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Farmers' income in India: trends and prospects for future growth

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Abstract The Government of India aims to double agricultural income by 2022–23. This paper examines whether this target can be met—by analysing the trends in farmer income, sources, and factors of performance by farm class and state—and finds it unlikely. Income growth would be accelerated by improving resource use efficiency and access to agricultural extension, markets, and credit; and by diversifying towards high-value, high-growth sectors like animal husbandry and horticulture. To sustain income growth in the long term, greater resources must be allocated to agricultural research, and gainful employment opportunities must be created in the rural non-farm sector.

Keywords Farmers' income, income growth, diversification

JEL codes O47, P25, Q12, Q15, R11

The green revolution, a paradigm shift in the agricultural policy in India in the mid-1960s, emphasized the large-scale diffusion of biochemical technologies, including high yield varieties of seeds and chemical fertilizers. Agricultural productivity and food supplies increased significantly; the production of food grains grew from 72.35 million metric tons (MT) in 1965–66 to 176.39 MT in 1990–91, and to 285 MT in 2018–19, and milk production, too, rose from around 20 MT in the 1960s to almost 188 MT in 2018–19. Such phenomenal growth in food production made India food-secure, reduced its import dependence, improved nutritional outcomes, and alleviated poverty (Ravallion and Datt 1996; Datt et al. 2016). However, the distributional benefits of technological progress have been asymmetrical across populations and regions, primarily because agricultural policy aimed to improve the national food security and initially targeted the regions that had greater potential for producing staple foods (wheat and rice). The technological revolution bypassed the less endowed rain-fed regions, which were diversified towards coarse cereals, pulses, and oilseeds (Das and Barua 1996; Fan et al. 2000), and its benefits, being proportional to

landholding size, were expropriated mainly by relatively large farm households.

Another dimension of the income distribution is the disparity between agricultural and non-agricultural populations. The labour productivity gap between agricultural and non-agricultural populations has widened to the disadvantage of agricultural populations from just 30% in 1970–71 to 75% in 2015–16 (Birthal 2019). Within the rural sector, too, the income gap between cultivators and non-agricultural workers increased. The farm income per cultivator, 34% of a non-agricultural worker's income in the 1980s, fell to 25% after 1993–94 (Chand 2017); at present, a farmer earns only 20% of the national per capita income (Birthal et al. 2017). The income disparity between agricultural and non-agricultural sectors and within the agricultural sector is growing, and it is a matter of serious policy concern; if not reversed, it may have serious socio-political and economic consequences.

At the same time, Indian agriculture has been facing several challenges, such as diminishing farm size, decelerating productivity growth, rising input costs and price volatility, and climate change. Past policies helped

to achieve food security, but at the cost of degradation of natural resources, especially the groundwater and soils. The frequency of extreme climatic events has increased, and it is predicted to rise further in the plausible future climate scenario (Field et al. 2012). Agrarian distress is growing; a large proportion of smallholder farmers would like to quit agriculture but cannot because the alternative income opportunities are few (BIRTHAL et al. 2015). Agriculture's share in the gross domestic product (GDP) has fallen significantly, but it still engages almost half the workforce.

Improving farmers' income, and not food production alone, indicates another paradigm shift in agricultural policy. In 2016–17, almost half a century after the green revolution, the Government of India targeted this goal by 2022–23. This commitment has been reiterated several times and widely discussed in the academic and policy debates. The critics argue that doubling farmers' income in such a short period is impossible (Chand et al. 2015; Satyasai and Bharti 2016). The counterargument is that if the strategies are differentiated by region, and appropriately targeted to the populations and regions that lag behind in agricultural development in particular and economic development in general, the challenge, though difficult, is not unsurmountable (BIRTHAL et al. 2017).

This paper explores the challenges to, and prospects of, improving farmers' incomes along several dimensions, including landholding size, income sources, social affiliation, education/skills, and access to technology, information, and credit. The findings are likely to be useful to policymakers in formulating regionally differentiated strategies for enhancing income and allocating resources optimally.

Data sources

In this paper, we have used data from two large-scale surveys conducted by the National Sample Survey Office (NSSO): the Situation Assessment Survey of Farmers, 2002–03, which covers 51,770 farm households from 6,638 villages in India, and the Situation Assessment Survey of Agricultural Households, 2012–13, which covers 35,200 farm households from 4,529 villages (NSSO 2003, 2013). These surveys provide information on various socio-economic aspects of farm households, including income sources. These surveys define 'farm household'

differently (Sarkar 2017): in 2002–03 farm households were classified by land ownership, but in 2012–13 they were based on a minimum farming income of INR 3,000. To ensure that the data is comparable, only the farm households possessing land were considered, and the final sample of households numbered 50,522 in 2002–03 and 34,296 in 2012–13.

