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.LAND DISTRIBUTION, INCOME GENERATION AND INEQUALITY IN INDIA'S AGRICULTURAL SECTOR

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This paper is a contribution to understanding income generation and inequality in India's agricultural sector. We analyze the National Sample Surveys of agriculture in 2003 and 2013 using descriptive and regression based methods, and estimate income inequality in the agricultural sector at the scale of the nation and its 17 largest states. We show that: (a) there are significant state-level differences in the structures/patterns of income generation from agriculture, (b) there is a negative relationship between the amount of land owned by the household and share of wages in total income, (c) income inequality in India's agricultural sector is very high (Gini Coefficient of around 0.6 during the period), and (d) about half of the income inequality is explained by the household-level variance in income from cultivation, which in turn is primarily dependent on variance in landownership.

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1. INTRODUCTION

This paper is a contribution to understanding income generation and inequality in India's agricultural sector over the decade 2003–13, a period when

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the country's gross domestic product increased by over three times in nominal terms from $ 599 billion to $ 1,856 billion. We analyze the Situation Assessment Surveys of Farmers/Agricultural Households undertaken by India's official statistical agency, National Sample Survey Organisation (NSSO), in 2003 and 2013. We provide estimates of inequality and use descriptive and regression based methods (Mookherjee and Shorrocks, 1982; Shorrocks, 1982; Jenkins, 1995; Fields, 2003; Cowell and Fiorio, 2011) in order to quantify the underlying factors contributing to this inequality in the agricultural sector, at the national scale and disaggregated to the scale of the 17 large states that house about 95 percent of the national population. The contribution of this paper is fourfold.

The first, which is also an important point of departure from a large body of literature on inequality in India, is that we focus on income and not consumption. We show that there is a large difference between the two measurement concepts—income vs. consumption inequality—where the Gini Coefficients of per capita income and consumption are 0.58 and 0.28 respectively in the agricultural sector in 2013. Our paper provides a much needed correction to the usual narrative, for example, in reports of the World Bank and the United Nations Development Programme,[1] characterizing India as a country with low income inequality (World Bank, 2007 p. 46; Anand *et al.*, 2014).[2]

Second, since we are analyzing incomes, we are able to focus on the factors contributing to this income inequality, an aspect that is missing in the existing literature that analyses either consumption expenditure data or wages. Thus, our paper complements the literature on rural income generation activity (Davis *et al.*, 2010, 2017; Hazell, 2015) and the drivers of rural income inequality in developing countries characterized by small family farms (Lanjouw and Stern, 1993; Adams Jr., 2001; Lanjouw and Shariff, 2002; Himanshu *et al.*, 2013). We find that the two primary sources of earnings of these households are cultivation and wages. The importance of income from livestock and non-farm business has not increased. In particular, we are able to highlight the finding that the underlying endowments of economic resources, specifically land, is the driver of inequality. We find that in the decade 2003–13, the salience of cultivation in accounting for income inequality has increased from 39 percent to nearly 50 percent. Not surprisingly, household-level variance in income from cultivation is primarily dependent on variance in landownership.

Third, we find that the share of inequality in total net cultivation income accounted for by land-size groups increased from 10 percent to 15 percent over the decade. In contrast, the contribution of the between- and within-group components of land size to consumption inequality has hardly changed. There are large variations at the sub-national level, across states and agro-climatic zones, in the structures and patterns of income generation in agricultural households. We find, in particular, that the increase in the share of inequality in total cultivation incomes accounted for by differences between land-size groups is much higher for states in the Indo-Gangetic plain, doubling from 13 percent to 26 percent.

[1]See http://hdr.undp.org/en/content/income-gini-coefficient.

[2]Chancel and Piketty (2017) relied on triangulation of host of data sets including tax data to argue that income inequality in India is high.

Fourth, our findings provide an opening into discussions on the challenges in doubling agricultural productivity and incomes of small-scale food producers, one of the targets under the Sustainable Development Goals 2030. The governments of the two most populous economies of the world, China and India, have stated their desire to double the income of farmers by 2020 and 2022 respectively. When we consider the decade of 2003–13, we find no evidence of doubling of income of agricultural households, except for owners who had more than 10 hectares of land, the largest land size group and hence the most prosperous.

Indian agriculture is characterized by small land holdings. Our finding that income inequality is driven by differences in landownership feeds into the larger on-going debate on whether small farm led development[3] is a relevant strategy in Asia and Africa (Collier and Dercon, 2014; Hazell, 2015). Though this debate is on-going, it is not new. Nearly three decades ago, Chakravarty (1987) explicitly noted that the challenge facing policy-makers in India was to make small farms viable. He wrote: "I believe that no sustainable improvement in the distribution of incomes is possible without reducing the 'effective' scarcity of land" (p. 5). This challenge has become even more acute, with the continuing fragmentation of land holdings (to an average size that was down to 1.15 hectares in 2010–11) as a result of which the primary income source of marginal/small farmers is wages and not cultivation.

These core arguments and their supporting evidence are laid out in the rest of the paper. The data issues are discussed in Section 2. This is followed by a discussion of the patterns evident from the data. Section 4, which is key, provides estimates of income and consumption inequality, the contributions of various sources of income to total inequality, and the contributions of inequality within and between various socio-economic groups to total income inequality. Section 5 concludes.

2. Data Sources

We analyze data from NSSO's Situation Assessment Survey of Farmers conducted in 2003 (hereafter referred to as the 2003 survey) and Situation Assessment Survey of Agricultural Households in 2013 (hereafter referred to as the 2013 survey). In both surveys, each household was visited twice. In the 2003 survey, households were visited once between January-August and then again between September-December. In the 2013 survey, households were visited first between January–July and then between August-December. The 2003 survey collected information from 51,770 and 51,105 households in visit 1 and visit 2 respectively. Thus the attrition rate was 1.28 percent. The 2013 survey collected information from 35,200 and 34,907 households in visit 1 and visit 2, respectively. The attrition rate was lower, at 0.83 percent. Both data sets are representative at the national and sub-national levels.[4] In both surveys, each household is given a sam-

[3]For a discussion on whether land fragmentation increases the cost of cultivation in India see Deininger *et al.* (2017).

[4]There are serious concerns that surveys miss households at the very top end of the income distribution and hence underestimate inequality.

pling weight, which makes it possible to generate reliable estimates at the national and sub-national levels. The details of the sampling procedures are available in the reports published by Government of India (2005, 2014).

