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Regional dimensions and determinants of income diversification in rural India

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Abstract Using a nationally representative data-set this paper examines the sources of farmers' income and their determinants. The study finds that middle income regions are more diversified relative to the poor and rich regions. Around 60% of the total income is contributed by agricultural and allied activities and remaining comes from farm and non-farm wage including salaries and non-farm businesses. Diversification is more prevalent in agro-climatically fragile regions characterised by greater risks to primary source of income. It is also found to be higher in low-income regions with relatively better infrastructure. Households in economically well-off regions tend to specialise; and those who diversify do it for income enhancement. In sum, income diversification is more associated with distressed factors. The paper suggests region-specific policies for sustenance of income generating activities for a smooth economic transformation.

Keywords Income sources, Diversification, Determinants, Rural

JEL classification O15, P25, Q18, R11

1 Introduction

Globalisation and market liberalisation have posed new challenges to the viability of small farms (Patnaik & Chandrasekhar 1995; Shiva et al. 1999; Bhalla 2004; Bhalla & Singh 2009). About 85% of the Indian farmers are small (less than or equal to one hectare) (GOI 2014a). Despite a significant decline in its share in gross domestic product (GDP) to 15.4% in 2015-16 from 29.5% in 1990-91, agriculture engages half of the country's workforce (GOI 2014b). The policymakers and development practitioners are fully aware that Indian peasantry has been facing severe livelihood crisis for quite some time. This crisis has severe implications for poverty reduction, and food and nutritional security. In recent decades, several initiatives have been taken to minimize the adverse effect of agrarian crisis. These include provision of guaranteed employment, increased flow of institutional credit and strengthening of public distribution system

for food, raising of minimum support prices of crops, crop insurance etc. Diversification of income opportunities has been viewed as an important means of sustainable economic transformation because of its crucial role towards smoothening of income shocks during agricultural downtrends (Haggblade et al. 2007; Fantini 2013; Newman & Kinghan 2015).

Non-farm sector is viewed as a residual as well as an agent of structural transformation of rural economy (Vaidyanathan 1986; Ellis 1998; Shariff & Lanjouw 2004; Haggblade et al. 2007; Binswanger-Mkhize 2012; Singh 2012). And, it is well recognized that rural non-farm sector provides alternative income opportunities and encourages income diversity among rural households (Barret et al. 2001; Lanjouw & Lanjouw 2001; Reardon et al. 2007).

Income diversification may be an outcome of the survival or accumulation strategy and thus the heterogeneity of diversification process lies in its origins and outcomes (Ellis 1998). This process holds true for households as well as regions. For instance,

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the agriculturally developed regions may experience income diversification due to surplus extraction from agriculture and investment in non-farm activities, while the agriculturally backward regions may diversify due to entirely different reasons in order to sustain steady flow of meagre incomes (Barrett et al. 2001; Haggblade et al. 2010; Himanshu et al. 2011). Thus, there are several factors that influence households' decision to diversify. Their relative role in diversification strategies may vary across regions. This paper (i) examines income sources or extent of income diversification across households and regions, and (ii) identifies push and pull factors underlying households' decisions to diversify.

Rest of the paper is organized as follows. Next section briefly discusses the data and methodology. Regional dimensions of income diversification are examined and discussed in section 3. Section 4 documents income disparities across agricultural households and regions. Determinants of income diversification are discussed in section 5. The final section concludes the discussion.

2 Data and methodology

The paper makes use of household-level data from the 'Situation Assessment Survey of Agricultural Households' conducted in 2012-13 by National Sample Survey Office (NSSO) of the Government of India. This data-set provides information on income from various sources for agricultural households.¹

Income diversification can be defined in several ways (Delgado & Siamwalla 1997; Reardon 1997; Sujithkumar 2007). However, in the present study, we consider it as the number of income sources and the income obtained from these. A household with more number of income sources can be considered as more diversified. In addition, a household earning almost equal amounts from different activities is considered more diversified (Sujithkumar 2007).

To estimate the extent of income diversification we calculate Simpson Index of Diversification (SID).

$$SID = 1 - \sum_{i=1}^n P_i^2$$

Where, $i = 1, 2, \dots, n$; n is number of income sources and P_i is the proportion of income from i^{th} source in the total household income. In the survey, there are five broad income sources namely, crop cultivation, livestock activity, non-farm business, agricultural wage and non-agricultural wages/salaries. SID is bound by 0 and 1, where 0 indicates complete specialization and 1 signifies complete diversification, and a movement from 0 to 1 indicates an increase in income diversification (Sharma & Singh 2014). While, calculating SID we have dropped 5,178 observations with negative income.

Determinants of income diversification have been analysed through Tobit regressions.² The SID has a censored distribution; it lies between zero to one, which implies that some observation above or below a threshold are misreported at the threshold (Hansen 2012). Tobit model estimates a regression line utilising entire information at the limit and those above it (Alobo & Bignebat 2017). Therefore, there is some latent process y_i^* with unbounded support, but only

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* \geq 0 \\ 0 & \text{if } y_i^* < 0 \end{cases} \text{ is observed. Here, } i=1,2,\dots,N \text{ denotes}$$

the sample size, y_i the dependent variable (SID) and y_i^* is the latent variable only observed for income shares above a threshold ($y_i^* \geq 0$). The latent variable model proposed by Tobin was, $y_i^* = x_i'\beta + e_i$, where $e_i \sim iid N(0, 1)$ with the observed variable y_i generated by the above expression. Here, x_i represents a vector of independent variables (such as socio-economic variables and attitudinal variables of the households), β is a vector of coefficients to be estimated and e_i is the normally distributed error term.