Farm household income has been classified into income from crop cultivation, animal husbandry, wages and salaries, and non-farm business enterprises. The income from crops was estimated as the value of main and by-products minus the cost of inputs. The income from animal husbandry was estimated as the income from sale of live animals or livestock products minus costs incurred. The income earned as labourers (outside their households) in agriculture or non-farm enterprises was classified as income from wages and salaries. The net income from non-farm business enterprises falls in the last income category.

Landholding size and income sources

Indian agriculture is dominated by small holdings of less than 2 hectares (ha); their proportion has risen from 83% in 2002–03 to 87% in 2012–13 (Table 1), and the proportion of marginal holdings (<1 ha) from 65% to 70%. The average size of marginal and small holdings remained the same, but the average size of large holdings declined from 7.52 ha to 6.60 ha. On the whole, the average size of holdings declined by almost 15%, from 1.22 ha to 1.03 ha, during this period. The declining size of operational holdings, and the rising proportion of small landholdings, constitute a cause of concern for the livelihood of a large rural population.

Table 2 presents the growth in income by source. The annual household income grew at 3.7% per annum, from INR 53,330 to INR 77,283, from 2002–03 to 2012–13 (at 2012–13 prices). The growth was not uniform, however; the income from animal husbandry increased at 13.2% per annum, followed by agricultural wages (6.4%) and crop husbandry (4.3%). Non-farm wages declined by 2.9% a year, while non-farm business income remained almost stagnant. The income of marginal farm households increased by 2.9% per annum, compared to 6–7% for medium and large farm households (Table 3). The slow growth in income during this period was accompanied by an increase in inequality. The annual increase in income from crops

Table 1 Size distribution of land holdings in India

Farm class	2002–03		2012–13	
	Average size (ha)	Households (%)	Average size (ha)	Households (%)
Marginal (<1.00 ha)	0.41	65.47	0.42	69.63
Small (1–2 ha)	1.37	18.18	1.39	17.13
Medium (2–4 ha)	2.63	10.63	2.59	9.18
Large (>4 ha)	7.52	5.71	6.60	4.05
Overall	1.22	-	1.03	-

Table 2 Distribution and changes in farm household income in India (at 2012–13 prices, INR/household/annum)

Income source	2002–03	2012–13	Compounded annual growth (%)
Crop husbandry	24,135 (45.3)	37,017 (47.9)	4.3
Animal husbandry	2,493 (4.7)	9,300 (12.0)	13.2
Agricultural wages	8,022 (15.0)	15,269 (19.8)	6.4
Non-agricultural wages	12,735 (23.9)	9,489 (12.3)	-2.9
Total wages (agricultural and non-agricultural combined)	20,757 (38.9)	24,758 (32.0)	1.8
Non-farm business activities	5,944 (11.1)	6,206 (8.0)	0.4
Total income	53,329 (100.0)	77,283 (100.0)	3.7

Note Figures in parentheses represent the percentage of total income.

and animals, and also wages and salaries, was the highest for large households and the lowest for marginal households.

Social status—based on caste, religion, and ethnicity—might have significant influence on household income because the early adopters of technologies and innovations, with better resource endowments and access to extension services, usually belong to the upper strata of society (Batte and Arnholt 2003; Ali 2012; Kumar 2013; Birthal et al. 2015). Our findings reveal that the landholdings of Scheduled Caste (SC) households are almost half the size of that of upper caste households (Table 4). Scheduled Tribe (ST) and Other Backward Class (OBC) households, too, have smaller landholdings.

Further, in 2002–03, the annual income of a SC household was almost 40% less than that of an upper caste household, and the gap widened slightly in 2012–13. The income of SC households increased annually at 2.4%, less than the 3–5% annual increase for other castes (Table 5). The most striking feature is the decline in non-farm wages and business activities for SC and ST households.

