India (0.25)	All India (2.99)
Bihar (3.23)	Maharashtra (1.56)	Maharashtra (7.64)	Assam (-0.39)	Orissa (2.97)
All India (3.14)	Gujarat (1.49)	Jharkhand (7.00)	Gujarat (-0.42)	Gujarat (2.84)
Gujarat (2.92)	AP (1.44)	Assam (5.87)	WB (-0.77)	Maharashtra (2.79)
Orissa (2.74)	Kerala (0.74)	Gujarat (5.65)	Bihar (-1.00)	Kerala (2.55)
MP (2.51)	Bihar (0.72)	Kerala (4.98)	Punjab (-1.16)	Bihar (2.15)
Karnataka (2.40)	WB (-1.67)	Bihar (4.76)	UP (-1.69)	J&K (1.08)
WB (2.18)	Assam (-2.45)	WB (4.27)	MP (-2.18)	Assam (0.96)
Punjab (2.04)	Jharkhand (-4.28)	J&K (4.20)	Karnataka (-3.24)	WB (0.75)
Jharkhand (0.32)	J&K (-6.70)	MP (3.94)	Jharkhand (-7.05)	Jharkhand (-1.02)

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021).
Note: Figures in parentheses are growth rate.

Among different sources of income, the highest growth rate was registered in the income from farming of animals at the all-India level, which was about 10.58 per cent. Though the number of states that registered a growth rate more than the national average was only 7, a total of 13 states have registered a growth rate of over 5 per

cent in the income of farming of animals, which is remarkable. Most agriculturally developed states have registered a larger growth rate in the income from the farming of animals. This could be because of two reasons. First, the increased milk prices along with increased milk yield in recent times in different states may have increased its income (Kumar *et al*., 2018; Srivastava *et al.,* 2020). Second, the relatively low income from crop production may have also pushed the farmers to shift from crop production to farming of animals, leading to increased income. One needs to find out why is the income from farming of animals increased at a faster pace in most states using more disaggregated data to have meaningful policy conclusions.

Unlike the other sources of income, the net receipt from non-farm business income has registered a negative growth rate (-0.25) at the all-India level. Not only this, the states which have registered a positive growth rate in the non-farm business income, have also recorded a relatively less growth rate. For instance, Rajasthan state has registered the highest growth rate of 3.10 percent, which is very low compared to the highest growth registered in the other three sources of income. It was expected that given the low margin from crop production, the farmer households would try to get more income from the source of non-farm business income, which has not happened. However, one important point emerging from the correlation value is that non-farm income is highly positively correlated with wage income (see, Table 4). This means that those states which earn higher wage income also earn more income from the source of non-farm business income, which is plausible.

TABLE 4: CORRELATION VALUES AMONG DIFFERENT SOURCES OF INCOME OF FARMER HOUSEHOLDS

Year	Variables	TMIA	MIWA	MICP	MIFA	MINF
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TMIA	1	0.88[a]	0.90[a]	0.51[b]	0.82[a]
	MIWA	0.88[a]	1	0.62[a]	0.34[d]	0.90[a]
2002-03	MICP	0.90[a]	0.62[a]	1	0.37[d]	0.55[b]
	MIFA	0.51[b]	0.34[d]	0.37[d]	1	0.29[ns]
	MINF	0.82[a]	0.90[a]	0.55[b]	0.29[ns]	1
	TMIA	1	0.78[a]	0.85[a]	0.55[b]	0.47[c]
	MIWA	0.78[a]	1	0.36[d]	0.23[ns]	0.74[a]
2012-13	MICP	0.85[a]	0.36[d]	1	0.48[b]	0.04[ns]
	MIFA	0.55[b]	0.23[ns]	0.48[b]	1	-0.06[ns]
	MINF	0.47[c]	0.74[a]	0.04[ns]	-0.06[ns]	1
	TMIA	1	0.72[a]	0.79[a]	0.79[a]	0.59[a]
	MIWA	0.72[a]	1	0.16[ns]	0.34[d]	0.88[a]
2018-19	MICP	0.79[a]	0.16[ns]	1	0.74[a]	0.06[ns]
	MIFA	0.79[a]	0.34[d]	0.74[a]	1	0.16[ns]
	MINF	0.59[a]	0.88[a]	0.06[ns]	0.16[ns]	1

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021).
Notes: a, b, c and d are significant at 1, 5, 10, 20 percent level respectively; ns-not significant.