Since there are some differences in the way households were sampled in the 2003 and 2013 surveys, we first outline how we made the data from these two surveys comparable. For the 2013 survey, NSSO defined an agricultural household "as a household receiving some value of produce more than Rs. 3000 from agricultural activities (e.g. cultivation of field crops, horticultural crops, fodder crops, plantation, animal husbandry, poultry, fishery, piggery, bee-keeping, vermiculture, sericulture etc.) and having at least one member self-employed in agriculture either in the principal status or in subsidiary status during last 365 days" (p. 3, Government of India, 2014). These agricultural households constitute about 57.8 percent of the total estimated rural households. An overwhelming majority of the remaining 42.2 percent of the rural households are agricultural labor households whose income is at the bottom end of the income distribution. In the 2003 survey, unlike the 2013 survey, there was no income cut-off specified. However, unlike in 2013, possession of land was a prerequisite to be considered a farming household in 2003.

So, to compare the two surveys, it is necessary to only include households in the 2003 survey with an income corresponding to Rs. 3,000 at 2013 prices. Using the All India Consumer Price Index - Agricultural Labourers (CPI-AL) as a price deflator, we estimate that number to be Rs. 1,345 in 2003 prices and use this as the cut-off. This filter drops 5,055 households from the 2003 survey, constituting about 10 percent of the total sample.

Both surveys have information on the principal source of income of the household. In 2013, the distribution of households by principal source of income was: Cultivation (63.5 percent), Livestock (3.7 percent), Other Agricultural Activity (1 percent), Non-Agricultural Enterprises (4.7 percent), Wage / Salaried Employment (22 percent), Pension (1.1 percent), Remittances (3.3 percent), and Others (0.7 percent). In 2003, when we focus on households with an income from agriculture of at least Rs. 1,345, we find the distribution to be similar: Cultivation (64.7 percent), Farming other than Cultivation (2.2 percent), Other Agricultural Activity (3 percent), Non-Agricultural Enterprises (6 percent), Wage/Salaried Employment (19.9 percent), Pension (0.5 percent), Remittances (1.8 percent), and Others (1.9 percent). It is evident that in both 2003 and 2013 cultivation and wage or salaried employment were the two major sources of income, accounting for about 85 percent of the total.

In addition to the income filter mentioned above, we restrict the sample in both surveys to households whose primary source of income is cultivation, livestock, other agricultural activity, non-agricultural enterprises, and wage/salaried employment. We ignore those households whose primary source of income is pension, remittances, interest and dividends or others—that is, what may be thought of as "unearned" income. It is necessary to do this because both data sets have detailed information on income received from only four sources: wages, net receipt from cultivation, net receipt from farming of animals, and net receipt from non-farm business. This filter based on the source of income—whereby we drop households whose primary income is unearned—removes an additional 2,411 households from the 2003 survey (constituting another 5 percent of the original total sample) and

1,567 households (about 4 percent) of the total sample in 2013. Having applied these filters, we believe that it is indeed appropriate to undertake comparisons of the 2003 and 2013 surveys. The NSS report corresponding to the 2013 survey states that comparison of results of these two rounds is permissible as long as one takes into account the differences across the two surveys (Government of India, 2014, p. 4).

The one big methodological difference between the two surveys is the recall period for wages / salary: in the 2003 survey the reference period was 7 days, while it was 6 months in the 2013 survey. It is possible that shorter recall periods (as in 2003) tend to bias estimates upwards because respondents tend to forget older information. If that is the case, then the means for 2003 may be biased upwards. We do not see this as a major problem. Changing the mean does not change the distribution, so the inequality estimates should be unaffected. If anything, our understanding of growth and structural change may be more conservative than in reality (because, since the 2003 incomes may be overestimated, the growth rate from 2003 to 2013 may be underestimated).

In both the 2003 and 2013 surveys, the reference period for collecting information on net receipts from farming of animals and non-farm business was 30 days preceding the survey. In both surveys the net income from cultivation is calculated for the year as a whole; i.e., July 2002-June 2003 and July 2012–June 2013 respectively. Given the differences in the reference period for collecting information on the four income sources, we followed the procedure outlined in the NSSO's survey documentation to arrive at the household's estimated monthly income. The household's monthly income can be interpreted as being calculated using a mixed reference period. The household's per capita monthly income is arrived at dividing the monthly income by the household size. We believe that this method may yield a good indicator of welfare because it derives net income (after taking out the cost of agricultural production). In order to be consistent with the literature, we have used the metric of per capita income and per capita consumption instead of income per worker in the household. Our results are unchanged even if use the latter metric.

A final note on consumption: In both visits in 2013, the household's total consumer expenditure was asked with a recall period of 30 days. However, the 2013 survey used a short schedule and a uniform reference period of 30 days for collecting information on consumption, whereas the 2003 survey used a more detailed schedule and a mixed reference period, i.e. 30 days for frequently consumed items and 365 days for less frequently consumed items. We have concerns over the comparability of estimates of consumption inequality across the two surveys. Hence, in the analysis, we do not compare estimates of inequality in consumption over time. For each year, however, we can compare the estimate of inequality in income with that of consumption inequality.

3. Summary Statistics

In the discussion that follows, our objective is to identify the patterns evident in the data and to highlight the extent to which they conform to patterns identified across countries. We restrict our discussions to the four income-generation categories on which detailed information are available; i.e. wages,

and net receipts from: cultivation, farming of animals, and non-farm businesses. Tables 1–4 lay out the basics of income generation in the agricultural economy by state and landownership.

First, it is reasonable to argue that rural is not synonymous with farming. The World Development Report 2008 made the observation that "individuals participate in a wide range of occupations, but occupational diversity does not necessarily translate into significant income diversity in households" (World Bank, 2007, p. 72). This is true in the Indian context too. Consistent with what is found in other countries, although households report one major source of income, their members actually undertake multiple activities. In 2013, among agricultural households who report that cultivation is their principal source of income, 12 percent report not undertaking any additional activity. Since 63.5 percent of households report their principal source of income as cultivation, this implies that 7.6 percent of all agricultural households are engaged only in cultivation. Among those who report livestock as their principal source of income, only 13 percent report not undertaking any additional activity. Among those who report their principal source of income to be wage / salaried employment, 20 percent of these households report that they engage in cultivation.