Regional variation

The regional variation in income levels and growth is huge (Table 6). The household income declined in West Bengal, Bihar, Arunachal Pradesh, Mizoram, and Uttarakhand between 2002–03 and 2012–13, but it was almost stagnant in Assam and Sikkim. Many low-

Table 3 Distribution and changes in household income across various size categories in India (at 2012–13 prices)

Income source/ Size category	(INR/household/annum)											
	Marginal (<1 ha)			Small (1–2 ha)			Medium (2–4 ha)			Large (≥4 ha)		
	2002–03	2012–13	Compounded annual growth (%)	2002–03	2012–13	Compounded annual growth (%)	2002–03	2012–13	Compounded annual growth (%)	2002–03	2012–13	Compounded annual growth (%)
Crop production	10,837	16,787	4.5	29,762	50,837	5.5	52,874	90,626	5.5	105,144	204,604	6.9
Animal husbandry	2,471	7,878	12.3	2,645	10,015	14.2	2,133	14,410	21.0	2,918	19,118	20.7
Wages and salaries	23,176	26,422	1.3	16,671	20,845	2.3	16,657	19,905	1.8	13,666	23,714	5.7
Non-farm business activities	6,121	5,589	-0.9	4,655	7,208	4.5	4,463	6,595	4.0	10,766	11,683	0.8
Total household income	42,607	56,679	1.9	53,735	88,906	5.2	76,129	131,538	5.6	132,495	259,120	6.9

Note The growth rates represent the compounded annual growth from 2002–03 to 2012–13.

Table 4 Average landholding size (ha) across social classes in India

Caste group	Year	
	2002–03	2012–13
ST	1.19	1.01
SC	0.75	0.65
OBC	1.23	1.04
Upper castes	1.55	1.31

income states performed better than high-income states, changing the inter-state dynamics of farm household income. Arunachal Pradesh was at the top of the income hierarchy in 2002–03 and Odisha at the bottom; the ratio of their incomes was around 5.9. In 2012–13, Punjab emerged at the top and Bihar at the bottom; the ratio of their incomes was nearly 5. The gap between the poorest and richest states narrowed during this period, a welcome development. Between 2002–03 and 2012–13, the income rankings improved for Bihar, West Bengal, Uttarakhand, Jharkhand, Uttar Pradesh, Assam, Sikkim, Mizoram, and Arunachal Pradesh, while the rankings of other states fell.

The changes in farm household income across different states in India between 2002–03 and 2012–13 may be explained largely by the changes in income from crop production and income from animal husbandry. The annual growth in income from crop production was almost 6% or higher in most of the states (14) where income growth was higher than the all-India average (Table 7). Such growth was more than 9% per annum in Odisha and Chhattisgarh and more than 10% per annum in Rajasthan. The growth in household income was lower than the all-India average but positive in eight states; in these states, the growth in income from crop production was either very low or negative.

The annual increase in income from crop production exceeded 4% in Maharashtra and Uttar Pradesh, but it was negative in most other states (Nagaland, Jammu and Kashmir, Jharkhand, and Sikkim). The income from crop production declined considerably in all the states (except Arunachal Pradesh) where the farm household income declined between 2002–03 and 2012–13. Clearly, increasing the income from crop production is a prerequisite for accelerating growth in farm household income in India.

Table 5 Household income across social groups in India

Caste group	Average annual income (INR/household/annum)		Compounded annual growth (%, 2002–03 to 2012–13)
	2002–03	2012–13	
Scheduled tribes	43,793	70,428	4.9
Scheduled castes	43,074	54,824	2.4
Other backward castes	49,428	76,758	4.5
Upper castes	70,684	96,736	3.2

Table 6 Changes in household income across different Indian states

State	Annual income (INR/household)		Compounded annual growth (%)	State	Annual income (INR/household)		Compounded annual growth (%)
	2002–03	2012–13			2002–03	2012–13	
Odisha	25,360 (27)	59,624 (22)	8.9	Nagaland	84,388 (8)	120,764 (7)	3.6
Rajasthan	45,552 (21)	88,662 (14)	6.9	Maharashtra	62,849 (16)	88,872 (13)	3.5
Madhya Pradesh	38,203 (24)	74,740 (18)	6.9	Uttar Pradesh	42,256 (22)	59,308 (23)	3.4
Haryana	89,498 (7)	173,219 (2)	6.8	Meghalaya	106,299 (5)	141,961 (5)	2.9
Tripura	35,754 (26)	65,256 (20)	6.2	Jammu & Kashmir	121,369 (4)	152,280 (3)	2.3
Andhra Pradesh	40,565 (23)	73,009 (19)	6.1	Jharkhand	47,881 (19)	58,293 (24)	2.0
Tamil Nadu	48,932 (18)	85,189 (15)	5.7	Assam	73,703 (10)	79,948 (17)	0.8
Chhattisgarh	36,573 (25)	62,224 (21)	5.5	Sikkim	76,874 (9)	81,544 (16)	0.6
Manipur	64,008 (15)	103,667 (11)	4.9	West Bengal	51,281 (17)	47,900 (26)	-0.7
Punjab	135,977 (2)	216,459 (1)	4.8	Bihar	46,369 (20)	42,986 (27)	-0.8
Karnataka	69,064 (13)	106,248 (9)	4.4	Arunachal Pradesh	148,695 (1)	130,610 (6)	-1.3
Himachal Pradesh	69,072 (12)	105,579 (10)	4.3	Mizoram	128,506 (3)	109,369 (8)	-1.6
Gujarat	64,033 (14)	95,242 (12)	4.1	Uttarakhand	72,638 (11)	56,140 (25)	-2.5
Kerala	96,771 (6)	143,769 (4)	4.0	All India	53,330	77,283	3.7

Note Annual compound growth rate from 2002–03 to 2012–13. Figures in parentheses are income ranks during the year.

