



Sources of Income Inequality among Rural Farm Households in North Western Himalayas

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Abstract: Study assesses the inequality arising from variations of economic opportunities across different agro-climatic zones of Himachal Pradesh. The poor in the state tends to diversify their income portfolio towards wages and salaries. Income from wages and salaries is most equally distributed, yet it contributes maximum (43.63%) in total inequality. The high Gini correlation of wages and salaries with total income ($R_k=0.597$), showing that households which are above in the total income stratum derive more income from wages and salaries activities, also contributed its share (43.63%) in total inequality. Wages and salaries and livestock inequalities are increasing in its effect; other factors remaining constant. One per cent increase in income from wages and salaries and livestock, increased total inequality by 0.115 and 0.140 per cent. The income from agriculture and livestock tend to significantly reduce income inequality in the state. However, agriculture is the major income source across all Zones showed a wide disparity among the share of other sources in the total income. Income of households was more unevenly distributed in the Zone-II, and Gini index for the Zone-II ($G_k=0.231$) was higher than that of the Zone-IV, Zone-III and Zone-I of the state. The result of the Theil index emphasized within group inequality was the key contributor to overall disparity across agro-climatic zones. Therefore, Policy intervention at zonal level would be imperative for correcting spatial imbalances in income distribution among agricultural households of Himachal Pradesh, and would cover the way for their comprehensive and more unbiased development.

Keywords: Agro-climatic zones, Correlation, Income inequality, Theil index

With poor people making up less than a tenth of its population, Himachal Pradesh is one of more prosperous states in India. Since 1994, there has been a steady decline in poverty in the state, especially in the rural areas. As a result, the difference in poverty levels between the state's rural and urban areas has narrowed considerably. In spite of this, Himachal Pradesh's western and central districts record higher levels of poverty than its other regions. Growth in the state has been modest after 2005, driven mainly by the non-farm sectors of the economy. In urban areas, consumption inequality has increased. The economy of Himachal Pradesh is predominantly dependent upon agriculture and in the absence of strong industrial base, any fluctuations in the agricultural or horticultural production, effects the economic growth of the State. Most of Himachal Pradesh's people are engaged in farming. Non-farm jobs account for a lower share of employment than in most other states. Over two-thirds of Himachal Pradesh's workforce is self-employed, and very few of the rest have salaried jobs. Since 2005, jobs in the state have grown, albeit slowly. Many of the jobs created during this period were in construction. While female labor force participation in the state is high, it has been declining in recent times. During 2017-18 about 8.84 percent of state income has been contributed by agriculture sector alone

(Economic survey of HP, 2018-19).

There has been much debate about economic growth and increasing inequality both across the countries and within the country. Researchers and policy makers have tried to explain this relationship both at micro and macro level but could not get any conclusion. Few decades ago, this debate has also been started in India and continues today without any common consciences (Pal and Ghose 2007). A number of studies from developing countries have suggested that diversification of rural economy towards non-farm activities has considerable potential to augment farmers' income and reduce rural poverty (Adams 2001, Barrett et al 2001, Janvry et al 2005). Diversification towards non-farm activities overcomes the land constraint to income growth, enables the farmers cope up with the shocks of crop failure and enhances their capacity to invest in productivity-enhancing agricultural inputs and technologies. Further, a growing rural non-farm sector can absorb surplus labour from agriculture, reduce rural urban migration, narrow down rural-urban disparities and promote farm-nonfarm linkages. The rural non-farm sector is quite heterogeneous in India, and its distributional consequences are likely to vary depending on whether an income source is accessible to the rich or the poor. Adams (2001) in Egypt have found inverse relationships between

non-farm income and land ownership as well as household income. The studies from Rwanda (Dabalen et al 2004), Jordan (Adams 2001), on the other hand, have found that non-farm income has un-equalizing effect on income distribution.