As regards the total annual income of farmer households, the average growth rate at the all-India level is not very impressive as compared to the growth rate registered in the income from the source of farming of animals and wage labour. For instance, the all-India average growth rate for the total annual income of farmer households comes to 2.99 per cent, whereas the same comes to 10.58 per cent for farming of

animals and 3.14 per cent for wage income. While considerable differences exist in the growth rate between different sources of income, a total of 9 states out of 18 states have registered a growth rate more than the national average in the total annual income of farmer households. The states which achieved the highest growth rate in descending order are Rajasthan (6.17), Haryana (5.86), AP (4.62), Chhattisgarh (4.22), MP (4.07), Tamil Nadu (3.99), Punjab (3.61), Karnataka (3.34) and UP (3.11). Rajasthan state was able to achieve the highest growth rate in the total annual farm income because of the impressive growth rate that it registered in all four major sources of income. Punjab, which is considered to be the most advanced state in agriculture, could not register the highest growth rate among the states because it could not register a higher growth rate even in the source of crop production income. On the extreme end, states like J&K, Assam, WB and Jharkhand have registered a poor growth rate (less than one percent) in the total annual of income of farmer households because of their poor performance in all the sources of income.

3.3 Important Determinants of Farmer Income – Univariate Regression Results:

One of the key objectives of the study is to find out the important determinants of farmer income from different sources. Needless to mention that the factors determining each source of farm income is different. The variable irrigation (PIRA) may be an important factor in determining the crop production income, whereas ROAD could be an important factor in determining the wage income of the farmer households. Keeping this in view, a total of 114 univariate regressions are estimated covering each source of income and three-time points data by using selected independent variables to find out the important determinants of farm income.

As the net crop production income accounts for a major share in the total monthly income of the farmer households, let us first find out which is the most important factor that determines its income. The crop production income is determined by various factors and therefore, a total of 9 univariate regressions are estimated by treating MICP (total monthly net crop production income) as a dependent variable. The univariate regression results presented in Table 5 show that the impact of all the 9 independent variables on determining MICP is not the same. Four variables namely RELE, PIRA, MECP and ROAD have positively and consistently impacted MICP in all the three-time points. While the regression coefficient of RELE has increased from 12.77 in 2002-03 to 19.73 in 2018-19, the coefficient of PIRA has increased from 8.18 to 22.68 during the same period. Similarly, the coefficient of MECP has increased from 0.06 to 0.62 and the same for ROAD increased from 10.14 to 19.72 during the same period. Of the four variables that significantly determine MICP, three are related to infrastructure variables. These results are not unexpected because many studies have already confirmed the importance of infrastructural variables in deciding the crop production income (see, Fan *et al*., 1999; Narayanamoorthy and Hanjra, 2006; Narayanamoorthy *et al*., 2015). Since the literacy rate (LTAH) of the farmer households plays a crucial role in

deciding the adoption of modern technology (Narayanamoorthy, 2000; Panda, 2015; Agarwal and Agarwal, 2017), it was expected that it would influence the dependent variable MICP significantly. But, the regression results show an insignificant influence of LTAH on the crop production income.