The second point relates to the significance of land in the determination of income, its source, and its distribution. In Tables 1 and 3, we use the standard classification for rural landholding used in India's Agricultural Census. From the 2013 survey we estimate that 2.6 percent of agricultural households have barely any land, 31.9 percent have between 0.01 and 0.4 hectares of land, 34.9 percent have 0.41–1 hectare, 17.1 percent have 1–2 hectares, 9.4 percent have 2–4 hectares, 3.7 percent have 4–10 hectares, and 0.4 percent have over 10 hectares of land holdings. As evident from Table 1, there is a negative relationship between extent of land owned and share of wage income, with the share decreasing from 64 percent for those owning less than 0.01 hectares to 3 percent for those owning more than 10 hectares. The opposite is true for the share of cultivation income, which increases from 1 percent for those owning less than 0.01 hectares to 86 percent for those owning more than 10 hectares. This finding is consistent with evidence from countries such as Mexico, Chile, Ecuador, China, etc. (see Winters *et al.*, 2009 and the references therein) and this relationship is expected to be stronger in countries where "land scarcity is a greater issue, such as in parts of Asia, and limited land ownership suggests limited options" (p. 1437).

Overall, cultivation provided close to half (49 percent) of total income in both surveys (Table 2). Wages were important (providing about 31 percent of incomes in 2013) but had grown more slowly than income from cultivation. It should not also come as a surprise that at the sub-national level there are marked differences in the relative importance of the four sources of income. The significance of wages to total income also varied widely between states: from 53 percent in West Bengal to 19 percent in neighboring Assam. The most rapid income growth was from farming of animals, an activity that provided 12 percent of total agricultural income in 2013. The least significant income source was non-farm business (8 percent). It is important to note that non-farm businesses did not provide more than 10 percent of total income in any but three states (Kerala, 22 percent; West Bengal, 16 percent; Tamil Nadu, 14 percent). Overall, monthly per capita incomes varied widely,

TABLE 1
QUANTITY AND SHARE OF AVERAGE MONTHLY INCOME FROM DIFFERENT SOURCES BY SIZE CLASS OF LAND OWNED, 2013—ALL INDIA

Size Class of Land Owned (hectares)	Income from Wages	Net Receipts from			Income	Consumption
		Cultivation	Farming of Animals	Non-Farm Business		
	A	B	C	D	A+B+C+D	
<0.01	3,019 (64%)	31 (1%)	1,223 (26%)	469 (10%)	4,742	5,139
0.01-0.40	2,557 (58%)	712 (16%)	645 (15%)	482 (11%)	4,396	5,402
0.41-1.00	2072 (39%)	2,177 (41%)	645 (12%)	477 (9%)	5,371	5,979
1.01-2.00	1,744 (24%)	4,237 (57%)	825 (11%)	599 (8%)	7,405	6,430
2.01-4.00	1,681 (15%)	7,433 (69%)	1,180 (11%)	556 (5%)	10,849	7,798
4.01-10.00	2,067 (10%)	15,547 (78%)	1,501 (8%)	880 (4%)	19,995	10,115
>10.00	1,311 (3%)	36,713 (86%)	2,616 (6%)	1,771 (4%)	41,412	14,445
All Classes	2,146 (31%)	3,194 (49%)	784 (12%)	528 (8%)	6,653	6,229

Source: Source: Calculations from Unit Level Data of 2013 Survey.
*This is for all states and union territories.

TABLE 2
AVERAGE MONTHLY PER CAPITA INCOME BY SOURCES AND MONTHLY PER CAPITA CONSUMPTION EXPENDITURE (MPCE) PER AGRICULTURAL HOUSEHOLD, 2013

		Net Receipts from				
	Wages	Cultivation	Farming of Animals	Non-farm Business	Income	MPCE
Andhra Pradesh	680 (40)	580 (34)	266 (16)	156 (9)	1,681	1,622
Assam	275 (19)	921 (64)	179 (12)	62 (4)	1,437	1,237
Bihar	255 (35)	369 (50)	48 (7)	64 (9)	736	1,097
Chhattisgarh	376 (35)	707 (65)	-3 (0)	0 (0)	1,081	920
Gujarat	536 (33)	621 (38)	399 (24)	74 (5)	1,630	1,566
Haryana	692 (26)	1,404 (53)	480 (18)	85 (3)	2,662	1,951
Jharkhand	367 (34)	341 (32)	306 (29)	54 (5)	1,068	952
Karnataka	580 (31)	1,052 (56)	125 (7)	121 (6)	1,878	1,295
Kerala	1,398 (41)	1,090 (32)	162 (5)	738 (22)	3,388	2,737
Madhya Pradesh	265 (20)	883 (67)	133 (10)	40 (3)	1,321	1,062
Maharashtra	455 (29)	842 (54)	122 (8)	150 (10)	1,569	1,215
Odisha	405 (34)	343 (29)	343 (29)	111 (9)	1,203	974
Punjab	1,034 (27)	2,311 (60)	389 (10)	137 (4)	3,872	2,743
Rajasthan	484 (31)	701 (46)	204 (13)	152 (10)	1,540	1,493
Tamil Nadu	704 (38)	545 (30)	320 (17)	263 (14)	1,832	1,537
Telangana	383 (23)	1,149 (68)	98 (6)	54 (3)	1,683	1,261
Uttar Pradesh	215 (22)	589 (60)	101 (10)	73 (7)	979	1,200
West Bengal	533 (53)	250 (25)	64 (6)	160 (16)	1,007	1,468
All India*	444 (31)	687 (49)	169 (12)	114 (8)	1,414	1,323

Note: Figures in brackets are the state-level shares in average income.
All figures in 2013 Rupees.
*This is for all 36 States and Union Territories. We have not reported the numbers separately for 19 minor states and union territories. The states reported here cover about 95% of the national population.

TABLE 3
RATIO OF AVERAGE MONTHLY INCOME FROM DIFFERENT SOURCES IN 2013 TO THE AVERAGE MONTHLY INCOME FROM DIFFERENT SOURCES IN 2003 (MAJOR STATES ONLY)

Size Class of Land Owned (hectares)	Income from Wages	Net Income from			Total Income
		Cultivation	Farming of Animals	Non-Farm Business	
<0.01	1.01	0.34	3.40	0.63	1.13
0.01-0.40	1.07	1.09	2.78	0.67	1.10
0.41-1.00	1.26	1.40	2.61	1.08	1.38
1.01-2.00	1.23	1.50	3.31	1.61	1.52
2.01-4.00	1.26	1.54	5.39	1.23	1.59
4.01-10.00	1.81	1.76	7.88	1.33	1.85
>10.00	1.23	2.06	3.58	1.32	2.02
All Classes	1.22	1.32	3.21	1.00	1.34

Source: Authors computations from unit level data.