3 Regional dimensions of income diversification

The dynamics and pattern of rural income diversification may vary considerably across regions. The nature of income diversification depends on the conditions, such as location and level of development and growth of agriculture (Lanjouw & Lanjouw 2001;

¹ An agricultural household for this survey was defined 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.

² The mathematical interpretation of the Tobit model is derived from Hansen (2012). The model was developed by Tobin in 1958 as the censored regression model.

Shariff & Lanjouw 2004; Reardon et al. 2007). It is argued that diversity in economic activities varies with the level of economic development; at low level of development the households adopt multiple-economic activities, and they move towards specialisation as the economy proceeds on the path of development. This process has been called “inverted U” hypothesis (Reddy et al. 2014). An analysis at regional level, thus, offers interesting perspectives for better understanding of the contexts in which diversification occurs (Alobo & Bignebat 2017).

Based on the level of diversification (measured through SID) and the average income of households we categorise different state into four classes (figure 1): (i) high-income, high-diversification, (ii) high-income, low-diversification, (iii) low-income, high-diversification, and (iv) low-income, low-diversification.

Punjab and Kerala appear to be outliers due to significantly higher income and low level of

diversification. Hence, a separate analysis was conducted for these states. Finally, all states were categorised into five classes (table 1). This classification is an over-simplification of regional dimensions, but is expected to contribute to the debate on rural income diversification.

The heterogeneity in diversification strategies is an outcome of “demand-pull” and “distress-push” factors (Ellis 2000; Barret et al. 2001; Escobal 2001; Haggblade et al. 2010; BIRTHAL et al. 2014). Distress-push phenomenon is associated with economic adversities or low productivity in agriculture, forcing an individual or a household to resort to multiple economic activities to escape further fall in income. Demand-pull diversification, however, is a response to new opportunities due to increased productivity or income. The former type of diversification is associated with economically poorer or ecologically fragile regions where the households participate in less-productive, low-scale and low-paying agricultural/non-

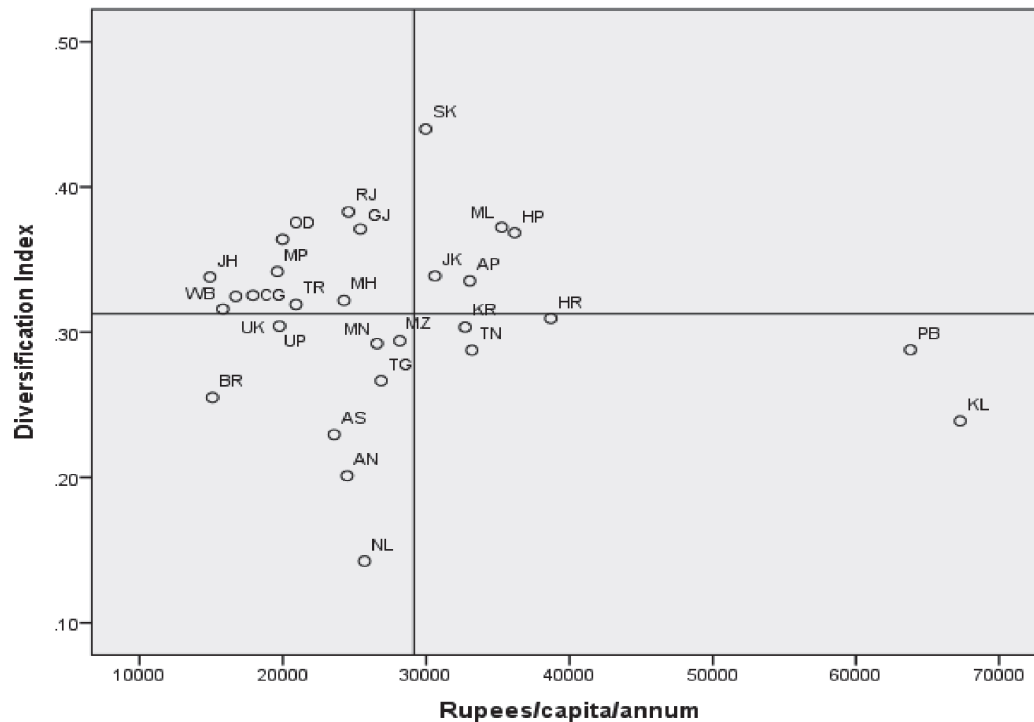


Figure 1. Per capita income and diversification across states

Source: GOI (2013)

Notes: Excluding negative incomes, the mean per capita income is Rs 28,248 with a mean SID of 0.33.

PB: Punjab; KL: Kerala; HR: Haryana; TN: Tamil Nadu; JK: Jammu & Kashmir; HP: Himachal Pradesh; SK: Sikkim; ML: Meghalaya; AP: Andhra Pradesh; UK: Uttarakhand; RJ: Rajasthan; TR: Tripura; WB: West Bengal; JH: Jharkhand; OD: Odisha; CG: Chhattisgarh; MP: Madhya Pradesh; GJ: Gujarat; MH: Maharashtra; UP: Uttar Pradesh; BR: Bihar; AN: Arunachal Pradesh; NL: Nagaland; MN: Manipur; MZ: Mizoram; AS: Assam; TG: Telangana.