Animal husbandry is another significant source of income. The growth in income from animal husbandry was considerably higher in the states where the growth in farm household income was high and positive. The annual growth in income from animal husbandry was as high as 73.5% in Manipur, 41.6% in Odisha, and 22.2% in Rajasthan. The high growth in income from animal husbandry somehow compensated for the decline in income from crop production in the states where the growth in household income was lower and positive; in most of these states, the growth in income from animal husbandry was in double digits. The growth in income from animal husbandry was negative in most of the states where the growth in household income was negative.

The changes in income from wages and salaries and

from non-farm business activities are not clearly related with the changes in farm household incomes, but in the states where the overall farm household income declined between 2002–03 and 2012–13 the income from wages and salaries grew at the slowest pace and the income from non-farm business activities declined sharply. The analysis of the changes in household income and its components across the various Indian states points to the fact that farming remains the mainstay of the livelihood of farming households and any strategy to enhance farm household income in future will have to focus on agriculture. While there is a need to diversify the income sources in rural India, it requires a comprehensive strategy on generating employment opportunities in the non-farm sector, which has not happened at least in the recent past.

Table 7 Income composition and its changes across different states in India (INR/household/annum)

State/Income source	Crop production			Animal husbandry			Wages and salaries			Non-farm business activities		
	2002-03	2012-13	% growth	2002-03	2012-13	% growth	2002-03	2012-13	% growth	2002-03	2012-13	% growth
Odisha	6,974	16,933	9.3	482	15,621	41.6	14,404	20,570	3.6	3,500	6,499	6.4
Rajasthan	13,848	37,593	10.5	1,640	12,147	22.2	24,416	30,411	2.2	5,648	8,512	4.2
Madhya Pradesh	26,627	48,207	6.1	-6074	8,969	NA	14,976	15,994	0.7	2,674	1,570	-5.2
Haryana	48,776	94,404	6.8	-5012	31,699	NA	36,068	41,919	1.5	9,666	5,197	-6.0
Tripura	16,626	33,281	7.2	1,502	3,785	9.7	15,195	26,233	5.6	2,431	1958	-2.1
Andhra Pradesh	17,240	35,190	7.4	2,515	9,199	13.8	16,875	24,677	3.9	3,935	3,942	0.0
Tamil Nadu	15,316	23,001	4.2	2,593	13,715	18.1	26,325	34,842	2.8	4,697	13,630	11.2
Chhattisgarh	16,641	40,197	9.2	-37	-124	12.9	17,665	22,152	2.3	2,304	0	NA
Manipur	19,394	35,143	6.1	64	15,861	73.5	38,341	45,821	1.8	6,209	6,842	1.0
Punjab	75,059	130,308	5.7	8,431	19,914	9.0	40,249	57,362	3.6	12,238	8,875	-3.2
Karnataka	31,010	59,286	6.7	3,729	7,437	7.1	29,490	32,087	0.8	4,834	7,437	4.4
Himachal Pradesh	16,784	34,524	7.5	5,180	12,881	9.5	33,845	48,355	3.6	13,262	9,819	-3.0
Gujarat	26,125	35,240	3.0	11,398	23,239	7.4	23,116	32,097	3.3	3,394	4,667	3.2
Kerala	27,289	42,268	4.5	3,871	7,188	6.4	48,386	63,115	2.7	17,225	31,198	6.1
Nagaland	41,688	38,524	-0.8	-759	16,786	NA	32,405	64,730	7.2	11,055	725	-23.8
Maharashtra	29,916	46,302	4.5	3834	6,665	5.7	21,934	25,862	1.7	7,165	10,043	3.4
Uttar Pradesh	22,396	34,221	4.3	1,521	6,642	15.9	13,818	13,819	0.0	4,521	4,626	0.2
Meghalaya	74,941	77,795	0.4	3,083	8,092	10.1	22,004	45,286	7.5	6,272	10,789	5.6
Jammu & Kashmir	48,790	36,699	-2.8	8,981	9,441	0.5	49,154	88,018	6.0	14,443	18,121	2.3
Jharkhand	17,812	17,430	-0.2	2,059	15,856	22.6	23,174	22,093	-0.5	4,836	2,915	-4.9
Assam	39,579	50,447	2.5	3,611	9,194	9.8	24,469	17,189	-3.5	6,044	3,118	-6.4
Sikkim	22,832	20,386	-1.1	16,528	11,824	-3.3	34,286	37,347	0.9	3,229	11,987	14.0
West Bengal	17,589	11,736	-4.0	1,744	2,635	4.2	22,000	25,531	1.5	9,949	7,999	-2.2
Bihar	21,933	20,633	-0.6	6,816	3,697	-5.9	12,427	15,819	2.4	5,193	2,837	-5.9
Arunachal Pradesh	36,579	79,672	8.1	8,922	15,020	5.3	18,736	24,947	2.9	84,459	10,971	-18.5
Mizoram	67,723	54,685	-2.1	20,818	10,499	-6.6	39,708	43,857	1.0	257	328	2.5
Uttarakhand	40,314	30,428	-2.8	8,208	10,105	2.1	12,784	12,632	-0.1	11,332	2,975	-12.5

