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Agricultural Economics Research Review 2018, 31 (Conference Number), 9-16
DOI: 10.5958/0974-0279.2018.00017.4

Dynamic poverty processes in rural India and the role of livestock

Shweta Bijla*

ICAR-National Dairy Research Institute, Karnal 132001, Haryana, India

Abstract India had made notable progress in reducing poverty. Incidence of poverty declined from 35% in 1993-94 to 22% in 2011-2012. It declined in both urban and rural areas. Poverty, however, remains a rural phenomenon where live 80% of the total poor. For the rural poor, agriculture is the main source of livelihood, but it is vulnerable to several production and market risks. Diversification of agriculture towards livestock is considered a pathway out of poverty, and this paper examines whether it helps escape poverty. Our results show that livestock, especially dairy animals, prevent households from falling into poverty, and also help them escape poverty.

Keywords Livestock, Rural poverty, India

JEL classification C20, Q01, Q19

1 Introduction

"Ending poverty in all its forms everywhere" is the most important goals set by the United Nations Development Program in its agenda on Sustainable Development Goals. In India, although, poverty has reduced considerably, from 35% in 1994 to 22% in 2012 (Narayan & Murgai 2016), it remains widespread in rural areas, where live about 80% of the country's total poor. Agriculture is the main source of livelihood for rural people, but more than 85% farmers depend on tiny pieces of land not exceeding 2 hectares. They are resource-poor, mostly engaged in agricultural and low-wage activities. Chand et al. (2011) report that if agriculture were to be the sole source of livelihood, a majority of such households would have remained trapped in poverty.

Diversification of agriculture towards activities, such as livestock, fisheries, poultry and beekeeping that are more remunerative, generate a stream of income and provide a cushion against climatic shocks, are claimed to be an important pathway to reduce poverty. The demand for animal-based food products is income elastic and has been increasing faster compared to cereals, creating prospects for rural people to diversify their production portfolio towards animal husbandry. The question then arises: is the demand-driven growth in livestock production pro-poor?

Land and livestock are the major resources for rural households, and the evidence show that distribution of livestock is more equitable than land (Ali 2007; Birthal & Negi 2012). Livestock rearing is widespread and largely concentrated among small landholders. In a study conducted on 600 rural households in Uttar Pradesh, Ojha (2007) find 23% households escaping poverty through livestock route. Akter et al. (2008) in a study in Andhra Pradesh find that livestock activity alone cannot make households escape poverty but it can be an important entry point for reducing poverty. There are evidences from other developing countries as well that suggest that animal husbandry can be an important pathway for landless and marginal farmers to escape poverty (Datt et al. 2000; Dolberg 2003; Maltsoglou &Taniguchi 2004; Kristjanson et al. 2004).

Most of these studies have explored the importance of livestock in poverty reduction using the cross-section data, neglecting the dynamic nature of poverty and the factors responsible for changes in poverty. In other words, it is difficult to comment 'who have escaped

*Email: shwetabijla00@gmail.com

poverty or who have fallen in poverty and why' (Krishna 2010). Although there are some studies e.g., Krishna (2010), that analyze livestock's relationship with poverty dynamics, but these are limited to a small sample or are based on recall. In this paper, we analyze role of livestock in poverty dynamics using a large data-set over a period of time.

2 Data

We make use of data extracted from the nationally representative India Human Development Surveys (IHDS) conducted jointly by the University of Maryland (USA) and the National Council of Applied Economic Research (NCAER), New Delhi (India) in 2004-05 and 2011-12. This data-set comprise a panel of 41,554 households from 33 states and union territories spread over 1,503 villages and 971 urban neighborhoods. We focus on rural households that control about 95% of the livestock population (Birthal & Taneja 2006). Our sample comprises of 26,734 households in 2004-05 and 26,693 households in 2011-12[1]. These two rounds of surveys were merged to form a panel of 26,758 households from 22 states. The descriptive statistics presented in this paper are weighted by sample weights of IHDS 2004-05.