Table 1. Division of states based on Income and Diversification level

States	Description
Punjab, Kerala	High-income outliers
Haryana, Karnataka, Tamil Nadu	High-income, low-diversification
Jammu & Kashmir, Himachal Pradesh, Sikkim, Meghalaya, Andhra Pradesh	High- income. high- diversification
Uttarakhand, Rajasthan, Tripura, West Bengal, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, Gujarat, Maharashtra	Low-Income, high diversification
Uttar Pradesh, Bihar, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Assam, Telangana	Low-income, low-diversification

agricultural activities. However, the latter type of diversification is associated with well-off regions where the households participate in highly remunerative activities to enhance their income-level (Ellis 2000; Vatta & Sidhu 2007; Kumar et al. 2011; Adebayo et al. 2012; BIRTHAL et al. 2014).

Punjab and Kerala differ in their economic structure, but the economic progress in rural areas there is commendable. Their location in low diversification quadrant (figure 1) is on account of high degree of specialisation in a few activities, e.g. cropping activities in Punjab, and plantations in Kerala. The households in high-income, low-diversification region are specialising in a few economic activities. These regions fit in the theoretical understanding that economically developed regions are less diversified. The region with high-income, high-diversification comprises hill states, where agricultural activities are limited due to difficult terrain and smallholdings, but are more diversified towards high-value crops and non-farm activities. The region with low-income, high-diversification comprises economically backward states located in

eastern and central parts of the country. It is highly diversified but towards low-income, low-risk crops and low-paid wage activities. This region is prone to frequent climatic shocks of droughts and floods. The north-eastern states have low level of economic development and lower degree of diversification owing to lack of income opportunities and poor infrastructure.

4 Regional dimensions of income diversification

Diversification is important for securing livelihood security when households have limited assets, mainly land; and employment opportunities are casual and seasonal. A single source of income may not be sufficient to sustain livelihood and farmers may adopt different activities simultaneously. Table 2 shows distribution of farm households by their primary source of income (a primary source is defined as the source which yields maximum income amongst all income sources).

A majority of the households in all the regions (except Punjab and Kerala) report crop cultivation as their

Table 2. Distribution of farm households by their primary source of income (%)

Regions	Cultivation of crops	Livestock	Other agricultural activities	Non-farm business	Wages/ salaries	Others*	Total
High-income outliers	31.1	7.7	8.7	9.3	31.0	12.3	100.0
High-income, low-diversification	62.5	7.1	1.9	2.8	23.7	2.0	100.0
High- income. high- diversification	50.9	3.3	1.4	5.1	33.2	6.1	100.0
Low-Income, high diversification	63.4	3.1	0.8	4.8	23.7	4.2	100.0
Low-income, low-diversification	69.3	3.1	0.4	4.6	16.4	6.2	100.0
All India	63.5	3.7	1.1	4.7	22.0	5.1	100.0

Source: GOI (2013).

Note: *Others include pension, remittances etc.

Table 3. Share of income sources in total income (%)

Regions	Crop cultivation	Livestock wages	Farm wages	Non-farm business	Non-farm	Total
High-income outliers	48.09	7.55	4.71	28.56	11.10	100.00
High-income, low-diversification	47.35	12.63	10.08	21.47	8.47	100.00
High-income, high-diversification	32.58	12.26	13.71	32.77	8.68	100.00
Low-income, high diversification	44.94	13.75	12.09	20.93	8.29	100.00
Low-income, low-diversification	61.84	10.21	4.81	4.21	18.93	100.00
All-India	47.80	12.07	10.39	21.67	8.07	100.00

Source: As for table 2.

primary source of income. Wages/salaries comprise the next most important income source. Non-farm business and animal husbandry are reported as primary income sources by about 5% of the households. Interestingly in Punjab and Kerala other income (pensions, remittances, etc.) and non-farm business activities are relatively more important.

Table 3 shows composition of the household income. Crops contribute a major share in the total income and in all the regions. And, as expected non-farm wages comprise the second major income source, followed by livestock, farm wages and non-farm business activities. Their relative importance, however, varies across regions. In Punjab and Kerala, crops and non-farm wages contribute 48% and 29% to the total income, respectively. Non-farm business contributes more than one-tenth. Farm wages are not an important income source in these states. We observe almost a similar pattern of distribution in high-income, low diversification states. Here, livestock and farm wages also emerge as important sources. In high-income, high-diversification region, crops and non-farm wages each contribute to about one-third to the total income. Almost a similar pattern is observed in low-income, high-diversification region but the contribution of crops is more than twice that of non-farm wages. In contrast, in low-income, low-diversification region, crops with a share of 62% comprise the most important income source, and followed by non-farm business activities. Wage opportunities in this region appear to be limited.

5 Determinants of income diversification

5.1 Descriptive statistics

In this section, we identify factors associated with diversification in each region. These include personal

and household characteristics (age, education, gender, household size, dependency ratio, social group), resource endowments (livestock, land size, asset value), access to infrastructure (electricity, drinking water, irrigation), and institutions (technical education, information, membership of social organisations, credit) and location.

Age of the household-head can be linked to greater possession of skills and experience. Hence, it is hypothesised that younger household-heads may have a more diversified income portfolio. Education improves skills and understanding, and therefore it is expected that educated household-heads have better access to income opportunities. It is also claimed that male-headed households are more likely to diversify (Zakaria et al. 2015). Caste is considered to influence income levels and access to income opportunities via access to assets, technology and institutions. We expect lower-caste low-income households to be more diversified. Dependency ratio indicates capability of a household to meet its subsistence needs (Khatun & Roy 2012). Higher the dependency ratio, less the ability. Hence, a household with a higher dependency ratio is hypothesized to diversify more.