Note % growth means compound annual growth during 2002-03 and 2012-13 for a particular income source.

Correlates of farmers' income

The income of a farm household, and its growth over time, are determined by many factors, such as farm size, resource use efficiency, access to institutional credit, technical information, and human capital. The analysis of changes in farm size did not show any effect on the extent of growth in farm household income in the states. Thus, the analysis was extended to changes in crop profits (Table 8).

At the all-India level, the crop profits increased annually at 4.2%, from INR 20,574 per ha in 2002–03 to INR 31,015 per ha in 2012–13 (at constant prices), but the growth varied considerably by state—from less than 1% per annum in Punjab to more than 10% per annum in Himachal Pradesh. Profits declined 0.1–5.6% per annum in five states—Jharkhand, West Bengal, Bihar, Arunachal Pradesh, and Mizoram. Profits grew at a much higher rate in states where the household income increased at a faster pace. The profitability of farming declined in the states where household income fell. The changes in crop profitability appear to be an important factor in enhancing farm household income. The correlation coefficient between the growth rate of profits and household income is positive and high, at 0.6.

Indebtedness is claimed to be an important indicator of farmers' distress as the incidence of debt may be a direct outcome of the lack of viability of farming. Table 9 shows the extent of debt among agricultural households, and changes in the extent, between 2002–03 and 2012–13. At the all-India level, the extent of debt of agricultural households increased at the compound annual growth rate (CAGR) of 7.1%, and it increased more in the states where the growth in household income was higher between 2002–03 and 2012–13—evident in the positive correlation coefficient (0.58) between the change in debt and change in household income for each state.

Educational attainment has the potential to improve farmers' income (Lanjouw and Lanjouw 2001; Foster and Rosenzweig 2004). Education improves human capital and positively influences farm and non-farm income. In 2002–03, almost 75% of the household heads were illiterate, an additional 20% were merely literate, and only 6% had higher education (Figure 1). The percentage of illiterates declined to less than 50% in 2012–13 and 8.6% of the farmers had higher education. The percentage of household heads with higher secondary education increased from 20% in 2002–03 to 36% in 2012–13. The percentage of household heads educated up to secondary level

Table 8 Profits from crop farming and its growth in different states of India

State	Net profits (INR/ha)		% annual growth (compounded)	State	Net profits (INR/ha)		% annual growth (compounded)
	2002–03	2012–13			2002–03	2012–13	
Odisha	9,214	22,271	9.2	Nagaland	96,994	464,285	17.0
Rajasthan	7,402	18,143	9.4	Maharashtra	18,776	34,084	6.1
Madhya Pradesh	13,087	20,901	4.8	Uttar Pradesh	18,279	31,282	5.5
Haryana	26,112	35,387	3.1	Meghalaya	54,105	80,271	4.0
Tripura	31,252	36,646	1.6	Jammu & Kashmir	52,209	62,720	1.9
Andhra Pradesh	12,818	22,384	5.7	Jharkhand	30,104	29,832	-0.1
Tamil Nadu	20,696	26,619	2.5	Assam	42,465	49,244	1.5
Chhattisgarh	12,876	32,871	9.8	Sikkim	21,815	27,515	2.3
Manipur	35,309	45,122	2.5	West Bengal	24,739	24,103	-0.3
Punjab	48,936	52,912	0.8	Bihar	24,294	19,107	-2.4
Karnataka	16,824	33,121	7.0	Arunachal Pradesh	316,389	177,591	-5.6
Himachal Pradesh	18,709	51,589	10.7	Mizoram	44,197	39,678	-1.1
Gujarat	15,219	26,258	5.6	Uttarakhand	35,825	39,596	1.0
Kerala	42,263	54,674	2.6	All India	20,574	31,015	4.2