IHDS also collected data on household consumption expenditure. For both the rounds, the monthly per capita expenditure was compared with the official poverty line as provided by Tendulkar Committee, and accordingly the households have been classified as poor and non-poor. The same procedure was followed by Thorat et al. (2017) to determine the dynamic poverty processes in context of caste-based discrimination. In our analysis, we compare poverty status of a household in 2011-12 with its status in 2004-05. The poverty status of a household in both time periods has then been compared to know the proportion of households who (i) remained poor, (ii) remained non-poor, (iii) escaped poverty, and (iv) fell into poverty. The poverty dynamics i.e., in and out of poverty, have then been assessed in relation to a household's ownership and composition of livestock.

3 Estimation procedure

We began analyzing poverty dynamics through cross-tabulations of 'who escaped and who fell into poverty' by livestock ownership groups i.e. who owned livestock and those who did not own livestock. We compare poverty between these groups comparing its incidence in terms of proportion, but it can be misleading when the groups are initially at different levels of poverty. Thus, we follow the dynamic logistic regression approach that provides probability of escaping from or falling into poverty. We estimate three dynamic logistic regressions: lagged logistic regression for analyzing overall poverty transitions, and two dynamic regressions separately for those who escaped poverty and who fell into poverty. In the lagged logistic regression, the poverty status (poor/ non-poor) of rural households in 2011-12 is taken as the dependent variable given their poverty status in 2004-05 (Equation 1). These models can be written as:

$$Y_t = \alpha + \beta X_{t-1} + \gamma Y_{t-1} + e_t \quad \ldots(1)$$

$$Y_1 = \alpha + \beta_1 (bovines\ ownership) + \beta_2 (ovines\ ownership) + \beta_3 X_t\text{-}1 + e_t \quad \ldots(2)$$

$$Y_2 = \alpha + \beta_1 (bovines\ ownership) + \beta_2 (ovines\ ownership) + \beta_3 X_t\text{-}1 + e_t \quad \ldots(3)$$

Where, Y_t is the poverty status of a household in 20011-12 and Y_{t-1} is its poverty status in 2004-05). X_{t-1} is a set of initial conditions (caste, education, region, income source etc.) in 2004-05. Y_1 represents whether a household escaped poverty or not (Equation 2), and Y_2 represents whether a household fell into poverty or not (Equation 3). e_t is the error term.

The set of initial conditions or control variables includes:

(i) Region dummies: We divided all states based on their geographical proximity into five regions viz., Northern, Eastern, Central, Western and Southern regions. Northern region is taken as base or reference region.

(ii) Caste dummies: The sample households were classified into two broad groups: (i) those belonging to the scheduled caste or tribe (SC/ST), and (ii) non-SC/ST. The SC/ST group is taken as a reference category.

(iii) Highest education level of an adult in the family: This variable provides information about the highest level of education attained by an adult in the household. The education level was classified into four categories: (i) illiterate, (ii) primary & secondary, (iii) matriculation & intermediate, and

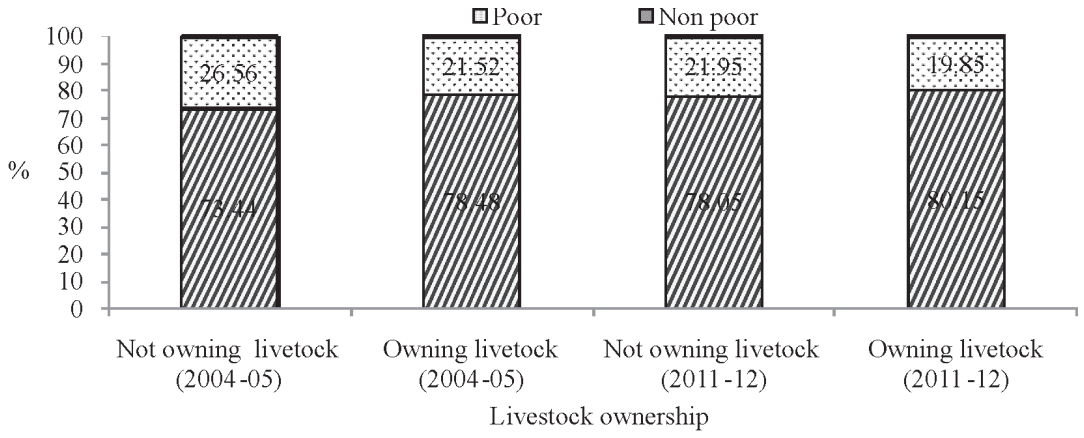

Figure 1. Poverty rates across livestock ownership (2004/05 and 2011/12)
Source: Estimated by author from IHD Surveys.