TABLE 5: UNIVARIATE REGRESSION RESULTS – FACTORS DETERMINING THE TOTAL MONTHLY NET CROP PRODUCTION INCOME OF FARMER HOUSEHOLDS

Model	2002-03		2012-13		2018-19	
	Coefficient	R2	Coefficient	R2	Coefficient	R2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
MICP=a+b_1RELE	12.77 (2.32)^{b}	0.25	20.83 (2.17)^{b}	0.23	19.73 (2.40)^{b}	0.27
MICP =a+b_1HPLO	6.25 (0.41)^{ns}	0.01	-27.80 (-1.14)^{ns}	0.08	-34.59 (-2.25)^{b}	0.24
MICP =a+b_1PIRA	8.18 (1.29)^{ns}	0.10	22.33 (2.12)^{c}	0.22	22.68 (2.58)^{b}	0.29
MICP =a+b_1LTAH	5.57 (0.33)^{ns}	0.01	28.08 (0.74)^{ns}	0.03	17.91 (0.56)^{ns}	0.02
MICP =a+b_1AICP	10.71 (0.67)^{ns}	0.03	2.87 (0.09)^{ns}	0.01	-3.22 (-0.15)^{ns}	0.01
MICP =a+b_1MECP	0.06 (2.61)^{b}	0.30	0.69 (5.23)^{a}	0.63	0.62 (5.45)^{a}	0.65
MICP =a+b_1ESFP	21.94 (1.13)^{ns}	0.07	-47.94 (-1.07)^{ns}	0.07	-35.39 (-0.91)^{ns}	0.05
MICP =a+b_1ROAD	10.14 (1.42)^{d}	0.11	18.08 (1.72)^{d}	0.16	19.72 (2.26)^{b}	0.24
MICP=a+b_1SCST	-29.99 (-1.77)^{c}	0.17	-27.83 (-1.36)^{d}	0.10	-15.58 (-0.75)^{ns}	0.03

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021); Census of India (various years); Government of India (various years). *Notes*: a, b, c and d are significant at 1, 5, 10, 20 per cent level respectively; ns-not significant.

For studying the determinants of the monthly wage income of farmer households (MIWA), a total of seven univariate regressions are estimated treating RELE, HPLO, PIRA, LTAH, AICP, ROAD and SCST as independent variables for three-time points. Of the seven variables, except RELE (percent of villages electrified), all other variables have not significantly and consistently influenced the dependent variable MIWA in all the three-time points (see, Table 6). The regression coefficient of RELE has increased substantially from 9.69 in 2002-03 to 21.07 in 2018-19, which suggests the importance of rural electrification in impacting MIWA. It was expected that the variables such as HPLO (share of agricultural households possessing land less than 1.00 ha) and ROAD would influence the wage income, but both variables turned out to be positive and significant only for the year 2002-03 and 2012-13.

Similarly, since most SCST farmer households belonging to the marginal size category, it was expected that its coefficient will have a positive and significant influence on MIWA. But, against our expectation, it turned out to be negative and significant in all the three-time points. On the whole, the analysis suggests that variable such as RELE, HPLO and ROAD seem to be the important determinants of monthly wage income.

TABLE 6: UNIVARIATE REGRESSION RESULTS – FACTORS DETERMINING THE TOTAL MONTHLY INCOME FROM WAGES OF FARMER HOUSEHOLDS

Model	2002-03		2012-13		2018-19	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
MIWA=a+b_1RELE	9.69 (2.59)[b]	0.30	18.22 (3.25)[a]	0.40	21.07 (2.94)[a]	0.35
MIWA =a+b_1HPLO	17.71 (1.83)[c]	0.17	23.59 (1.51)[d]	0.12	13.81 (0.86)[ns]	0.04
MIWA =a+b_1PIRA	1.43 (0.31)[ns]	0.01	4.28 (0.55)[ns]	0.02	-0.91 (-0.09)[ns]	0.01
MIWA =a+b_1LTAH	21.77 (2.05)[c]	0.21	33.20 (1.36)[d]	0.11	-42.24 (-1.54)[d]	0.13
MIWA =a+b_1AICP	-7.06 (-0.63)[ns]	0.02	-39.84 (-2.39)[b]	0.26	-69.01 (-7.32)[a]	0.77
MIWA =a+b_1ROAD	13.55 (3.31)[a]	0.41	10.79 (1.53)[d]	0.13	9.04 (1.03)[ns]	0.06
MIWA =a+b_1SCST	-21.11 (-2.67)[b]	0.31	-24.89 (-1.93)[c]	0.19	-43.13 (-2.64)[b]	0.30

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021); Census of India (various years); Government of India (various years).
Notes: a, b, c and d are significant at 1, 5, 10, 20 percent level respectively; ns-not significant.