TABLE 4
RATIO OF AVERAGE MONTHLY INCOME FROM DIFFERENT SOURCES IN 2013 TO 2003

Major States	Income from Wages	Net Income from			Total Income
		Cultivation	Farming of Animals	Non-Farm Business	
Andhra Pradesh**	1.59	1.56	3.61	1.07	1.64
Assam	0.69	1.15	2.45	0.51	1.02
Bihar	1.28	0.80	0.44	0.55	0.83
Chhattisgarh	1.25	2.05	1.58	–*	1.57
Gujarat	1.34	1.18	1.84	1.30	1.36
Haryana	1.20	1.85	–*	0.57	1.93
Jharkhand	1.09	0.78	5.88	0.56	1.13
Karnataka	1.27	1.66	1.92	1.49	1.52
Kerala	1.21	1.43	1.58	1.62	1.36
Madhya Pradesh	1.17	1.48	–*	0.59	1.75
Maharashtra	1.29	1.54	1.82	1.49	1.47
Odisha	1.41	1.79	33.35	1.54	2.08
Punjab	1.56	1.80	2.39	0.68	1.67
Rajasthan	1.36	1.60	3.99	1.63	1.63
Tamil Nadu	1.24	1.16	3.93	2.43	1.48
Uttar Pradesh	1.00	1.38	3.76	0.99	1.31
West Bengal	1.18	0.62	1.44	0.76	0.91
All India	1.22	1.32	3.21	1.00	1.34

Notes: For sake of comparability the 2003 income was adjusted to 2013 prices using CPI-AL. So the comparison is in real terms and not nominal terms.
*We do not report this ratio since the average net income from this source is negative or zero in one or both the years.
**Estimates for Andhra Pradesh in 2013 includes Telangana, a new state which was carved out of the former

from Rs. 3,872 in Punjab down to Rs. 736 in Bihar (a five-fold difference); incomes from cultivation varied even more widely, from Rs. 2,311 in Punjab to Rs. 250 in West Bengal (a nine-fold difference). Most disturbing is the finding that monthly expenditures exceeded income in three of the largest states in the country—West Bengal, Uttar Pradesh, and Bihar.

The third point relates to how small and marginal farmers, almost inevitably, lead a marginal existence. The monthly income of farmer households with less than 1 hectare of land is insufficient to cover their reported monthly expenditure[5] (Table 1). This finding is consistent with the evidence from other countries. Rigg *et al* (2016) observe that within east and south east Asia, small land- holding leads to subsistence farming rather than market-oriented farming. After examining the cross-country evidence and reviewing the debate on whether small farms are indeed "beautiful," Hazell (2015, p. 195) concludes that while small farms might be efficient, the land sizes are "too small to provide an adequate income from farming." Hazell also points out that since the beginning of the green revolution the average farm size has declined. As a result, one is likely to observe subsistence farming rather than market-oriented farming. In such a scenario, he conjectures that small farm size will be an impediment to rural non-farm growth.[6]

In fact, in India too, we do not see an increase in the share of income from non-farm business: the contribution of non-farm business to total household income declined from 11 percent to 8 percent over the decade 2003–2013. At the all-India level, real incomes increased by a factor of 1.34 in real terms. Among the components of total income, wages increased by a factor of 1.22, net income from cultivation by 1.32 times, net income from farming of animals by a factor of 3.21 and the net income from non-farm business was unchanged (which implies that its share in total income declined from 11 percent to 8 percent). We find evidence of doubling of income among households with over 10 hectares of land. In fact, all households with at least 1 hectare of land saw their income from cultivation and total income increase by at least 1.5 times (Table 3). This is consistent with the literature on inclusive growth in India which analyses data on consumption expenditure and suggests that growth has bypassed small farms. For example, Motiram and Naraparaju (2015) do not find growth to be inclusive for Indian farmers with less than one hectare of land (a size that constitutes two-thirds of all agricultural landholdings in India).

Our fourth point is about the growth in incomes over the decade 2003–2013 at the sub-national level. We find that the average monthly income increased in all

[5]The data do not allow us to explain how the additional expenditure was financed and hence is an issue beyond the scope of this paper.

[6]"Another efficiency concern is that as small farms get smaller, they may not have the kinds of cash income and expenditure patterns that help drive growth in the rural nonfarm economy. During Asia's green revolution, for example, small farms generated significant marketed surpluses and cash incomes, much of which was spent locally on a range of agricultural inputs, consumer goods and services, and investment goods for their farm and household. These expenditure and investment patterns generated significant secondary rounds of intensive growth in employment in the rural nonfarm economy—or large growth multipliers (see Haggblade *et al*., 2007 for a review of the literature). Small farms today are less than half the size of the small farms of the green revolution era, and many are subsistence farms rather than market-oriented ones. Much may depend on how off-farm sources of income are spent, but the possibility arises that it is now the commercially oriented and medium-sized farms (what used to be called small farms) that are able to generate significant growth multipliers." (pp. 197–8, Hazell, 2015).

states except two (Bihar and West Bengal) (Table 4). There are large differences in the change in average income by land size class at the sub-national level.

The change over the period 2003–2013 is best illustrated by a Pen's Parade (following the vivid description of Jan Pen, 1971) depicting how average incomes have changed by land size class across the Indian states (Figure 1). Since the average size of land holding all-India is just over 1 hectare,[7] we group households in each of the 17 major Indian states into two groups: those with up to 1 hectare of land and those with more. For each state and for each land class, we calculate the weighted average per capita monthly total income and per capita monthly net income from cultivation. The Pen's Parade is presented for the years 2003 and 2013 in Figure 1a for total income and Figure 1b for net income from cultivation. The spearman rank correlation in the ranking of average per capita monthly total income of state-land class size pair for the years 2003 and 2013 is 0.78. The spearman rank correlation in the ranking of average per capita net income from cultivation of state-land class size pair for the years 2003 and 2013 is 0.85.