(iv) graduate & above. Here, the category illiterate is taken as a reference.

(iv) Main income source: Income sources were classified into four groups: (i) crop cultivation and allied activities, (ii) labour, (iii) salaried jobs, and (iv) others (business, shops, government and other benefits, etc.). Cultivation and allied activities was taken as base category.

(v) Cultivated area: The area cultivated by each household in acres.

(vi) Livestock: For livestock we included whether the household (i) owned cow/ buffalo, and (ii) sheep/ goat.

4 Results

4.1 Descriptive statistics

Our results show a decline in rural poverty from 24% in 2004-05 to 20% in 2011-12. However, the households that did not own livestock in 2004-05 had a larger proportion of poor (26.56%) as compared to those who owned livestock (21.52%) (figure 1). We find similar evidence for 2011-12.

One of the reasons for decline in poverty could be a higher rate of escaping poverty by the previously poor than the rate of falling into poverty by the previously non-poor. Of the total rural households, 15% had escaped poverty and 12% fell into poverty. Hence, we can say that many households have escaped poverty and have shown transitory poverty. On the other hand, there are some households who could not escape poverty and remained poor (8.5%). In other words, 64% of the rural poor (in 2004-05) managed to escape poverty in2011-12, and about 16% of the rural non-poor fell into poverty (Thorat et al. 2017).

The share of those who escaped and fell in poverty could have been different among those who owned livestock and those who did not own livestock. We classified livestock owners into four groups: (i) NN (who did not own livestock in 2004-05 as well as in 2011-12), (ii) YN (who owned livestock in 2004-05 but not in 2011-12), (iii) NY (who did not own livestock in 2004-05 but owned in 2011-12), and (iv) YY (who owned livestock in 2004-05 as well as 2011-12). Table 1 shows their distribution.

There was no change in ownership status for 68% of the households during this period; almost half of the households did not own any livestock in 2004-05 as

Table 1. Distribution of households by livestock ownership

Group	% of total households	Estimated number of households
NN	34.18	58338089
YY	34.72	59257478
NY	14.38	24539601
YN	16.72	28537398
	100.00	170672566

Source: Estimated by author from IHD Surveys.

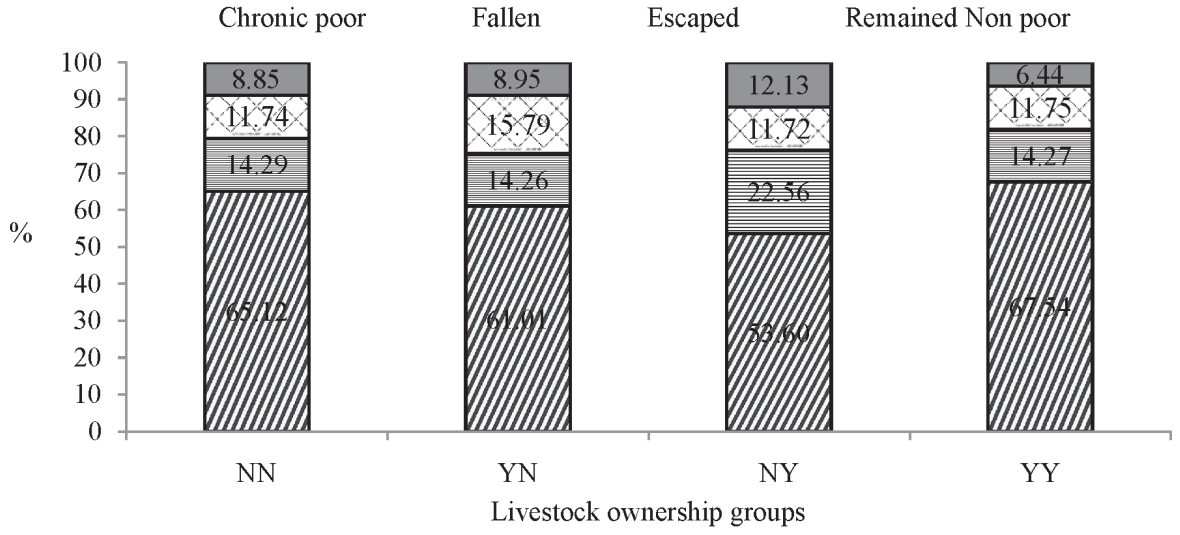

Figure 2. Poverty rates across livestock ownership groups
Source: Estimated by author from IHD Surveys.