Evidences from the existing literature suggested that most of the studies in the Indian context pertaining to income inequality of rural households and distributional consequences of income sources have been carried out for the country as a whole. However, effective poor growth policy prerequisites a clear understanding of regional composition of income earned by farm households and distributional impact of income sources. The present study is an attempt to show the actual picture of the extent of income inequality by sources of income between agricultural households prevailing in different zones of Himachal Pradesh.

MATERIAL AND METHODS

Data: Himachal Pradesh is a hilly and mountainous Indian Himalayan state. This state is the only state in India with nearly 90% of the population living in rural areas. It is located in the central chain (lesser Himalaya) of mountain ranges. Being a hilly State, the cropping pattern and the agricultural income of the farmers vary according to the altitude of the State. In the valley areas, the main agricultural products are food grains, i.e., wheat, maize, paddy, pulses, sugarcane, oilseeds etc., whereas due to suitable topography and climatic conditions, the hilly areas of the state are widely known for horticultural products, viz., apple, seed potato, apricot, grapes, ginger, dry fruits etc. To conduct this study, purposive sampling was adopted to select districts of agro-climatic zones of Himachal Pradesh. Una, Hamirpur, Solan and Kangra districts of Himachal Pradesh were selected purposively from Zone-I, Mandi and Sirmaur districts from Zone-II, Shimla and Kullu districts from Zone-III and Chamba and Kinnaur districts were selected from Zone-IV. The survey covered 120 rural farm households from each agro-climatic zones of Himachal Pradesh. Thus, a sample of 480 rural farm households was ultimately selected from four agro-climatic zone of Himachal Pradesh by adopting probability proportion method. The required information was collected from the sample households with the help of pre-tested survey schedule during 2020-21. The data pertaining to income of agricultural households in Himachal Pradesh from various sources viz., agriculture, livestock, wages and salaries and non-farm income were collected from selected households.

The four major income sources were crop farming, livestock, wages and salaries and non-farm business. Income from crop farming is from the cultivation of various seasonal and annual crops. Income from livestock is earned

by a household from the sale of various products like milk, eggs and live animals. Wages and salaries are derived by various household members employed in labour outside their household – either in other's fields or in non-farm enterprises. Income from wholesale and retail trade, manufacturing, transportation and storage, accommodation and food service, construction and other services were covered under non-farm business. Some households reporting unusual and high negative income from crops and livestock farming were removed from the dataset to avoid their possible influence on the estimates of our substantive interest.

Analytical approach: Gini coefficient and Theil index have been used. Gini coefficient has been computed to explain the inequality across various zones of Himachal Pradesh. Following Kaditi and Nitsi (2011), vertical decomposition of inequality (Gini coefficient) was performed to measure the contribution of various income sources to total inequality. Apart from decomposing inequality by income source, horizontal decomposition of inequality into within and between zones was obtained by the Theil index, which provided information on how inequality arises from variation of economic opportunities across zones.

Gini coefficient and vertical decomposition of inequality:

Following Lerman and Yitzhaki (1985), the Gini coefficient for total income inequality, G , was computed as follows

$$G = \sum_{k=1}^K S_k G_k R_k \quad (1)$$

Where S_k represents the share of source k in total income and reflects how important the income source is with respect to total income, G_k is the source Gini corresponding to the distribution of income from source k indicating equality/inequality of income distribution from a given income source, and R_k is the Gini correlation of income from source k with the distribution of total income indicating how a given income source is correlated to the total income of a household.

In eq. (1),

$$G_k = 2Cov(Y_k, F_k) / \bar{Y}_k \quad (2)$$

and

$$R_k = Cov(Y_k, F) / Cov(Y_k, F_k) \quad (3)$$

Where \bar{Y}_k is the mean income from income source k , $Cov(Y_k, F_k)$ is the covariance between income component k and its cumulative distribution, $Cov(Y_k, F)$ is the covariance between income component k and cumulative distribution of total income.