These figures simply replicate, in greater detail, the core, and at this point unsurprising, finding that landownership is the most important determinant of income and, therefore, as we will argue in the next section, of income inequality. This is compounded by the relative lack of non-cultivation income sources in India's poorest states (Bihar, Jharkhand), so that, in 2013, the total income of the larger landowners in these poorer states averaged less than that of smaller landowners in states like Punjab, Kerala, and Haryana, of course, but also less productive states like Tamil Nadu, Karnataka, and Gujarat.

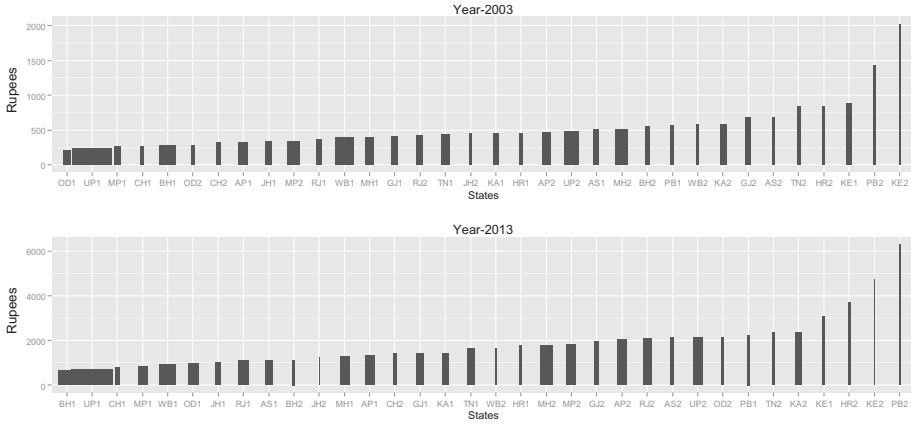
4. Estimates of Consumption and Income Inequality

Among the widely used measures for estimating inequality are the Gini, Log Mean Deviation and Theil Index. The Log Mean Deviation and Theil Indices cannot be estimated when there are zeros or negative values. In our data, 3.4 percent and 6.1 percent of households in the 2013 and 2003 sample respectively have either zero or negative total net income. Hence, we estimate inequality using the Gini Coefficient (G).[8]

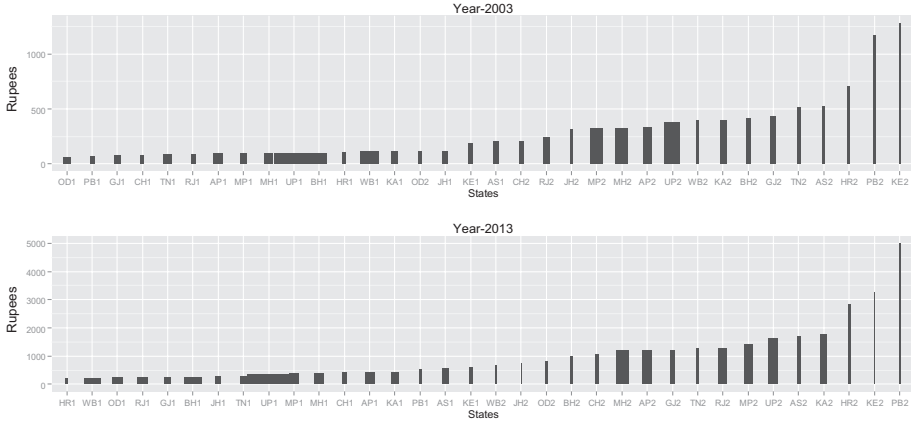
$$\text{Gini Coefficient}\,(G) = \frac{1}{\left(2n^2\mu\right)} \sum_{j=1}^{m} \sum_{k=1}^{m} n_j n_k |y_j - y_k|$$

[7]It is worth noting that the nationwide average of 1.15 hectares masks the reality that small holdings (92 million of the 138 million land holdings) averaged just 0.39 hectares. In several major states, the average landholding size was less than 1 hectare: Kerala (0.22 ha.), Bihar (0.39 ha), Uttar Pradesh (0.76 ha), West Bengal (0.77 ha), and Tamil Nadu (0.8 ha); together, these states covered close to one-quarter of all the agricultural land in the country.

[8]We recognise that in the presence of negative incomes, the maximum value of the Gini coefficient can be greater than 1. Given this, we adopt the standardization technique given by Chen *et al*. (1982) and Berrebi and Silber (1985) to arrive at a value of Gini that is comparable to the value arrived for distributions without any negative incomes. Our results indicate that the income Gini values for the respective years, 2003 and 2013, remain largely unchanged (up to the second decimal) before and after adopting the standardization procedure. Results available on request.



a. Mean per capita total income by size of land holding in major states



b. Mean per capita net income from cultivation by size of land holding in major states

Figure 1. Pen's Parade of Total and Cultivation Income by Size of Landholding, 2003 and 2013
Abbreviations: AP: Andhra Pradesh, AS: Assam, BH: Bihar, CH: Chhattisgarh, GJ: Gujarat, HR: Haryana, JH: Jharkhand, KA: Karnataka, KE: Kerala, MH: Maharashtra, MP: Madhya Pradesh, OD: Odisha, PB: Punjab, RJ: Rajasthan, TN: Tamil Nadu, UP: Uttar Pradesh, WB: West Bengal. The suffix 1 and 2 after each state corresponds to households with less than 1 hectare of land and more than 1 hectare of land.

where y_j,y_k are net per capita income receipts of households j and k respectively; n_j is the number of households with per capita income receipts y_j; m denotes the number of distinct per capita incomes; n is the total number of households; μ is the mean of per capita income receipts across households.

We also estimate inequality using another measure, G.E.(2), which is half the-squared coefficient of variation. This measure is a member of the family of single-parameter Generalized Entropy Measures, with a corresponding parameter value of 2.

$$G.E.(2) = \frac{1}{2}\left[C.V.\left(y_i\right)\right]^2$$

where y_i denotes the net per capita income receipts of a household i.

These measures allow for estimation of inequality despite some households having negative or zero net incomes.