The income from the farming of animals has increased massively in 2018-19 over the period of 2002-03, as compared to other sources of income. Therefore, we have expected clear cut results from the regression estimated using MIFA as a dependent variable. Of the seven univariate regressions estimated, none showed a positive and significant relationship consistently with MIFA (see Table 7). However, the regression coefficients of RELE, PIRA and ROAD have positively and significantly influenced the MIFA in 2012-13 and 2018-19, which is expected because the infrastructure support is very important to increase the income from farming of animals. Since the variables such as farm size (HPLO) and SCST are included to

TABLE 7: UNIVARIATE REGRESSION RESULTS – FACTORS DETERMINING THE TOTAL MONTHLY INCOME FROM FARMING OF ANIMALS OF FARMER HOUSEHOLDS

Model	2002-03		2012-13		2018-19	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
MIFA=a+b_1RELE	0.54 (0.32)[ns]	0.01	4.40 (1.63)[d]	0.14	8.53 (2.59)[b]	0.30
MIFA =a+b_1HPLO	6.09 (1.63)[d]	0.14	-1.80 (-0.26)[ns]	0.04	-8.75 (-1.27)[ns]	0.09
MIFA =a+b_1PIRA	-0.43 (-0.24)[ns]	0.01	4.85 (1.65)[d]	0.15	10.80 (3.26)[a]	0.40
MIFA =a+b_1LTAH	-1.04 (-0.23)[ns]	0.03	1.58 (0.05)[ns]	0.01	-7.32 (-0.56)[ns]	0.02
MIFA =a+b_1AICP	-0.46 (-0.11)[ns]	0.01	0.75 (0.09)[ns]	0.01	-7.64 (-0.91)[ns]	0.05
MIFA =a+b_1ROAD	1.99 (1.03)[ns]	0.06	5.62 (2.07)[c]	0.21	8.55 (2.45)[b]	0.27
MIFA =a+b_1SCST	-4.33 (-1.26)[ns]	0.09	0.57 (0.95)[ns]	0.05	-11.96 (-1.48)[d]	0.12

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021). Census of India (various years); GoI (various years).
Notes: a, b, c and d are significant at 1, 5, 10, 20 percent level respectively; ns-not significant.

reflect the resource condition of farmer households, it was expected that these two variables would positively influence MIFA. But unexpectedly the regression coefficients of both variables turned out to be insignificant and negative in two time periods. While there are variations among the variables influencing MIFA, the regression results suggest that the variables such as RELE, PIRA and ROAD seem to be important in determining the income from farming of animals.

For studying the determinants of monthly income from non-farm business (MINF), a total of seven regressions are estimated. The regression results presented in Table 8 show a somewhat different picture for MINF from other sources of income. The variable HPLO has consistently and significantly influenced MINF in all the three-time points, which is not observed in any other sources of income analysed so far. Though the magnitude of the regression coefficient of MINF has not increased consistently across the three-time points, its strength of relationship with HPLO looks relatively strong. This suggests that if the share of agricultural households possessing land less than 1.00 hectare increases, then there is every possibility to have increased non-farm income for farmer households. This is plausible because smallholders will have to earn from non-farm businesses to sustain their livelihood.