Landholding size is an indicator of productive asset. Smaller the farmers, more diversified is their income portfolio. Irrigation influences agricultural productivity and it also creates opportunities for diversification. Likewise, the housing structure, whether pucca or kutcha, may influence the degree of diversification. Other important variables that may influence the nature and extent of income diversification include farmers' access to and use of information, acquisition of skills through training and access to credit. Table 4 provides description of the variables used in Tobit model.

Table 4. Description of nature of variables used in the study

Variables	Nature of variable	Description
Age	Continuous	Years
Education	Continuous	Years
Gender	Categorical	Male=1; female=0
Social group	Categorical	General, OBC=1; ST/SC= 0
Dependency ratio	Continuous	(Non-working members/ total members) *100
Irrigation area as% to total area	Continuous	%
Operational land	Continuous	Hectares
Household structure	Categorical	Pucca, semi-pucca=1; kutcha=0
Access to information ³	Categorical	Yes=1; no=0
Adoption of information ⁴	Categorical	Yes=1; no=0
Training ⁵	Categorical	Yes=1; no=0
Access to credit	Categorical	Yes=1, No=0

Note: SC, ST and OBC stand for schedule caste, schedule tribe, other backward caste respectively.

Table 5. Households characteristics- categorical variable (%)

Regions	Male headed	SC/ST	Pucca/ semi-pucca	Access to credit	Access to information	Adoption of information	Training attained
High-income outliers	86.3	14.8	98.7	66.1	50.2	56.4	3.2
High-income, low-diversification	91.2	20.0	94.2	70.2	49.2	51.8	6.5
High- income. high- diversification	89.4	29.7	93.0	62.2	54.4	56.1	1.9
Low-Income, high diversification	93.2	37.8	90.1	49.3	44.0	44.7	2.1
Low-income, low-diversification	91.6	24.2	88.4	43.1	40.5	41.3	2.2
All India	92.0	30.1	90.3	50.3	44.2	45.2	2.6

Source: As for table 2.

In the following paragraphs, we discuss regional differences in the key variables. Table 5 presents means of qualitative variables. A striking feature emerging from this comparison is that in the low-income, high-diversification region there is a high proportion of lower caste households and they also have lower access to information and credit. On the other hand, their proportion is one of the lowest in the high-income, low diversification states (including Punjab and Kerala). In these states, they have better access to credit and information.

In table 6 we compare means of continuous variables. The household-heads in the high-income, low-diversification states are relatively older and more educated. Irrigation level is also high there, except in the region with low-income low-diversification. Interestingly, the level of irrigation is the lowest in the high-income, high-diversification category of states.

The explanatory variables⁶ are tested for multicollinearity, and we do not find any significant

³ The survey has asked households about their access to modern technology and technical advices in the field of agriculture. From a given list of agencies/sources, the households were asked to report 'whether they have accessed any of these sources for any technical advice' (NSSO, 2013).

⁴ Households in the survey have also been asked if they have adopted the information/technical advice in their agricultural operations.

⁵ The survey has asked- whether an individual has attended any formal training in agriculture or not?

⁶ For state-wise details, refer table A2, A3, A4 and A5 in appendix.

Table 6. Mean of quantitative variables used in the Tobit model

Regions	SID	Age	Education	Irrigation (%)	Land operated	Dependency ratio
High-income outliers	0.27	55.54	8.17	54.15	1.22	0.55
High-income, low-diversification	0.31	49.30	6.51	51.72	1.40	0.57
High- income. high- diversification	0.34	48.8	5.62	42.73	1.11	0.61
Low-Income, high diversification	0.36	47.08	5.60	43.52	1.14	0.54
Low-income, low-diversification	0.29	47.46	5.65	77.45	0.75	0.45
All India	0.33	47.80	5.78	56.76	1.02	0.52

Source: As for table 2.

Table 7. Determinants of income diversification

Explanatory variables	High-income outliers	High-income, low-diversification	High- income, high-diversification	Low-income, high diversification	Low-income, low-diversification
Age	-0.0019	0.0018	0.0032 [#]	0.0019 [#]	0.0022 [#]
Age squared	0.0000	-0.0000	-0.0000 [*]	-0.0000 ^{***}	-0.0000 [#]
Education	0.0339 [#]	-0.0201	0.0265 [#]	0.0093	-0.0258 ^{**}
Education squared	-0.0105 ^{***}	0.0014	-0.0078 ^{***}	-0.0051 ^{***}	0.0030
Gender (male =1, otherwise = 0)	0.0944 ^{***}	0.0759 ^{***}	0.0336 ^{**}	0.0786 ^{***}	0.0656 ^{***}
Social group (general, OBC=1; otherwise=0)	-0.0320	0.0091	-0.0138 [#]	-0.0327 ^{***}	-0.0009
Dependency ratio	0.1217 ^{***}	0.0255	0.0650 ^{***}	0.0293 ^{***}	0.0473 ^{***}
Irrigation area	0.0005 ^{***}	0.0003 ^{**}	-0.0003 ^{***}	-0.0003 ^{***}	-0.0001 ^{**}
Land operated	-0.0132 ^{***}	-0.0160 ^{***}	-0.0074 [#]	-0.0178 ^{***}	-0.0294 ^{***}
Land operated squared	0.0002	0.0002 [*]	0.0001	0.0002 ^{***}	0.0013 ^{***}
Household structure (pucca, semi-pucca=1; otherwise=0)	0.1839 ^{***}	0.0100	-0.0527 ^{***}	-0.0029 [#]	0.0175 [#]
Access to information (yes=1; otherwise=0)	0.0125	0.1069 ^{***}	0.1026 ^{***}	0.1160 ^{***}	0.0383 ^{***}
Adoption of information (yes=1; otherwise=0)	0.0204 [#]	0.0136	0.0087	0.0291 ^{***}	0.0166 ^{***}
Training (yes=1; otherwise=0)	-0.0196	0.0055	-0.0042	0.0015	0.0176
Access to credit (yes=1; otherwise=0)	0.0604 ^{***}	0.0020 [#]	-0.0207 ^{**}	-0.0124 ^{***}	0.0472 ^{***}
Intercept	-0.0674	0.1179 [*]	0.2035	0.1850 ^{***}	0.0884 ^{**}
Log-likelihood	-232.2929	-527.9890	-92.5065	-698.0786	-2474.4389
Sigma	0.2355	0.2445	0.2210	0.2228	0.2622
Number of observations	1,419	2,701	2,426	10,614	8,416