well as in 2011-12 (NN), and another half remained engaged in animal husbandry (YY). About 14% households did not own livestock in 2004-05 while 17% abandoned livestock in 2011-12.

Figure 2 shows poverty status across ownership groups. Interestingly, the largest share of those escaping poverty was from NY group (those who owned livestock in second in 2011-12 but not in 2004-05) *i.e.,* 22.56%. Also, the proportion of those falling into poverty was the least for this group (11.72%). On the whole, the group that owned livestock throughout had the highest proportion of the total non-poor (YY), i.e. 82%. This group also had the lowest proportion (18.20%) of the total poor.

Further, it is of interest to know what type of livestock is more instrumental in reducing poverty. Figure 3 shows that those who owned cows and buffaloes had a poverty incidence of 19% as compared to 27% among those who owned other livestock species i.e., sheep and goats. This was also true in 2011-12 (figure 4). Interestingly, the poverty declined among those who owned any type of livestock; to 17% among those who owned cows and buffaloes, and 23% who owned sheep and goat.

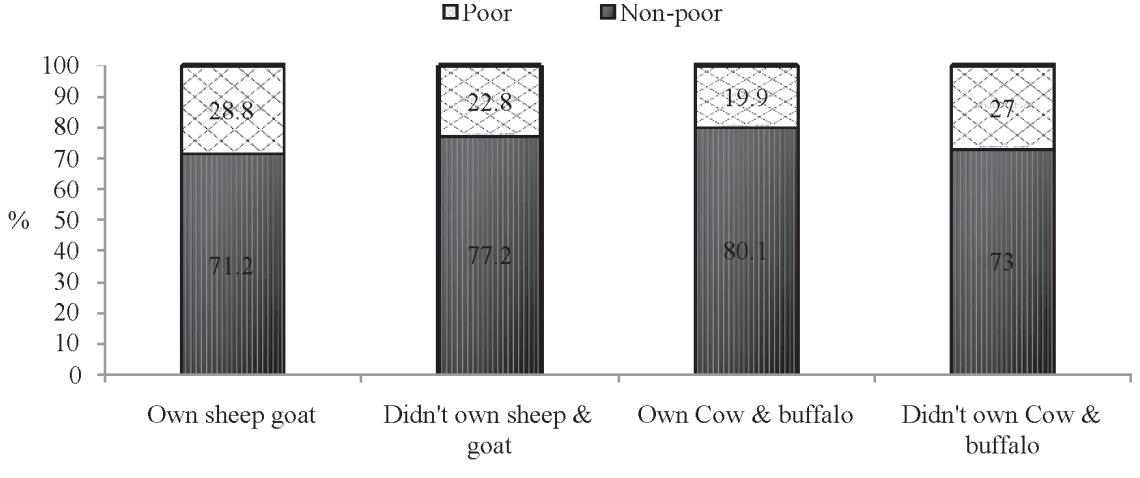

Figure 3. Poverty rate by type of livestock ownership in 2004-05
Source: Estimated by author from IHD Survey.