Table 9 Indebtedness among agricultural households in states in India (INR/household at 2012–13 prices)

State	Household debt		% annual growth (compounded)	State	Household debt		% annual growth (compounded)
	2002–03	2012–13			2002–03	2012–13	
Odisha	20,247	42,689	7.7	Nagaland	5,750	24,214	15.5
Rajasthan	48,879	89,630	6.3	Maharashtra	47,785	79,816	5.3
Madhya Pradesh	35,850	59,707	5.2	Uttar Pradesh	26,371	53,695	7.4
Haryana	70,669	154,868	8.2	Meghalaya	3,645	58,194	31.9
Tripura	12,076	20,924	5.7	Jammu & Kashmir	12,029	36,339	11.7
Andhra Pradesh	32,630	87,915	10.4	Jharkhand	20,544	17,963	-1.3
Tamil Nadu	39,503	106,695	10.4	Assam	8,765	18,581	7.8
Chhattisgarh	15,850	26,016	5.1	Sikkim	11,440	67,796	19.5
Manipur	16,889	24,628	3.8	West Bengal	15,099	26,863	5.9
Punjab	89,887	175,183	6.9	Bihar	23,123	34,773	4.2
Karnataka	50,170	96,685	6.8	Arunachal Pradesh	14,396	20,172	3.4
Himachal Pradesh	41,487	83,244	7.2	Mizoram	14,653	46,270	12.2
Gujarat	51,640	83,106	4.9	Uttarakhand	27,660	59,294	7.9
Kerala	60,904	185,827	11.8	Overall	36,672	73,020	7.1

Table 10 Crop profitability across various levels of educational attainment in India

Education level	Profit (INR/ha)		% annual growth (compounded)
	2002–03	2012–13	
Illiterate	19,107	26,591	3.4
Literate	25,309	36,378	3.7
Higher education	23,070	35,829	4.5

Figure 1 Distribution of farmers according to their educational attainment (%ages)

increased from 6% in 2002–03 to 9% in 2012–13. The literacy levels have improved over time and across all farm categories, but the percentage of household heads who had higher education is larger among larger farm households, and illiteracy is still high.

To examine the effect of education on household income, we estimate crop profits across the education

levels of household heads (Table 10). If the household head is educated, a household's profits average 1.3 times that of households headed by illiterate farmers; in addition, educated farmers realize higher growth in profits. Higher education makes access to non-farm sector employment and income easier. Table 11 provides information on the education level and

Table 11 Proportion of income from non-farm business activities across education levels

Education level	Income share from non-farm business activities (%)	
	2002–03	2012–13
Illiterate	8.2	6.0
Primary	13.3	8.6
Middle	12.6	9.9
Secondary	13.6	9.0
Graduate and above	10.3	12.8

Table 12 Use of technical information and returns and returns from farming in India

Information sources	Net returns (INR/ha)	
	2002–03	2012–13
Formal sources	23,255	34,810
Informal sources	19,412	29,997
No information source	20,510	31,438

proportion of income from non-farm business activities. It appears that higher education results in a more diversified income portfolio. The non-farm sector, despite being heterogeneous, has the potential to engage workers with varying skills and education levels in a more productive manner (Birthal et al. 2014).

Access to technical information, in addition to education, can also influence farm income. In 2002–03 as well as in 2012–13 around 40% of the households had access to technical information on agriculture from formal sources (the public extension system, research institutes, Krishi Vigyan Kendras, cooperatives, radio, television) or informal sources (fellow farmers, input dealers, traders, processors). About 10–11% of farmers had access to both formal and informal sources. The profits of farmers who use technical information for decision-making are usually 12% higher than those who do not use such information (Birthal et al. 2015).

The farmers who had access to formal sources of technical information in agriculture realized higher net returns than farmers that did not have such access (Table 12). The information from informal sources did not have any significant effect on income.

The variation in the proportion of households accessing technical information across states is considerable (Table 13), but the relationship between the changes in the extent of formal sources of information and income growth does not appear significant. While there is no denying the fact that technical information leads to higher income, there is a need to focus on the quality of information being made available through these sources.