Further, using the Gini decomposition by income source, the effect of changes in a particular component on inequality can be estimated, holding income from all other sources constant. Assuming a change in each household's income from source equal to e , where e is close to 1, then the partial

derivative of the Gini coefficient with respect to a percentage change e in source k will be

$$\frac{dG}{de_k} = S_k (R_k G_k - G) \quad (4)$$

Then, the marginal effect of the income source relative to the overall Gini can be obtained by dividing eq. (4) by overall Gini coefficient as follows

$$\frac{dG / (de_k)}{G} = \frac{S_k R_k G_k}{G} - S_k \quad (5)$$

Following Kimhi et al robustness of the marginal effect was observed using bootstrapping techniques.

Theil index and horizontal decomposition of inequality: The Theil index is one of the two most commonly applied inequality measures

The key advantage of Theil index is that unlike the Gini coefficient the total amount of inequality measured by it can be decomposed into two additive components of between group and within group inequality as

$$I = \sum_{m=1}^m \left[\frac{N_m}{N} \right] \left(\frac{\bar{Y}_m}{\bar{Y}} \right) \ln \left(\frac{\bar{Y}_m}{\bar{Y}} \right) + \sum_{m=1}^m \left\{ \frac{N_m}{N} \frac{\bar{Y}_m}{\bar{Y}} \right\} \text{Im} \quad (6)$$

Where m equals the number of groups (zones in the present case), N and N_m the total number of households and the number of households in group m respectively, Y_m the monthly income of a household in group m and \bar{Y} is the mean income of all households. The first and second term of eq. (6) represents between group and within group inequality respectively.

As a small number of households in the dataset was total or source as negative or zero and these numbers were not a significant proportion of the total sample, m negative and zero values were replaced with very small positive value (e) following Bellu and Liberati (2018).

In this study, e is taken as 10^{-10} . The analysis has been carried out using Stata/SE..

RESULTS AND DISCUSSION

Household income composition across income quintiles: Agriculture has been found to be the biggest

source of income for farm households and it makes up 42.91 per cent of the total income on an average (Table 1), while wages and salaries activities, with a share of 32.01 per cent of the total income, comprise the second largest income source after agriculture. Non-farm income contributes only 13.52 per cent to the total household income. On an average animal production contributes only 11.52 per cent to the total household income. The difference in the contribution to income by various sources across income quintiles is pronounced. It is worthwhile to note that agriculture is the dominant source of income for the bottom quintile (20 per cent households), accounting for nearly 51 per cent of their total household income. Wages and salaries and livestock are the other major sources of income for these households. Share of livestock in total income decreases on moving from the bottom to top quintile, while on the contrary, share of crop cultivation tends to be higher in the higher income quintile.

The share of non-farm in total income is maximum (19.51%) for the top 20% of households. This pattern of income distribution indicates that the poor households depend mainly on the agriculture and wage labour and while the rich specialize towards non-farm activities. The declining share of agriculture and livestock income from the bottom to top income quintile, and rising share of wages and salaries, and non-farm income point towards the fact that income and employment opportunities in Himachal Pradesh is increasing. The large farmers may not prefer livestock as it is labour intensive. These trends also point towards the distress nature of wage work in the farm and non-farm sectors and other business activities in the non-farm sector.

Inequality Decomposition by Income Sources

Decomposing overall income inequality: It was observed that not all the households earn from all the activities, therefore, zero income value from the sources magnified the component's Gini (G_k) the Gini index of total income (Table 2). The Gini for non-farm income (G_k) is highest (0.732) followed by that for wages and salaries (0.449). The, income from wages and salaries is most equally distributed (yet it contributes maximum (43.63%) in total inequality as it is a

Table 1. Sources of income of farm households by income quintile

Quintile	Average income (INR/Household)	Agriculture income (%)	Livestock income (%)	Wages and salaries (%)	Non-farm income (%)
Bottom	402388.78	50.56	17.16	26.88	5.41
Second	552180.05	49.10	13.87	25.77	11.26
Third	646340.63	46.01	12.31	32.12	9.57
Fourth	760023.49	42.35	10.84	32.27	14.54
Top	1076842.38	35.41	8.20	36.88	19.51
Overall	687555.06	42.91	11.52	32.01	13.62

Source: Computed by the authors using data from farm households

major source of income ($S_k=0.321$). The high correlation of wages and salaries with total income ($R = 0.597$), showing that households which are above in the total income strata derive more income from wages and salaries activities, also contributed its share in total inequality (Fig. 1).