5. Inequality in Income and Consumption

We find that in both 2003 and 2013, income inequality was higher than inequality in Monthly Per Capita Expenditure, or MPCE (Table 5). This is true at the all-India level and for all the major states.[9] Income and consumption inequality in 2013 as measured by Gini was 0.58 and 0.28 respectively. In 2003, the Gini of income was 0.63 and for MPCE it was 0.27.[10]

Did overall income inequality really decline during the period covered by our surveys? The inequality in per capita incomes in 2003 as measured by the Gini was 0.63, with the 95 percent confidence interval of this estimate being 0.62–0.64. The corresponding confidence interval for 2013 was 0.57–0.59. Since the two confidence intervals do not overlap, it is possible to conclude that income inequality did reduce between 2003 and 2013. However, when we measure inequality in per capita incomes by computing half the-squared coefficient of variation (G.E. (2)), we find that in 2013, inequality was 1.84 (95 percent confidence interval: 1.48–2.20). In 2003, it was 2.49 (confidence interval: 1.71–3.27). Since the confidence intervals of the G.E. (2) measure overlap, it is not possible to unambiguously infer that income inequality came down.

If at all there was a real reduction in income inequality at the national scale, it may be partially attributable to changes in three states—Madhya Pradesh, Chhattisgarh, and Rajasthan—where we observe the largest reductions in income inequality. Earlier, in Figure 1, we saw that Madhya Pradesh and Chhattisgarh had moved up in the Pen's Parade between 2003 and 2013. The average net income from cultivation of farmers with less than one hectare of land in these two states improved more than those of farmers with similar landholdings in other states with similar positions in the parade in 2003. A possible explanation is that in Madhya Pradesh[11] and Chhattisgarh, there were substantial investments in rural

[9]The all-India patterns evident in the NSSO data are consistent with the patterns in the India Human Development Survey.

[10]Our estimate of inequality in consumption expenditure in 2013 is comparable with that from the larger survey of consumption expenditure conducted by NSSO in 2011 –12 from which the official estimates of poverty are generated. Based on the 2011–12 survey of consumption expenditure, we estimate the Lorenz Ratio for the distribution of MPCE in a comparable set of households to be 0.28 which is close to the estimate of consumption inequality from the 2013 survey data we analyse in this paper. Similarly, it has been established elsewhere that the estimates from the 2003 survey are comparable with the corresponding detailed survey of consumption expenditure (See Government of India, 2005, p. 20, for a discussion). These results assure us about the quality and reliability of the estimates of consumption expenditure and hence also income from the 2003 and 2013 surveys. Estimates of income from a nationally representative survey conducted in 2016–17, by National Bank for Agriculture and Rural Development, a leading development financial institution, are in the same ball park as the NSSO estimates. Report available: https://www.nabard.org/auth/writereaddata/tender/1608180417NABARD-Repo-16_Web_P.pdf.

[11]Shah *et al*. (2016) have written about how the irrigation reforms undertaken by Madhya Pradesh can act as a model for other states. Singh and Singh (2013) have written about a relatively new organization form, the Producer Company, that enhances "the bargaining power, net incomes, and quality of life of small and marginal farmers/producers in India." http://www.iimahd.ernet.in/users/webrequest/files/cmareports/14Producer_Company_Final.pdf.

TABLE 5
Estimates of Inequality (Gini) in MPCE and Per Capita Income, 2013 and 2003

	Per Capita Income		MPCE	
	2013	2003	2013	2003
Andhra Pradesh*	0.60	0.61	0.27	0.26
Assam	0.52	0.45	0.23	0.18
Bihar	0.61	0.56	0.22	0.21
Chhattisgarh	0.43	0.56	0.22	0.20
Gujarat	0.43	0.53	0.23	0.28
Haryana	0.51	0.60	0.25	0.23
Jharkhand	0.52	0.52	0.24	0.2
Karnataka	0.58	0.56	0.23	0.22
Kerala	0.59	0.52	0.31	0.35
Madhya Pradesh	0.49	0.82	0.25	0.22
Maharashtra	0.57	0.61	0.21	0.23
Odisha	0.53	0.60	0.24	0.23
Punjab	0.53	0.63	0.29	0.25
Rajasthan	0.50	0.65	0.27	0.25
Tamil Nadu	0.59	0.67	0.28	0.28
Uttar Pradesh	0.58	0.65	0.28	0.26
West Bengal	0.53	0.59	0.28	0.23
All- India	0.58	0.63	0.28	0.27

*For comparability with the 2003 data, the 2013 estimates for Andhra Pradesh were calculated by combining it with the new state of Telangana, which was carved out of the former.

infrastructure (in particular, in irrigation), agricultural output increased, and the respective governments ensured that the farmers got the minimum support price for their produce.

6. Contribution of Income Source to Income Inequality

Next we decompose total inequality in per capita income in order to arrive at the contribution made by each of the four components of total income. Toward this, we use the decomposition method proposed by Shorrocks (1982). The share of inequality contributed by each income factor (wages, and net receipts from cultivation, farming animals, and off-farm business) for 2013 and 2003 is reported in Table 6.[12]

Our three key findings are as follows.

First, income from cultivation is the most important factor in income inequality. This is consistent with what one would expect in a case like India, a land poor and labor rich country (Adams, 2001). At the all-India level in 2013, per capita net receipts from cultivation contributed 50 percent of the per capita total income inequality of agricultural households. The contribution of the other sources of income to inequality was as follows: income from non-farm business (22 percent), income from farming of animals (16 percent), and income from wages (13 percent). In certain respects, our results are consistent with the findings by Davis *et al*. (2010) who undertook a cross-country comparison of rural income generating

[12]Estimates are computed using the Ineqfac command in STATA (See Stata Technical Bulletin 48 March, 1999) Available: http://www.stata-press.com/journals/stbcontents/stb48.pdf. Accessed: May 5, 2016.