Access to markets is important for realizing remunerative prices. The agricultural markets in India are dominated by informal traders through whom almost 60% of paddy and around 36% of wheat is sold (Negi et al. 2018). These traders are also an important source of credit for farmers, who commit the sale of their produce as collateral. Smallholders have greater dependence on informal traders. While farmers realize higher prices for their produce by selling to government agencies, they end up selling their produce at significantly lower prices through informal channels. The marginal farmers are even more disadvantaged and realize significantly lower prices when compared to

Table 13 Access of agricultural households to formal sources of technical information across different Indian states

State	Access to formal sources (% households)		Change in %age	State	Access to formal sources (% households)		Change in %age
	2002–03	2012–13			2002–03	2012–13	
Odisha	16.8	23.2	6.4	Nagaland	36.0	10.1	-25.9
Rajasthan	7.6	15.2	7.6	Maharashtra	33.4	28.6	-4.8
Madhya Pradesh	27.1	22.7	-4.4	Uttar Pradesh	19.6	14.0	-5.6
Haryana	25.3	30.3	5.0	Meghalaya	32.6	16.4	-16.2
Tripura	16.4	30.6	14.2	Jammu & Kashmir	47.1	51.3	4.2
Andhra Pradesh	27.0	29.8	2.8	Jharkhand	18.7	23.5	4.8
Tamil Nadu	39.4	34.3	-5.1	Assam	35.0	50.6	15.6
Chhattisgarh	24.1	32.9	8.8	Sikkim	53.1	20.1	-33.0
Manipur	45.2	21.0	-24.2	West Bengal	29.5	25.3	-4.2
Punjab	22.5	31.0	8.5	Bihar	18.8	19.9	1.1
Karnataka	35.1	59.0	23.9	Arunachal Pradesh	20.8	14.6	-6.2
Himachal Pradesh	32.8	39.3	6.5	Mizoram	20.7	28.8	8.1
Gujarat	37.6	30.9	-6.7	Uttarakhand	8.0	23.8	15.8
Kerala	52.9	64.4	11.5	All India	25.9	26.1	0.2

large holders. Further, the average sales price in regulated markets is also lower than the minimum support price. This is in line with Meenakshi and Banerji (2005), which estimate a structural model of collusion in these markets to show price discounting.

Access to infrastructure also affects incomes. Farmers located near the roadside and urban centres engage more in the cultivation of high-value crops and the rearing of livestock because their access to markets is better and transaction costs lower (Rao et al. 2006; Birthal et al. 2005). Rural roads incentivize farmers to expand the area where high-value crops are cultivated, use improved technologies and modern inputs, and diversify out of agriculture (Shamdasani 2016). Birthal et al. (2017) examine the proportion of farm households in an income class in a district and the proportion of villages in the district having different types of infrastructure. The study reveals a negative and significant association between the incidence of low-income farmers and infrastructural variables, such as electricity, telephone lines, mobile connectivity, pucca roads, all-weather roads, commercial banks, and cooperative banks. The correlation coefficients were positive and significant for higher income classes.

Further, the income sources of farm households that

had better access to infrastructure were more diversified and their profits were higher, suggesting that the link between infrastructure and farmers' income is crucial. Rural roads and communication networks are reasonably good in most states, but the complementary infrastructure in the east and north-east is poor, and that may limit the benefits of investments in roads and communication to farmers (Birthal et al. 2017). In terms of boosting agricultural growth and reducing poverty, investment in agricultural research is a high pay-off activity (Fan et al. 2014; Birthal et al. 2014), but agricultural research and education spending is low in several states, and the investments in supporting infrastructures and institutions are low in the states where agricultural research investment is comparatively high.

Possibilities of doubling household income

We attempt to project the income of agricultural households in India and its states by 2022–23 and examine if household income might double. We use the household income estimates of the NABARD All-India Rural Financial Inclusion Survey for the year 2016–17 (at 2012–13 prices). We then project the income levels of rural households for year 2022–23.

Table 14 Projected levels of income of agricultural households in India and gaps from target of doubling of income

State	Income level (INR/household/annum)		Gap from target of doubling (%)	State	Income level (INR/household/annum)		Gap from target of doubling (%)
	2016–17	2022–23			2016–17	2022–23	
Odisha	68,771	114,702	16.6	Nagaland	88,510	109,434	38.2
Rajasthan	80,175	119,648	25.4	Maharashtra	91,339	112,279	38.5
Madhya Pradesh	70,443	105,125	25.4	Uttar Pradesh	59,315	72,492	38.9
Haryana	182,578	270,942	25.8	Meghalaya	89,302	106,011	40.6
Tripura	67,534	96,889	28.3	Jammu & Kashmir	83,217	95,382	42.7
Andhra Pradesh	66,686	95,133	28.7	Jharkhand	62,188	70,034	43.7
Tamil Nadu	86,953	121,265	30.3	Assam	87,870	101,307	42.4
Chhattisgarh	76,323	105,238	31.1	Sikkim	76,528	79,324	48.2
Manipur	87,718	116,881	33.4	West Bengal	68,993	119,583	13.3
Punjab	205,779	272,627	33.8	Bihar	63,825	115,559	9.5
Karnataka	94,319	122,124	35.3	Arunachal Pradesh	80,700	74,606	53.8
Himachal Pradesh	105,216	135,452	35.6	Mizoram	88,341	80,192	54.6
Gujarat	105,847	134,705	36.4	Uttarakhand	96,560	217,587	-12.7
Kerala	150,574	190,524	36.7	All India	86,050	107,010	37.8