The lowest value of Gini correlation in the case of livestock ($R_k = 0.172$) indicates the biasness of the income source towards lower income quintile. This source has the potential to reduce overall income inequality. Wages and salaries and livestock inequality increasing in its effect; other factors remaining constant, 1% increase in income from wages and salaries and livestock, increases total inequality by 0.115% and 0.140%. Income from agriculture and that from livestock tend to significantly reduce income inequality in the state. Pavithra and Vatta (2013) have also reported prevalence of high income inequality in Punjab with Gini coefficient of 0.52; however, they reported that income from non-farm activities decreases income inequality. Vatta and Sidhu (2007) reported that non-farm sources reduce the overall income inequality in the state. In light of this, it is important to mention that the unease in the findings reported here regarding the nature of impact of non-farm source on inequality among households is mainly attributed to the differences in the concept of a household and consideration of activities under non-farm sources in earlier studies.

Decomposition of overall income inequality by agro-climatic zones of Himachal Pradesh: Himachal Pradesh with an area of 55,673 sq. km has various agro-climatic situations. The state has been divided into four agro-climatic zones on the basis of homogeneity, altitude, rainfall pattern, cropping pattern, etc. as: sub-mountain low hills sub-tropical (Zone -I), Mid-hills sub-humid (Zone-II), High hills sub temperate wet (Zone-III), and High hills sub temperate dry (Zone-IV) (Fig. 2, Table 3). The present study further disentangles the income inequality by income sources across the various agro-climatic zones of Himachal Pradesh. Income of households is more unevenly distributed in the Zone-II, and Gini index for the Zone-II ($G_k = 0.231$) is higher than that of the Zone-IV ($G_k = 0.212$), Zone-III ($G_k = 0.174$) and

Zone-I ($G_k = 0.130$) of the state (Table 4). Distribution of income among households is comparatively more equal in the sub-mountain low hills sub-tropical zone. However, agriculture is the major income source across all Zones; a wide disparity exists among the share of other sources in the total income. Wages and salaries is the second major source across all Zones and has significant share in the total income in the Zone-I ($S_k = 30.8\%$). Livestock has significant share in the total income in the Zone-I ($S_k = 11.9\%$), while in the Zone-IV it contributes only ($S_k = 8.1\%$) to the total income of the