Note: “***”, “**”, “*”, and “#” represents level of significance at 1%, 5%, 10% and 20%, respectively.

correlation between different variables (Table A1 in the appendix).

5.2 Econometric results

Table 7 presents results of the Tobit regression. Age has a non-linear effect on diversification in most zones;

diversification increases with age but after a threshold it starts declining. A similar association is observed with education. Its association in low-income, low diversification region, however, is opposite. A unique feature of diversification in all the regions is that male-headed households tend to diversify more than the

female-headed households. Further, the lower-caste households have a greater probability of diversifying their income sources especially in high-income, high-diversification, and low-income, low-diversification regions. The dependency ratio is identified to push up diversification in all the regions except in high-income, high-diversification region.

Amongst the infrastructural or household asset variables, increase in proportionate area under irrigation facilitates income diversification in high income outliers and high income, low diversification regions indicating that relatively less risk-averse agriculture provides a better opportunity to invest in other economic activities in well-off regions. This relationship is negative for other regions indicating that if the households are provided assured irrigation they are less likely to diversify into non-farm activities.

Landholding size has a negative influence on diversification, but after a threshold level it exerts a positive influence in most regions. Households with pucca houses are more diversified only in Punjab and Kerala. The negative sign of the coefficient on pucca houses in low-income, low-diversification region indicates that economically well-off households do not diversify much. This implies that diversification is distress-driven in this region. In low-income, low-diversification region, the pucca houses are positively associated with diversification, implying the need for a critical level of investment to trigger diversification (Reddy et al. 2014).

Farmers' access to information encourages diversification. Likewise, in some of the regions the access to credit also appears to promote diversification.

6 Conclusion

The study has examined the factors associated with income diversification by agricultural households in a regional perspective. We find that while agriculture remains a dominant income source for majority of the agricultural households, wages and salaries comprise a significant proportion of income for relatively richer households. It has been found that households in low-income, low-diversification region prove the hypothesis that those who are at subsistence level do not diversify much. In low-income, high-diversification region, households diversifying into less remunerative or low-paid activities. In high-income, high-

diversification region, comprising mostly of hill states with fragile ecologies, the households rely significantly on non-farm income sources. Finally, Punjab and Kerala are agriculturally well-off, and therefore, specialise more into a few activities. We conclude that diversification is more prevalent in regions characterized by greater production risk to crop production.

Regression results indicate that in the economically well-off states, households tend to specialise. The households with larger farm sizes do not diversify much, while those who do not have assured irrigation are more likely to diversify. Also, the socially backward and male-headed households are more likely to diversify. These results also indicate that diversification is distress-driven. Therefore, policies need to focus on creating on-farm and off-farm income opportunities through investment in skill development and provision of start-up capital.

References

- Adebayo, C. O., Akogwu, G. O., & Yisa, E. S. (2012). Determinants of income diversification among farm households in Kaduna State: application of Tobit regression model. *Production Agriculture and Technology Journal*, 8(2): 1-10.
- Alobo Loison, S., & Bignebat, C. (2017). Patterns and determinants of household income diversification in rural Senegal and Kenya. *Journal of Poverty Alleviation and International Development*, 8(1): 93-126.
- Barrett, C. B., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. *Food Policy*, 26(4): 315-331.
- Bhalla, G. S. (2004). *Globalisation and Indian Agriculture* (Vol. 19). Academic Foundation, New Delhi.
- Bhalla, G. S., & Singh, G. (2009). Economic liberalisation and Indian agriculture: a state-wise analysis. *Economic and Political Weekly*, 44 (52): 34-44.
- Binswanger-Mkhize, H. P. (2012). India 1960-2010: Structural change, the rural non-farm sector, and the prospects for agriculture. In *Center on Food Security and the Environment Stanford Symposium Series on Global Food Policy and Food Security in the 21st Century*, Stanford University.
- Birthal, P. S., Negi, D. S., Jha, A. K., & Singh, D. (2014). Income sources of farm households in India:

- determinants, distributional consequences and policy implications. *Agricultural Economics Research Review*, 27(1): 37-48.
- Delgado, C. L., & Siamwalla, A. (1997). Rural economy and farm income diversification in developing countries. In 1997 Conference, August 10-16, 1997, Sacramento, California (No. 197035). International Association of Agricultural Economists.
- Ellis, F. (1998). Household strategies and rural livelihood diversification. *The Journal of Development Studies*, 35(1): 1-38.
- Ellis, F. (2000). The determinants of rural livelihood diversification in developing countries. *Journal of Agricultural Economics*, 51(2): 289-302.
- Escobal, J. (2001). The determinants of nonfarm income diversification in rural Peru. *World Development*, 29(3): 497-508.
- Fantini, E. (2013). Developmental state, economic transformation and social diversification in Ethiopia. *ISPI Analysis*, 163(7).
- GOI. (2014a). All India report on number and area of operational holdings. Agricultural census, 2010-11. Department of Agriculture and Cooperation, Ministry of Agriculture and Farmers Welfare, New Delhi.
- GOI. (2014b). Employment and unemployment situation in India. Report no. 554 (68/10/1). National Sample Survey Office (NSSO), Ministry of Statistics and Programme Implementation, New Delhi.
- GOI. (2013). Unit level data, Situational Assessment Survey of Agricultural Households (Schedule 33), 70th round. National Sample Survey Office (NSSO), Ministry of Statistics and Programme Implementation, New Delhi.
- Haggblade, S., Hazell, P. B., & Reardon, T. (2007). Transforming the rural nonfarm economy: opportunities and threats in the developing world. The John Hopkins University Press, Baltimore.
- Haggblade, S., Hazell, P., & Reardon, T. (2010). The rural non-farm economy: prospects for growth and poverty reduction. *World Development*, 38(10): 1429-1441.
- Hansen, B. E. (2012). *Econometrics*. University of Wisconsin.
- Himanshu, H., Lanjouw, P., Mukhopadhyay, A., & Murgai, R. (2011). Non-farm diversification and rural poverty decline: a perspective from Indian sample survey and village study data. Working paper 44, Asia research centre, London School of Economics & Political Science.
- Khatun, D., & Roy, B. C. (2012). Rural livelihood diversification in West Bengal: determinants and constraints. *Agricultural Economics Research Review*, 25(1): 115-124.
- Kumar, A., Kumar, S., & Singh, D. K. (2011). Rural employment diversification in India: trends, determinants and implications on poverty. *Agricultural Economics Research Review*, 24(conference number): 361-372.
- Lanjouw, J. O., & Lanjouw, P. (2001). The rural non farm sector: issues and evidence from developing countries. *Agricultural Economics*, 26(1): 1-23.
- Newman, C., & Kinghan, C. (2015). Economic transformation and the diversification of livelihoods in rural Viet Nam (No. 2015/064). WIDER Working Paper.
- Patnaik, P., & Chandrasekhar, C. P. (1995). Indian Economy under 'Structural Adjustment'. *Economic and Political Weekly*, 30(47): 3001-3013.
- Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development*, 25(5): 735-747.
- Reardon, T., Berdegue, J., Barrett, C. B., & Stamoulis, K. (2007). Household income diversification into rural nonfarm activities. In *Transforming the rural nonfarm economy: opportunities and threats in the developing world* (S. Haggblade, P. B. R. Hazell & T. Reardon, eds.), The John Hopkins University Press, Baltimore.
- Reddy, D. N., Reddy, A. A., Nagaraj, N., & Bantilan, C. (2014). Rural non-farm employment and rural transformation in India (No. 57, p. 28). Working Paper Series, ICRISAT Research Program.
- Shariff, A., & Lanjouw, P. (2004). Rural non-farm employment in India. *Economic and Political Weekly*, 39(40): 4429-4446.
- Sharma, N. & Singh, S. P. (2014). Agricultural diversification in Indian Punjab: an assessment of government intervention through contract farming. *Journal of Agricultural & Food Information*, 15(3): 191-213.
- Shiva, V., Emani, A., & Jafri, A. H. (1999). Globalisation and threat to seed security: case of transgenic cotton trials in India. *Economic and Political Weekly*, 34(10-11): 601-613.
- Singh, G. (2012). *Depeasantization in Punjab: process and determinants*. Saarbrücken, LAP Lambert Academic Publishing, Germany.

- Sujithkumar, P. S. (2007). Livelihood diversification: a case study in rural Tamil Nadu. *The Indian Journal of Labour Economics*, 50(4): 715-722.
- Vaidyanathan, A. (1986). Labour use in rural India: A study of spatial and temporal variations. *Economic and Political Weekly*, 21(52): A130-A146.
- Vatta, K., & Sidhu, R. S. (2007). Income diversification among rural households in Punjab: dynamics, impacts and policy implications. *Indian Journal of Labour Economics*, 50(4): 723-36.
- Zakaria, H., Abujaja, A. M., Adam, H., & Salifu, W. Y. (2015). Does gender make any difference in livelihoods diversification? Evidence from Northern Ghana. *International Journal of Agricultural Extension & Rural Development Studies*, 1(1): 36-51.

Appendix

Table A1. Correlation Matrix for Explanatory Variables

Correlations	Age	Education	Gender	Social group	Dependency ratio	Irrigation area	Land operated	Household structure	Access to information	Adoption of information	Training	Access to credit
Age	1.000											
Education	-.136**	1.000										
Gender	-.047**	.166**	1.000									
Social group	.108**	.144**	-0.005	1.000								
Dependency ratio	.164**	-.129**	-.033**	-.071**	1.000							
Irrigation area	.049**	.107**	.061**	.233**	-.112**	1.000						
Land operated	.138**	.105**	.066**	.067**	.033**	.103**	1.000					
Household structure	.075**	.105**	0.001	.129**	-0.003	.089**	.069**	1.000				
Access to information	.098**	.103**	.063**	0.003	0.005	.355**	.215**	.074**	1.000			
Adoption to information	.079**	.118**	.054**	.147**	.022**	.172**	.180**	.097**	.298**	1.000		
Training	.000	.073**	.040**	.024**	0.006	.027**	.069**	.034**	.037**	.100**	1.000	
Access to credit	.015**	-0.007	.042**	.189**	.045**	.089**	.128**	.046**	.038**	.128**	.048**	1.000

Source: As for table 2.