TABLE 8: UNIVARIATE REGRESSION RESULTS – FACTORS DETERMINING THE TOTAL MONTHLY INCOME FROM NON-FARM BUSINESS OF FARMER HOUSEHOLDS

Model	2002-03		2012-13		2018-19	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
MINF=a+b_1RELE	2.12 (1.32)^{ns}	0.10	4.81 (2.04)^{c}	0.21	3.87 (1.79)^{c}	0.17
MINF =a+b_1HPLO	7.97 (2.26)^{b}	0.24	12.89 (2.47)^{b}	0.28	6.33 (1.56)^{d}	0.13
MINF =a+b_1PIRA	1.11 (0.64)^{ns}	0.03	-1.55 (-0.54)^{ns}	0.02	-0.42 (-0.16)^{ns}	0.02
MINF =a+b_1LTAH	8.68 (2.19)^{b}	0.23	26.93 (4.10)^{a}	0.51	-11.14 (-1.49)^{d}	0.12
MINF =a+b_1AICP	-3.35 (-0.79)^{ns}	0.04	-19.61 (-3.81)^{a}	0.48	-19.13 (-9.05)^{a}	0.84
MINF =a+b_1ROAD	4.19 (2.43)^{b}	0.27	4.14 (1.60)^{d}	0.14	2.09 (0.86)^{ns}	0.01
MINF =a+b_1SCST	-9.03 (-3.22)^{a}	0.39	2.03 (4.44)^{a}	0.55	-12.49 (-3.03)^{a}	0.36

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021); Census of India (various years); GoI (various years).
Notes: a, b, c and d are significant at 1, 5, 10, 20 percent level respectively; ns-not significant.

After studying the determinants of farmer income by source, we have attempted to study the total monthly income of the farmer households. For this, a total of 8 univariate regressions are estimated treating TMIA as a dependent variable. The results presented in Table 9 show a clearer picture of the determinants of total monthly income. Of the eight independent variables used in the regression estimate,

four of them (RELE, PIRA, MECP and ROAD) have positively and consistently influenced TMIA, while one variable (SCST) consistently negatively influenced it. These results are on the expected line. The variables RELE, PIRA and MECP are included in the analysis to reflect the availability of infrastructure; all of them have positively influenced TMIA. The variable MECP (monthly expenditure on crop production) is included in the analysis to reflect the use of modern inputs in crop production, which has also positively and significantly influenced the total income. As expected, the regression coefficient of the SCST variable has negatively and significantly influenced the dependent variable TMIA. This means that wherever the share of SCST households is higher, there is a possibility of a reduced monthly total income of the farmer households. In sum, it is clear from the analysis that the variables such as RELE, PIRA, MECP and ROAD appear to be important in positively determining the total monthly income of farmer households.

TABLE 9: UNIVARIATE REGRESSION RESULTS – FACTORS DETERMINING THE TOTAL MONTHLY INCOME OF FARMER HOUSEHOLDS

Model	2002-03		2012-13		2018-19	
(1)	Coefficient (2)	R^2 (3)	Coefficient (4)	R^2 (5)	Coefficient (6)	R^2 (7)
$TMIA=a+b_1RELE$	25.13 (2.49)[b]	0.28	48.27 (3.72)[a]	0.45	56.20 (3.98)[a]	0.50
$TMIA=a+b_1HPLO$	38.03 (1.42)[d]	0.11	6.85 (0.17)[ns]	0.02	-25.19 (-0.69)[ns]	0.03
$TMIA=a+b_1PIRA$	10.29 (0.85)[ns]	0.04	29.91 (1.68)[d]	0.15	37.42 (1.91)[c]	0.19
$TMIA=a+b_1LTAH$	34.98 (1.14)[ns]	0.08	89.78 (1.53)[d]	0.13	-48.87 (-0.74)[ns]	0.03
$TMIA=a+b_1AICP$	-0.15 (-0.05)[ns]	0.02	-55.82 (-1.23)[ns]	0.09	-104.01 (-2.93)[a]	0.35
$TMIA=a+b_1MECP$	0.09 (1.79)[c]	0.17	0.99 (3.84)[a]	0.48	1.12 (3.93)[a]	0.49
$TMIA=a+b_1ROAD$	29.87 (2.47)[b]	0.27	38.63 (2.43)[b]	0.27	42.55 (2.38)[b]	0.26
$TMIA=a+b_1SCST$	-56.47 (-2.68)[b]	0.31	-69.09 (-2.25)[b]	0.24	-83.82 (-2.18)[b]	0.23

Sources: Computed using data from NSSO-SAS (2005; 2014; 2021); Census of India (various years); GoI (various years).