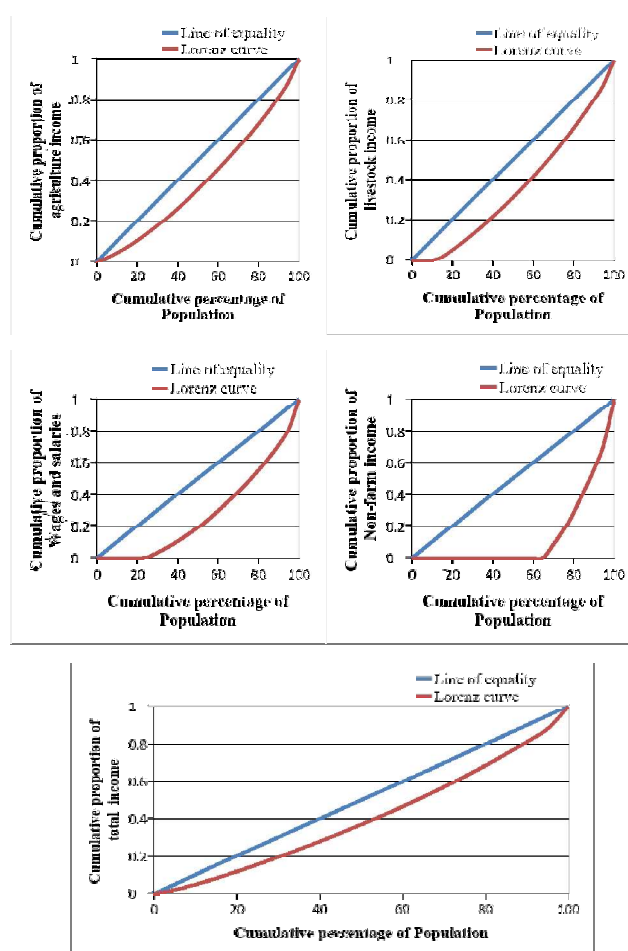


Fig. 1. Lorenz curve of income sources

Table 2. Decomposition of inequality by sources of income

Source of income	Income share (S_k)	Source Gini (G_k)	Gini correlation (R_k)	Share in total Gini	Marginal contribution to Gini/% change
Agriculture	0.428	0.215	0.554	0.258	-0.169(0.0347)*
Livestock	0.115	0.285	0.172	0.028	-0.086(0.0129)*
Wages and salaries	0.321	0.449	0.597	0.436	0.115(0.0456)*
Non-farm income	0.136	0.732	0.547	0.276	0.140(0.0336)*
Total income		0.197			

Source: Computed by the authors using data from farm households

Note: Figures in parentheses indicates bootstrapped standard error

*,@ and + statistical significance at 1,5 and 10 % levels

households. Non-farm activities is an important source of income after agriculture and livestock in the Zone-I. Further, earnings from agriculture, with an exception in Zone-III, contribute maximum to total income inequality and are significantly inequality increasing in their effect across all the zones. Wage and salaries has the highest share in Gini coefficient in the Zone-IV (64.5%),

1% increment in income from wages and salaries

activities, *ceteris paribus*, would significantly increase inequality by 22.9% in the region. Therefore, any effort to bridge the inequality gap in the zone should not be wage and salary oriented. The non-farm income is the most unequally distributed in Zone-IV ($G_k = 0.754$) followed Zone-II, Zone-III and Zone-I.

Decomposition of income inequality within and between agro-climatic zones: Theil index is more for 'within' the zone

Table 3. Agro-climatic zones of Himachal Pradesh, India

Agro-climatic zones	Districts covered	Major crops grown	Altitude (m)	Average rainfall (mm)	Cropping intensity (%)
Sub-mountain low hills sub-tropical (Zone -I)	Una, Bilaspur, Hamirpur, Solan and Kangra	Wheat, Maize, Paddy, Gram, Sugarcane, Mustard, Potato, Vegetables	Up to 650	1100	185
Mid-hills sub-humid (Zone-II)	Mandi and Sirmaur	Wheat, Maize, Barley, Black Gram, Beans, Paddy	651-1800	2200	187
High hills sub temperate wet (Zone-III)	Shimla and Kullu	Wheat, Barley, Lesser Millets, Pseudo-cereals (Buckwheat and Amaranthus), Maize and Potato	1801-2200	1000	179
High hills sub temperate dry (Zone-IV)	Chamba, Kinnaur and Lahul-Spiti	Wheat, Barley, Pseudo-cereals (Buck wheat and Amaranthus)	Above 2200	Snow fall	133