Note All the estimates are at 2012–13 prices. The gaps are estimated w.r.t. 2016.17. Negative gap means that doubling of income can be achieved by 2022–23.

We estimate the household income CAGR for the periods 2002–03 to 2012–13 and 2012–13 to 2016–17. We consider for each state the higher growth rate of the two periods because the past debates over the feasibility of achieving the target are based on optimistic assumptions and interventions.

Table 14 presents the agricultural household income by state for 2016–17 and 2022–23 and the difference from the target (doubled income). The estimates show that the target is not likely to be achieved by 2022–23—the shortfall at the all-India level will be around 37.8%; all the states (except Uttarakhand) will likely miss the target; and that the shortfall in most states will be 25–50%.

Conclusions and implications

This study examines the trends in farmers' income along several lines between 2002–03 and 2012–13. Farmer income grew at 3.7% per annum, but the growth was differential by state and farm class. Marginal farmers comprise the bulk of the farming population, and they are at the bottom of income distribution; their income grew at a much slower rate than of their larger counterparts. Some states (West Bengal, Bihar, Arunachal Pradesh, Mizoram, Uttarakhand, etc.) lagged behind in income levels and performed poorly over time while Odisha performed extremely well.

Livestock emerged as an important component of farmers' income, but the role of the non-farm sector was not sizable. This is a matter of concern, because the average landholding size is declining, and non-farm earnings must play a bigger role through the development of rural labour markets and the non-farm sector. The crop profitability improved, due possibly in turn to the improvement in productivity, prices, and resource use efficiency, and the improved crop profitability accelerated the pace of income growth and its variation across different states. The acceleration in the pace of income growth points to the need for targeting investment in agricultural research and development, as it seems unlikely that the target of doubling agricultural income by 2022–23 would be achieved.

The study draws the following major implications to ensure that the growth in farmers' income in India in the future is higher and more inclusive.

The more vulnerable farm households (marginal and SC) must be at the forefront of our future income growth strategy, and the disadvantaged regions (east, central, and west) should be given priority in resource allocation for higher growth.

The land resource is limited and shrinking, and there is a need to focus on improving resource use efficiency and diversifying to high-value, high-growth sectors such as horticulture and livestock. However, these sectors have not received policy focus commensurate with their economic contribution: the livestock sector's share in agricultural GDP exceeds 25%, but its share in total public sector investment and institutional credit is a mere 5% (Birthal and Negi 2012), and the insurance and extension support is negligible. To fully harness their growth potential, the horticulture and livestock sectors need more investment and institutional support. The policy should focus on allocating greater resources to high-value, high-growth sectors; developing efficient and inclusive markets and value chains; and investing in public infrastructure to stimulate private investment in marketing and food processing.

Access to technical information improves farm productivity and income, and there is a need to improve farmers' access to formal sources of agricultural extension. The use of information and communication technologies should be promoted to expand the outreach of formal sources.

Most farmers depending on informal traders fail to realize the government-administered prices for their produce, and there is a need to enforce market regulations. Improving the access of smallholders to institutional credit will reduce their dependence on informal traders.

The growth in farmers' incomes in the long run has to come from advancement in agricultural research for raising yield frontiers, improving resource use efficiency, reducing the cost of production, and improving the resilience of agriculture to climate change. It implies that the allocation of resources for agricultural research has to be raised from its current level of 0.6% of the agricultural GDP.

The rural non-farm sector is concentrated in and around large cities. But farm sizes are shrinking, and strategies are needed to develop and promote labour-intensive non-farm activities in the non-farm sector in rural areas

by investing in human capital, skills development, and industrial value chains and, thus, de-stressing agriculture from excessive employment pressure. This is most important to increase farmer income.

Finally, the inter-state disparities in household income and its sources are significant; therefore, a 'one size fits all' strategy will not improve the economic status. The regional characteristics in terms of infrastructure, investment, and institutions need to be mapped and the growth strategies formulated accordingly. If the growth in farmers' income is to be faster and more efficient, complementarities must be created among the different types of infrastructure and institutions.

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