Table A2. Pattern of distribution of primary source of income across regions (%)

Regions	Cultivation	Livestock	Other agri. activity	Non-farm business	Wages/ salaries	Others*	All
PB	45.6	9.2	0.8	5.2	32.0	7.3	100.0
KL	16.3	6.1	16.8	13.4	30.0	17.4	100.0
Overall	31.1	7.7	8.7	9.3	31.0	12.3	100.0
HR	60.0	9.2	0.0	4.7	23.6	2.6	100.0
KR	69.3	3.9	3.2	2.4	19.5	1.7	100.0
TN	55.0	10.2	1.1	2.3	29.3	2.2	100.0
Overall	62.5	7.1	1.9	2.8	23.7	2.0	100.0
JK	28.9	1.0	0.1	7.0	52.8	10.1	100.0
HP	38.3	1.8	0.2	8.7	35.4	15.6	100.0
SK	67.7	3.6	0.0	6.6	18.5	3.5	100.0
ML	64.4	0.0	6.4	6.3	21.2	1.6	100.0
AP	59.2	4.6	1.6	3.5	28.0	3.1	100.0
Overall	50.9	3.3	1.4	5.1	33.2	6.1	100.0
UK	61.1	2.7	0.6	3.5	11.8	20.4	100.0
RJ	45.1	6.6	0.8	5.6	33.9	8.1	100.0
TR	83.5	3.1	1.5	1.7	8.3	1.8	100.0
WB	55.8	1.2	1.7	8.3	26.8	6.3	100.0
JH	72.5	0.1	0.8	4.6	18.6	3.5	100.0
OD	60.3	1.0	1.2	7.3	25.8	4.3	100.0
CG	80.6	0.0	0.6	1.5	16.6	0.7	100.0
MP	75.3	2.4	0.1	0.6	20.6	1.1	100.0
GJ	58.8	9.1	0.7	3.5	26.6	1.2	100.0
MH	71.9	2.7	0.5	5.0	17.7	2.2	100.0
Overall	63.4	3.1	0.8	4.8	23.7	4.2	100.0
BR	65.3	3.1	0.2	5.1	18.6	7.7	100.0
AN	69.7	3.0	0.2	5.0	16.3	5.8	100.0
NL	87.0	0.3	3.3	0.4	7.4	1.6	100.0
MN	53.2	6.8	0.1	12.7	24.5	2.7	100.0
MZ	73.7	1.9	1.6	6.4	15.8	0.5	100.0
AS	84.1	0.5	2.8	0.5	10.7	1.4	100.0
TG	76.7	4.2	1.6	2.3	12.7	2.4	100.0
UP	86.9	1.8	0.4	1.8	6.2	2.9	100.0
Overall	69.3	3.1	0.4	4.6	16.4	6.2	100.0
All-India	63.5	3.7	1.1	4.7	22.0	5.1	100.0

Source: As for table 2.

Note: *Others include pension, remittances etc.

Table A3. Percentage distribution of Income from different sources for various regions

Regions/States	Crop cultivation	Livestock	Farm wage	Non-farm wage	Non-farm business	Total
PB	60.20	9.23	3.53	22.99	4.05	100.00
KL	29.57	4.97	6.50	37.08	21.88	100.00
Overall	48.09	7.55	4.71	28.56	11.10	100.00
HR	54.50	18.31	2.14	22.04	3.01	100.00
KR	55.46	7.08	12.70	17.67	7.10	100.00
TN	27.10	16.05	13.66	27.09	16.09	100.00
Overall	47.35	12.63	10.08	21.47	8.47	100.00
JK	24.03	6.19	2.15	55.73	11.89	100.00
HP	32.85	12.11	2.58	43.22	9.24	100.00
SK	24.96	14.53	12.81	33.01	14.70	100.00
ML	54.71	5.74	12.18	19.74	7.63	100.00
AP	34.04	17.64	25.87	16.06	6.38	100.00
Overall	32.58	12.26	13.71	32.77	8.68	100.00
UK	54.08	17.89	4.56	18.17	5.29	100.00
RJ	42.20	13.86	5.18	28.91	9.85	100.00
TR	50.96	5.82	11.31	28.87	3.03	100.00
WB	24.56	5.49	18.01	35.20	16.75	100.00
JH	29.84	27.26	10.16	27.69	5.04	100.00
OD	28.43	26.14	10.24	24.47	10.72	100.00
CG	64.71	-0.31	12.88	22.70	0.02	100.00
MP	64.55	12.07	12.00	9.27	2.11	100.00
GJ	36.89	24.55	16.46	17.38	4.72	100.00
MH	52.25	7.76	14.52	14.04	11.43	100.00
Overall	44.94	13.75	12.09	20.93	8.29	100.00
BR	47.52	8.87	18.40	18.64	6.57	100.00
AN	61.06	11.47	3.63	15.48	8.37	100.00
NL	31.92	13.88	4.64	48.95	0.61	100.00
MN	33.82	15.43	4.20	39.96	6.59	100.00
MZ	50.04	9.57	11.96	28.15	0.29	100.00
AS	63.22	11.48	3.22	18.24	3.84	100.00
TG	67.19	5.85	11.53	11.36	4.07	100.00
UP	66.15	9.74	5.47	3.26	15.39	100.00
Overall	61.84	10.21	4.81	4.21	18.93	100.00
All-India	47.80	12.07	10.39	21.67	8.07	100.00

Source: As for table 2.