Source: Himachal Pradesh Department of Revenue

Table 4. Decomposition of inequality by sources across agro-climatic zones

Agro-climatic zones	Source of income	Income share (S_k)	Source Gini (G_k)	Gini correlation (R_k)	Share in total Gini	Marginal contribution to Gini/% change
Zone-I	Agriculture	0.445	0.088	0.575	0.173	-0.272(0.031) [†]
	Livestock	0.119	0.187	0.090	0.015	-0.104(0.018) [†]
	Wages and salaries	0.308	0.282	0.647	0.434	0.126(0.048) [@]
	Non-farm income	0.126	0.677	0.572	0.336	0.250(0.059) [†]
	Total income		0.130			
Zone-II	Agriculture	0.416	0.295	0.768	0.409	-0.007(0.070) [†]
	Livestock	0.118	0.272	0.233	0.032	-0.086(0.023) [†]
	Wages and salaries	0.339	0.328	0.569	0.275	-0.064(0.070)
	Non-farm income	0.129	0.739	0.701	0.283	0.157(0.078) [@]
	Total income		0.231			
Zone-III	Agriculture	0.488	0.199	0.495	0.277	-0.212(0.054) [†]
	Livestock	0.147	0.301	0.358	0.091	-0.056(0.045)
	Wages and salaries	0.204	0.576	0.458	0.309	0.105(0.077)
	Non-farm income	0.159	0.738	0.477	0.322	0.162(0.092) [†]
	Total income		0.174			
Zone-IV	Agriculture	0.371	0.206	0.344	0.123	-0.247(0.043) [†]
	Livestock	0.081	0.311	0.075	0.008	-0.072(0.017) [†]
	Wages and salaries	0.415	0.450	0.733	0.645	0.229(0.075) [†]
	Non-farm income	0.133	0.754	0.471	0.222	0.089(0.069)
	Total income		0.212			

Source: Computed by the authors using data from farm households

Note: Figures in parentheses indicates bootstrapped standard error

[†],[@] and ⁺ statistical significance at 1,5 and 10 % levels

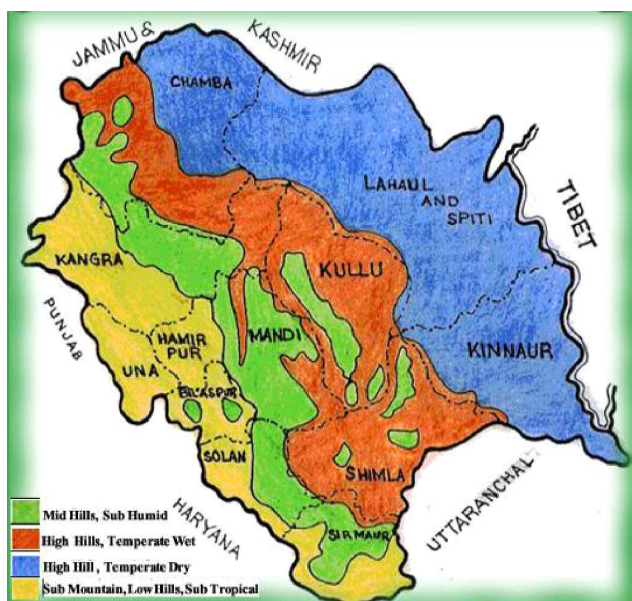


Fig. 2. Agro-climatic zones of Himachal Pradesh

Table 5. Theil index of inequality by agro-climatic zones

Source of income	Agro-climatic zones	
	Between	Within
Agriculture	0.0039	0.0895
Livestock	0.0139	0.2023
Wages and salaries	0.0465	0.4103
Non-farm income	0.0096	1.2237
Total income	0.0038	0.0794

Source: Computed by the authors using data from farm households

than the corresponding 'between' values for all the sources as well as total income (Table 5). Choudhary and Singh (2020) also observed that the value of Theil index is more for within the zone and district than the corresponding between values for all the sources as well as total income. This indicates that intra-zonal inequality is the main contributor in total inequality in the zones respectively. Therefore, policies aimed at the elimination of income differences between the various agro-climatic zones would not be more meaningful. Orientation of efforts within a geographically aggregated district represented by agro-climatic zones would be more imperative for smoothening the income inequality of agricultural households in Himachal Pradesh.