TABLE 6
Share of Inequality in Per capita Income by Income Source, 2003 and 2013

	Per Capita Net Receipts from							
	Per Capita Wages		Cultivation		Animals		Non-Farm Business	
	2003	2013	2003	2013	2003	2013	2003	2013
Andhra Pradesh	9.9	2.7	67.8	43.3	7.4	49.8	14.8	4.2
Assam	43.0	6.8	43.5	86.5	4.5	5.8	9.0	0.9
Bihar	27.9	27.0	44.8	33.0	13.4	35.2	13.8	4.8
Chhattisgarh	52.7	30.5	40.7	66.4	0.9	2.4	5.7	0.6
Gujarat	23.5	36.6	63.4	47.2	11.4	11.9	1.8	4.2
Haryana	31.8	22.1	55.5	69.5	8.2	8.5	4.4	−0.2
Jharkhand	44.6	6.7	22.7	13.2	11.7	61.1	21.0	19
Karnataka	18.5	8.1	54.7	77.8	14.6	9.2	12.2	4.9
Kerala	30.4	9.5	58.7	21.4	0.7	1.2	10.2	67.9
Madhya Pradesh	8.4	2.9	59.5	51.4	30.8	3.2	1.4	42.6
Maharashtra	17.6	7.2	9.4	72.4	1.9	13.3	71.1	7.2
Odisha	54.3	16.1	12.2	32.7	4.1	42.5	29.4	8.6
Punjab	6.4	12.1	84	63.6	8.7	18.3	0.9	6.0
Rajasthan	26.9	6.3	45.2	50.9	15.6	7.4	12.3	35.3
Tamil Nadu	17.3	6.4	39.5	23.2	1.8	35.3	41.3	35.2
Uttar Pradesh	13.9	12.8	74.5	72.7	7.6	3.4	4.0	10.7
West Bengal	52.6	44.6	4.9	9.4	3.8	22.7	38.7	21.3
All India	24.9	12.8	39	49.8	7.4	15.7	28.6	21.7

Note: The shares sum to 100 for each state for both years.

activities. They analyzed data from 16 countries across four continents, viz. Asia, Africa, Eastern Europe, and Latin America and found that the key drivers of income inequality varied across countries. In 4 countries, the highest contributor to income inequality was income from crop cultivation, in 5 countries it was non-agricultural wage, and in 6 countries it was income from self-employment. India appears to be similar to a subset of 4 countries in their study, viz. Malawi, Madagascar, Tajikistan, and Nigeria, where income from cultivation is the largest contributor to income inequality. In their sample of countries, income from cultivation is the second highest contributor to inequality in Ghana, Pakistan and Ecuador. At the sub-national level, the importance of net receipts from cultivation varies considerably as the driver of income inequality. In some states (like West Bengal and Jharkhand, where the net income from cultivation is the lowest in the country) the contribution of cultivation income to inequality is, not surprisingly, very small (around 10 percent), whereas in other states (like Assam, Karnataka, Uttar Pradesh and Maharashtra) it is very large (over 70 percent).

Second, the contribution of cultivation income to inequality increased over the study period. The share of inequality accounted for by net income from cultivation increased from 39 percent in 2003 to 50 percent in 2013[13] while the contri-

[13]In the Indian context, the only reliable estimate of how income inequality has evolved over time comes from a small sample longitudinal study of Palanpur village in the state of Uttar Pradesh (Himanshu *et al.*, 2013). In Palanpur, income inequality as measured by the Gini Coefficient increased over the period 1957–58 to 2008–09. The contribution of agricultural income to inequality declined from 92 percent to 28 percent while the contribution of non-farm income increased from 8 percent to 67 percent during the 50-year period. Palanpur is a prosperous and in many ways atypical village, which may explain why our findings do not match theirs.

bution of net income from farming of animals more than doubled from 7 percent to 16 percent. The share of the contribution of wages halved from 25 percent in 2003 to 13 percent in 2013 and the share of the contribution of non-farm business income reduced from 29 percent in 2003 to 22 percent in 2013. Davis *et al.* (2010) argue that it is a purely empirical question as to how growth in different components of income will affect inequality.

Understanding the factors behind this change in the share of inequality contributions of various sources of income between 2003 and 2013 brings us to the third point. We follow the methodology used by Jenkins (1995) and use the G.E. (2) measure to decompose this change. We find that the 26 percent reduction in inequality in per capita total incomes from 2.48 in 2003 to 1.84 in 2013 is accounted for by the four factors: wages -15 percent, net income from cultivation -2 percent, animal income 4 percent, and non-farm business -13 percent. The fact that inequality in cultivation incomes has hardly changed, in the face of substantial changes in inequality in other sources of income, shows how income from cultivation is a stumbling block in reducing income inequality.[14] We undertook the same exercise for each state and the results are available on request.

7. Land and Cultivation Income as Determinants of Inequality

In order to analyze the contribution of land ownership to inequality in per capita total incomes, we used the sub-group decomposition methodology of Shorrocks (1984), and classified the households into landownership categories mentioned in Section 3. We find that at the all-India level, in 2003, inequality in per capita incomes between landownership groups accounted for about 3 percent of total inequality in per capita incomes. This proportion increased to 7 percent by 2013. If we consider only the per capita incomes accrued from cultivation, then in 2003, inequality in per capita cultivation incomes between landownership groups accounted for about 10 percent of the total inequality in per capita cultivation incomes. This proportion increased to 15 percent in 2013. There are distinguishable patterns in within- and between-group inequality by land size class across Indian states. In the states which are in the Indo Gangetic plain (Bihar, Haryana, Punjab, Uttar Pradesh, West Bengal), as well as in the states of Chhattisgarh, Madhya Pradesh, and Odisha, the contribution of inequality between landownership groups in explaining inequality in per capita net income from cultivation has increased substantially. For those states in the first group, the contribution of inequality between landownership groups to the total inequality in per capita net income from cultivation increased from 13 percent in 2003 to 26 percent in 2013. In Chhattisgarh, Madhya Pradesh, and Odisha too, the contribution of inequality between landownership groups to the total inequality in per capita net income from cultivation increased from 17 percent to 27 percent. It is only in the "other" group of states that we see that the share of inequality between landownership groups increased only marginally from 9 percent to 10 percent.

[14]While inequality in income from animal farming has contributed to a small increase in income inequality, it still accounts for a much smaller share of total inequality.

Following Cowell and Fiorio (2011), in order to gain additional insights into the socio-economic factors contributing to inequality, we complement the above 'a priori decomposition approach' (i.e. Shorrocks, 1982, 1984 which are based on theoretical axioms) with a regression-based decomposition approach based on Fields (2003).[15] Among the covariates of per capita income that we include are social group of the household (scheduled caste, scheduled tribe, other social groups), gender of the household head, maximum education attained by any member of the household, age composition of the household (number of individuals in the age group 0–6, 7–14, 15–59 and above 60 years of age), work status of household members (number of individuals self-employed, regular wage salaried, casual labor, unemployed, attending educational institutions, engaged in domestic duties, and others), and the land size classes as described earlier.[16]

At the outset we would like to recognize that the share of inequality that is unexplained by the characteristics in the regression is captured in the "residual" term. Since a single equation model is only an approximation to explain the complexity of per capita household income, it is common to encounter such large residuals when using this procedure (e.g. see Brewer and Wren-Lewis, 2016, p. 304). We find that at the all-India level, in both years, the social group to which the household belongs appears to be a relatively unimportant factor in explaining income inequality (Table 7). The reason for this is that differences arise from systematically lower landownership rates for socially marginalized groups. Even after controlling for other covariates, we find land to be of prime importance (especially in 2013) in explaining inequality in both per capita total income and per capita cultivation income. At the all-India level, in 2003, 2.7 percent (9.9 percent) of the inequality in per capita total net income (net cultivation incomes) was accounted for by differences across land size classes. This proportion increased to 6.4 percent (13.3 percent) in 2013.