Table A4. Percentage of households with different characteristics

Regions	Male headed	SC/ST	Pucca/ semi-pucca	Access to credit	Access to information	Adoption of information	Training attained
PB	92.4	21.7	98.8	55.1	31.1	44.2	1.8
KL	80.8	8.6	98.6	76.0	69.2	67.3	4.5
Overall	86.3	14.8	98.7	66.1	50.2	56.4	3.2
HR	95.0	6.2	95.2	40.1	39.6	41.6	3.9
KN	91.0	22.7	95.4	76.2	63.8	69.2	6.0
TN	89.2	24.5	92.1	80.3	34.9	36.1	8.6
Overall	91.2	20.0	94.2	70.2	49.2	51.8	6.5
JK	95.7	20.8	82.8	28.6	51.5	51.7	0.7
HP	77.7	31.7	99.7	26.1	41.5	51.4	1.7
SK	92.0	42.6	97.7	13.0	0.6	0.6	0.0
ML	83.1	96.5	88.1	2.6	18.5	29.1	4.6
AP	91.0	26.2	95.1	92.4	63.0	62.8	2.2
Overall	89.4	29.7	93.0	62.2	54.4	56.1	1.9
UK	85.0	25.1	98.1	53.7	30.1	32.3	0.0
RJ	91.2	40.4	91.5	57.9	28.6	31.8	1.8
TR	92.8	64.1	97.4	23.3	27.9	31.6	6.8
WB	92.9	34.2	89.9	51.4	54.5	52.7	4.4
JH	92.9	49.6	80.8	30.6	41.1	43.3	0.6
OD	92.8	46.0	74.2	57.0	40.8	43.2	1.2
CG	93.3	55.4	88.0	37.4	57.0	50.6	4.0
MP	96.1	42.8	92.2	46.3	50.0	50.2	1.4
GJ	94.6	31.4	96.1	39.6	46.4	47.7	1.2
MH	93.0	21.4	95.6	53.6	43.4	45.2	2.5
Overall	93.2	37.8	90.1	49.3	44.0	44.7	2.1
BR	95.6	13.6	91.5	40.4	49.6	54.0	1.8
AN	93.0	83.8	37.5	19.4	19.6	18.0	2.7
NL	98.4	99.6	97.3	2.1	24.6	26.1	0.3
MN	88.9	50.7	76.3	25.6	30.8	31.6	2.1
MZ	87.1	99.0	73.2	6.5	40.7	38.6	1.0
AS	92.9	26.7	86.2	18.3	54.7	51.9	2.4
TG	93.8	27.1	96.7	88.3	40.2	45.1	1.9
UP	89.6	25.1	86.9	43.5	34.7	34.9	2.4
Overall	91.6	24.2	88.4	43.1	40.5	41.3	2.2
All-India	92.0	30.1	90.3	50.3	44.2	45.2	2.6

Source: As for Table 2.

Table A5. Mean of quantitative variables used in the Tobit model

Regions	SID	Age	Education	Irrigation (%)	Land operated	Dependency ratio
PB	0.28	52.71	6.91	75.41	1.94	0.57
KL	0.26	58.07	9.30	35.10	0.58	0.53
Overall	0.27	55.54	8.17	54.15	1.22	0.55
HR	0.34	47.01	7.99	65.33	1.40	0.45
KN	0.32	50.68	5.27	39.89	1.84	0.59
TN	0.28	49.11	7.19	58.43	0.85	0.61
Overall	0.31	49.36	6.51	51.72	1.40	0.57
JK	0.34	49.37	6.58	42.18	0.53	0.48
HP	0.36	52.91	7.23	24.58	0.58	0.66
SK	0.44	51.95	6.24	6.04	0.66	0.71
ML	0.39	48.64	6.78	22.70	1.06	0.52
AP	0.33	47.30	4.65	51.03	1.50	0.65
Overall	0.34	48.81	5.62	42.73	1.11	0.61
UK	0.34	50.32	6.74	40.82	0.48	0.59
RJ	0.38	45.62	4.68	42.18	1.64	0.53
TR	0.37	47.05	6.61	67.70	0.72	0.46
WB	0.33	47.58	6.49	70.72	0.41	0.46
JH	0.34	45.45	5.19	17.25	0.63	0.47
OD	0.38	47.99	5.40	33.64	0.74	0.51
CG	0.38	45.19	5.83	34.12	1.26	0.54
MP	0.36	45.27	4.46	45.91	1.42	0.53
GJ	0.41	46.91	6.20	49.09	1.14	0.61
MH	0.33	50.44	6.60	32.85	1.45	0.62
Overall	0.36	47.08	5.60	43.52	1.14	0.54
BR	0.24	48.11	4.74	84.11	0.62	0.39
AN	0.24	44.57	5.90	30.31	1.68	0.46
NL	0.22	47.94	10.68	49.87	1.05	0.41
MN	0.31	52.57	9.15	12.40	0.84	0.52
MZ	0.28	48.58	8.35	6.26	1.07	0.61
AS	0.25	47.39	7.22	19.88	0.91	0.43
TG	0.29	46.98	4.28	58.92	1.40	0.64
UP	0.32	47.25	5.77	88.60	0.67	0.46
Overall	0.29	47.46	5.65	77.45	0.75	0.45
All-India	0.33	47.80	5.78	56.76	1.02	0.52

Source: As for Table 2.