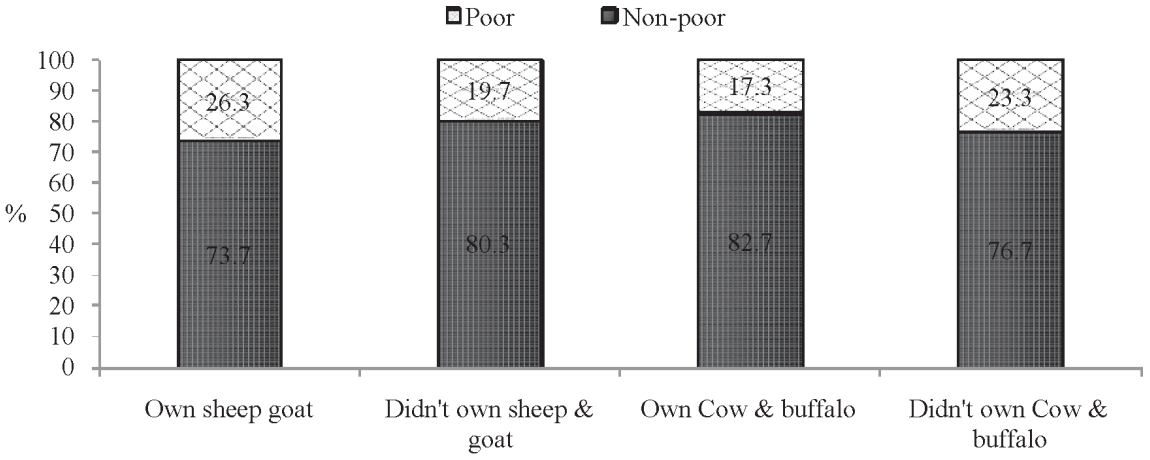

Figure 4. Poverty rate by type of livestock ownership in 2011-12
Source: Estimated by author from IHD Survey.

It is clear that more non-poor households are those who own milch cows and buffaloes. The households who owned cows and buffaloes in 2004-05 and also in 2011-12 have been more successful in escaping poverty (75.6%). The question then arises, whether the dairy animals also influence the rates of falling and escaping poverty.

4.2 Econometric results

The descriptive statistics gives an indication of the role of livestock in poverty reduction. However, there could be several other factors that may influence poverty status of households. In our poverty regression, we include some of the important variables as controls alongwith livestock ownership in the set of explanatory variables. First, we run a lagged logistic regression with poverty status in 2011-12 on household characteristics in 2004-05, controlling for location, caste, education and occupation. Here, we estimate two specifications; separate ownership of bovines and ovines in specification (1) and retain one of these which is significant for inclusion in specification (2).

Table 2 presents odds of a household becoming poor in 2011-12, controlling for the household characteristics. The probability of becoming poor reduces by 2.5% with an additional acre of land. Further, those who own milch cows and buffaloes have 17% less chances of becoming poor compared to those who do not. Interestingly, the response of poverty is stronger for livestock than for land. This confirms the observation of Birthal & Taneja (2006) and Birthal &

Table 2. Regression of overall poverty status in 2011-12 on 2004-05 characteristics

Variables	Becoming poor in 2011-12	
Region	1	2
Eastern	1.779***	1.846***
Central	1.691***	1.712***
Southern	0.701***	0.715***
Western	1.354***	1.396***
Hilly	1.308***	1.315***
Caste dummy		
Non-SC/ST	0.580***	0.575***
Education		
Primary& secondary	0.806***	0.797***
Matric & intermediate	0.599***	0.589***
Graduation and above	0.436***	0.427***
Income source		
Labour	1.093*	1.102*
Other	0.800***	0.808***
Salary	0.545***	0.547***
Cultivated area	0.975***	0.978***
Owned bovines (milch)	0.830***	
Owned ovines	1.203***	
Number of cows and buffaloes		0.939***
Previous poverty status	2.125***	2.141***
Constant	0.324***	0.319***
No. of observations	26758	26758
Count R square (%)	80.2	80.2

Source: Estimated by author from IHD Surveys.
Note: *** = p < .001; ** = p < .01; * = p < .05.

Negi (2014) who found that at similar rate of growth, compared to agriculture the livestock has a larger effect on poverty reduction.

Unexpectedly, this does not hold in the case of ovines perhaps because of their low milk yield (0.5 kg/ day). Most of the income (90%) is derived from wool and meat. The annual net returns per goat are in the range of Rs370 to 652 (Kumar 2007), as compared to Rs2028 for a cow and Rs 3720 for a buffalo(Suresh et al. 2009). The income from milk accounts for a major share (68%) in farmers' monthly income, while income from meat and wool account for only 7% and 0.3%, respectively (DAHD&F 2016-17). In general, ovines are reared by the poor who cannot afford rearing bovines because of their higher initial costs and feed and fodder constraints.