CONCLUSIONS

Improving the income of agricultural households and their even distribution among them is the basic goal of any policy intervention in agriculture. The present study estimated the inequality prevailing among agricultural households in Himachal Pradesh and examined the state's effect on income inequality from various sources of income that would be

crucial from a policy perspective. In almost all quintiles, crop production is the major source of income. On the opposite wages and salaries are the potential source to bridge the inequality gap. Therefore, strategic measures to improve these sub-sectors and to enable households to diversify their sources of income will also have a stronger redistributive impact of farmers' income. Nevertheless, it is important to keep in mind that in the Zone-IV income from wages and salaries triggers inequality in the region. Therefore, contribution of income sources to zonal inequality should be kept in mind during policy formulation and functioning. Further, it is important to re-emphasize that non-farm sources have significant equalizing effect in the Zone-I, Zone-II and Zone-III of the state. Hence, their contribution to rural Himachal Pradesh sustainable growth cannot be completely ignored. Finally Theil index decomposition shows that within group inequality is the key contributor to overall disparity across agro-climatic zones. Therefore, policy intervention at zonal level would be imperative for correcting spatial imbalances in income distribution among agricultural households of Himachal Pradesh, and would cover the way for their comprehensive and more unbiased development.

REFERENCES

- Adams RH 2001. *Non-farm Income, Inequality and Poverty in Rural Egypt and Jordan*. Policy Research Working Paper 2572. World Bank, Washington, D.C.
- Barrett CB, Reardon T and Webb P 2001. Non-farm income diversification and household livelihood strategies in rural Africa: Concepts, dynamics and policy implications. *Food Policy* **26**(4): 315-332.
- Chakravorty S, Chandrasekhar S and Naraparaju K 2016. *Income generation and inequality in India's agricultural sector: The consequences of Land fragmentation*. IGDR Working Paper, WP-16028.
- Choudhary BB and Singh P 2020. How unequal is rural Punjab? Empirical evidence from spatial income distribution in Punjab. *Current Science* **117**(11): 1855-1862.
- Dabalen A, Paternostro S and Pierre G 2004. *The Returns to Participation in Non-farm Sector in Rwanda*. Policy Research Working Paper 3462. World Bank, Washington, D.C.
- Economy Survey 2019. Economic and Statistics department of Himachal Pradesh. http://admis.hp.nic.in/himachal/economics/pdfs/EconomicSurveyEng2018_19_A1b.pdf.
- Himachal Pradesh Revenue 2018. <http://himachalrevenue.nic.in/agro-climatic-zones>.
- Janvry AD, Sadoulet E and Zhu N 2005. *The Role of Non-farm Incomes in Reducing Rural Poverty and Inequality in China*. Working Paper 1001. Department of Agricultural & Resource Economics, University of California, Berkley. Available at http://repositories.cdlib.org/are_uch.
- Kaditi EA and Nitsi EI 2011. Vertical and horizontal decomposition of farm income inequality in Greece. *Agricultural Economics Research Review* **12**(1): 69-80.
- Kimhi A, Arayama Y and Kim JM 2014. Identifying determinants of income inequality in the presence of multiple income sources: the case of Korean farm households. In Poster presented at EAAE Congress 'Agri-Food and Rural Innovations for Healthier Societies', Slovenia.

Lerman R and Yitzhaki S 1985. Income inequality effects by income source: a new approach and applications to the United States. *The Review of Economics and Statistics* **67**(1): 151-156.

Pal P and Ghose J 2007. *Inequality in India: A Survey of Recent Trends*. DESA Working Paper No. 45.

Pavithra SA and Vatta K 2013. Role of non-farm sector in sustaining

rural livelihoods in Punjab. *Agricultural Economics Research Review* **26**(2): 257-265.

Vatta K and Sidhu RS 2007. Income diversification among rural households in Punjab: Dynamics, impacts and policy implications. *Indian Journal of Labour Economics* **50**(4): 723-736.

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