Notes: a, b, c and d are significant at 1, 5, 10, 20 per cent level respectively; ns-not significant.

IV

CONCLUSION AND POLICY POINTERS

This study attempts to find out whose (state) and which (source) farm income increases in India by using SAS data of three-time points. It shows that at the all-India level, the net receipt from crop production accounted for the major share (45.82 per cent) of the total annual income of the farmer households in 2002-03, which declined to 37.17 percent in 2018-19. But, the share of wage income and the income from farming of animals has increased considerably across the states. Between 2002-03 and 2018-19, the share of wage income increased in 12 out of 18 states, while the

share of crop production income declined in 16 out of 18 states. But the share of net income from farming of animals has increased significantly in all the states; 12 out of 18 states including the most advanced agricultural states like Punjab and Haryana have recorded a more than 100 per cent increase in it.

The analysis of the growth rate shows that 11 out of 18 states have grown faster than the national average of 3.14 per cent in wage income between 2002-03 and 2018-19. The growth rate of net income from crop production is relatively smaller (1.80 per cent) than the growth rate registered for wage income. Only 9 out of 18 states have registered a growth rate over the national average in crop production income. Among different sources of income, the income from farming of animals has registered the highest growth rate at the all-India level. Not only this, 13 states have registered a growth rate of over 5 per cent in farming of animals, which is not observed in any other source of income. In the total annual income of farmer households, the average growth rate at the all-India level is not very impressive as compared to the growth rate registered in the income from the source of farming of animals and wage labour. At the all-India level, the total annual income of farmer households registered a growth of 2.99 per cent, whereas the farming of animals registered a growth rate of 10.58 per cent and wage income registered a growth of 3.14 per cent. A total of 9 states out of 18 have registered a growth rate more than the national average in the total annual income of farmer households. The states which achieved the highest growth rate in the order are Rajasthan (6.17), Haryana (5.86), AP (4.62), Chhattisgarh (4.22), MP (4.07), Tamil Nadu (3.99), Punjab (3.61), Karnataka (3.34) and UP (3.11). On the extreme end, states like J&K, Assam, WB and Jharkhand have registered a poor growth rate (less than one percent) in the total annual of income of farmer households because of their poor performance in all the sources of income.

As expected, the univariate regression analysis shows that the factors determining each source of income are different, which also varies from year to year. While the variables such as RELE (percentage of villages electrified), PIRA (percentage of irrigated area to cropped area), MECP (monthly expenditure of crop production) and ROAD (percentage of villages having pucca road) have positively and consistently determined the crop production income in all the three-time points, the variables such as RELE, HPLO (share of agricultural households possessing land less than 1.00 ha) and ROAD seem to be the important determinants of monthly wage income, which is plausible. The variables such as RELE, PIRA and ROAD seem to be the important determinant of the income from farming of animals, while the total monthly income of farmers is mainly determined by variables such as RELE, PIRA, MECP and ROAD. These results seem to reflect the ground level reality of farmer households and also confirm with the results of some of the earlier studies (Fan, et al., 1999; Narayanamoorthy and Hanjra, 2006). A recent field level study carried out from Uttar Pradesh also shows that education, family size, land size, proper infrastructure

for livestock, adequate production technology and access to market are significant variables affecting farm income (Khan *et al*, 2020).

The study, on the whole, suggests that the infrastructure variables like irrigation coverage, percent of villages electrified and pucca road facility seem to play a significant role in determining most sources of income including the total income of farmer households. Therefore, it is essential to strengthening these infrastructure facilities wherever lacking to accelerate the farmer income (the details of strategies to be followed for enhancing the farm income are succinctly given by Satyasai and Mehrotra, 2016). The share of income from the farming of animals and wage labour segment has increased in most states, whereas the share of income from crop production has declined in most states. This trend does not look good from the perspective of development of farm households. More studies using disaggregated data need to be carried out to find out why this trend has taken place in the recent period in general and in 2018-19 in particular.

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