Since the ownership of cows and buffaloes has a significant effect on poverty reduction, in specification (2) of the lagged logistic regression we replaced ownership status with herd size (number of cows and buffaloes). The odds ratio suggests with increase in herd size, the chances of a household to become poor are less by 6%. Further, we also find that for those who are literate and belong to non-SC/ST have less chances of becoming poor. These results suggest a crucial link of poverty with social status and human capital, and imply the need to focus poverty reduction efforts more on lower castes and investment in human capital for sustainable reduction in poverty.

We further probe the role of dairy animals in escaping poverty and falling into poverty. We estimate four regressions: two for escaping poverty and two for falling in poverty. Results are shown in table 3.

Escaping poverty: Here, our dependent variable is whether the previously poor households had escaped poverty or not. The explanatory variables include all the controls as in table 2 and ownership of cows/

Table 3. Regressions of 2004-05 to 2011-12 poverty transitions on 2004-05 characteristics

Variables	Escaping		Falling	
Region	1	2	1	2
Eastern	0.788**	0.775**	2.121***	2.236***
Central	0.626***	0.623***	1.524***	1.559***
Southern	1.519***	1.498***	0.725***	0.743***
Western	0.954	0.939	1.501***	1.560***
Hilly	0.557**	0.566**	1.234*	1.257*
Caste				
Non-SC/ST	1.736***	1.744***	0.592***	0.584***
Education				
Primary &secondary	1.269***	1.278***	0.818***	0.806***
Matric & intermediary	1.749***	1.764***	0.621***	0.610***
Graduation and above	2.211***	2.226***	0.449***	0.438***
Income Source dummy				
Labour	1.033	1.024	1.207***	1.215***
Other	1.217	1.205	0.807**	0.812**
Salary	1.147	1.132	0.492***	0.490***
Cultivated area	1.015	1.013	0.974***	0.977***
Owned bovines (milch)	1.180**		0.835***	
Owned ovines	0.935		1.281***	
Number of cows and buffaloes		1.065*		0.948**
Constant	1.168	1.190	0.283***	0.281***
No. of observations	6122	6122	20636	20636
Count R square (%)	63.5	63.5	85.1	85.1

Source: Estimated by author from IHD Surveys.
Note: *** = p < .001; ** = p < .01; * = p < .05.

buffaloes and sheep/goats. As expected, those who owned bovines had 18% more chances of escaping poverty than who did not. In its second specification we include herd size in place of ownership status and find the chances of escaping poverty increasing by 6.5%. The results regarding caste and education are almost similar as reported in table 2. This suggests that escaping poverty is also tied to traditional privileges. Lower castes are historically disadvantaged in terms of asset ownership and human capital which is crucial for poverty alleviation.

Falling into poverty: Whether the previously non-poor households fell in poverty or not is our dependent variable here. The ownership of milch animals lowers probability of falling into poverty by 17%. The effect of herd size is also similar i.e., the increase in herd size reduces chances of falling into poverty by 5%. The salaried jobs and cultivated area prevent households from falling into poverty (Kristjanson et al. 2006). Unexpectedly, the ownership of ovines ownership increases chances of falling into poverty.

5 Conclusions

Our results confirm that the poverty in rural areas has fallen, and livestock, particularly dairy animals, have played a significant role in it. Bovines prevent households from falling into poverty, and also help them to escape poverty. On the other hand, small ruminants are not much effective in poverty alleviation as these are mainly reared by the extremely poor households for subsistence purpose. On the other hand, India's majority of the population is vegetarian with milk and milk products as important components of its diet. Market for dairy products is better organized than for the meat and wool. These results clearly suggest need for greater investment in livestock sector to harness its pro-poor growth potential.

Acknowledgement

The author is grateful to Dr. Smita Sirohi for providing consistent support and valuable guidance throughout the study and to the University of Maryland (USA) and the National Council of Applied Economic Research (NCAER), New Delhi (India) for making data available on the Inter-university Consortium for Political and Social Research (ICPSR) website.

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