As a logical next step, we follow Mookherjee and Shorrocks (1982)[17] in order to decompose the change over the period 2003–2013. Their method decomposes the change in the inequality as measured by the mean log deviation $\left(I_0\right)$ at two points in time, 2003 and 2013 in our case, into the following components: changes in inequality within land size groups, changes that can be attributed to change in the population share in each land size group, and changes due to shifting relative incomes between land size groups. Note that the analysis will be restricted to households with net income greater than zero.

$I_0 = \frac{1}{n}\sum_i \ln\left(\frac{\mu}{Y_i}\right)$ where μ is the mean income of the population and Y_i is the per capita net income of the ith household.

At a point in time, this can be decomposed into between and within land group components

$$I_0 = I_{\text{Between}} + I_{\text{Within}}$$

[15]Estimates are computed using the ineqrbd command in STATA.

[16]In an alternative specification we included the household size and proportion of members in each age group and proportion of members in various work status. Our results are unchanged.

[17]This decomposition method is fairly standard and has also been recently used by Brewer and Wren-Lewis (2016).

TABLE 7
Share of Characteristics in Income Inequality from Regression-Based Decomposition

	Per Capita Income	Per Capita Cultivation Income
Survey Year: 2013		
Land	6.4	13.3
Social Group	0.2	0.2
State Dummies	2.9	1.9
Irrigation	0.3	1.6
Maximum Education of any Household Member	1.8	0.8
Gender of Household Head	0.0	0.0
No. of people in various age groups	2.6	1.9
No. of people in various principal activity groups	1.3	−0.5
Residual	84.6	80.8
Survey Year: 2003		
Land	2.7	9.9
Social Group	0.1	0.4
State Dummies	2.4	1.4
Irrigation	0.2	1.1
Maximum Education of any Household Member	1.9	0.4
Gender of Household Head	0.0	0.0
No. of people in various age groups	2.7	2.2
No. of people in various principal activity groups	2.0	−0.8
Residual	88.0	85.3

Note: Results of the underlying OLS coefficient estimates and their significance, are available up on request.

$$I_0 = \sum_g v_g I_{0g} + \sum_g v_g \ln\left(\frac{1}{\lambda_g}\right)$$

where $\lambda_g = \left(\frac{\mu_g}{\mu}\right)$ and $v_g = \left(\frac{n_g}{n}\right)$ and μ_g is mean income of land class g and n_g is it size and n is the overall number of households. As is evident, the first term is the weighted sum of inequality within the land size groups and the second term is the inequality due to differences in the mean income of the land size groups.

Mookherjee and Shorrocks (1982) show that the change in inequality at two points in time can be written as follows:

$$\Delta I_0 \approx \sum_g \bar{v}_g \Delta I_{0g} + \sum_g \bar{I}_{0g} \Delta v_g + \sum_g \left[\bar{\lambda}_g - \overline{ln\left(\lambda_g\right)}\right] \Delta v_g + \sum_g \left(\bar{\theta}_g - \bar{v}_g\right) \Delta ln\left(\mu_g\right)$$

where Δ denotes change, θ_g denotes the income share, and a bar over the variable indicates an average of the 2003 and 2013 values.

Overall inequality, as measured by I_0, reduced by about 9 percent between 2003 and 2013. When we decompose this change into various components as in

the above equation, we find that the change that can be attributed to change in the population share in each land size group (i.e. the sum of the second and third term in the above equation) is small (−2.24 percent). A stark finding is that while within-group inequality (the first term) declined, contributing to a −14.2 percent reduction in the overall inequality, the between-group component (the fourth term) *increased* by 7.4 percent. What this implies is that the change in the relative mean incomes of the land groups is the cause for inequality not decreasing substantially. Overall, whether it be the regression based decomposition or the decomposition of change in inequality as measured by mean log deviation, our findings substantiate the point that land (and hence cultivation income) is increasingly the main source of inequality.

8. Conclusion

In this paper we established that income inequality among agricultural households in India is very high and that it is driven by income from cultivation, which in turn is driven by landownership. We find that there is hardly any impact of change in the population shares across land size classes on the change in income inequality, i.e. it is not fragmentation that is causing the increase in the importance of land over the period 2003–2013. Rather it is the changes in the relative mean incomes across land groups that is leading to this condition. In line with the targets under the Sustainable Development Goals 2030 the Indian government has rolled out a slew of initiatives to double the income of farmers by 2022. The measures include a liberalization of land leasing laws, thereby enabling small and marginal farmers to lease in land. In its report, the Expert Committee on Land Leasing, appointed by Government of India, recognized the need for liberalizing land lease laws and developing a vibrant and well-functioning land rental market (Government of India, 2016). There is increasing recognition that liberalizing land lease laws would help[18] small and marginal landholders lease in land in order to make their operational holdings economically viable. The Expert Group was unequivocal in its report when it wrote: "The critical need of today is to legally allow farmers to lease out without any fear of losing land ownership right and provide support for their upward occupational mobility by way of access to either self-employment or wage employment (p. 15)."

We have shown in this paper the pressing need for ensuring upward mobility in occupation. During the period of our analysis, the reallocation of labor to other work (wage or enterprise) or, in other words, greater diversification of income sources, simply does not appear to have taken place. In fact, we observe that the correlation between total income and cultivation income has actually increased during this period. The only significant change has been in the growth of income from farm animals, but the bottom-line is that cultivation income outgrew both wage income and income from non-farm business in 2003-13. This is not a sign of an agricultural economy undergoing transition. Our findings lead to the conclusion

[18]The evidence from other countries is encouraging in this regard (Deininger and Jin 2008; Jin and Deininger, 2009).

that there has been little change—in terms of distribution or diversification of income sources—in India's agricultural economy.

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