

Inequalities of Per Capita Income in Himachal Pradesh

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Abstract

This paper focus on the empirical study deals with the measurement of disparities in income among different districts of Himachal Pradesh. For this calculation, district-wise information on Gross Value Added (at current prices) at aggregated and disaggregated levels compiled, available for the period from 2011-12 to 2017-18, again converted to per capita income sectors wise. The extent of income inequalities has measured by the alternative quantitative indexes, like Gini, Ricci-Schutz, Atkinson, Theil, and Entropy. The extent of harmony among the alternative measures has assessed through correlation analysis. The index associated with higher CV was preferred over the other indexes because that was (index with higher CV) more sensitive to temporal changes. The output values of every index fall between zero and one. Zero output value means that there are no inequalities of income, and one value state that income inequality is a hundred percent. As the value of output increases from zero to one, the income inequalities also increase and vice versa. The inequalities of income from primary and tertiary sector displayed decreasing trend for the study period. Whereas, inequalities of income from secondary sector and aggregate district domestic product were increasing from 2012 to 2018.

Keywords: Theil, Inequalities, Income and Himachal Pradesh

I. Introduction

A small hill state in western Himalayas, Himachal Pradesh. After attaining its statehood in 1971 has experienced remarkable economic and social growth. Even after limited resources and harsh geographical situations, Himachal Pradesh is between one of the India's best growing hill economies. State has shown improvements in literacy rate, living standards, health facilities, human developments and per capita income. Administratively, it has 12 districts with the density if 123 person per kilometer. The density of population in the state is less than that of country average, indicating the dispersed population due to difficult geographic situation. Whereas, the literacy rate of Himachal Pradesh is higher than the country. After the adoption of the liberalization, privatization and globalization policies by the India's government, Himachal Pradesh economic landscape began to shift towards secondary and service sectors. Solan, Baddi, Nalagarh and Una become the leading industrial hub for pharmaceuticals, food processing and consumer goods. Which leads the growth of secondary sector. The service sector which includes banking, transport, tourism and education, also witness fast growth. With this growth of secondary and tertiary sector the income of the peoples has also increased but with inequalities. Due to the concentration of industries in few district inequalities appears more pronounced. The divide is also on the basis of rural and urban, the rural households mainly depend horticulture, agriculture and government jobs. Whereas, urban households have greater access to diversified income and higher wages and salaries.

II. Methodology

For measuring income inequalities, we have made use of a number of alternative indexes, such as Gini (1912), Ricci-Schutz (1936), Atkinson (1970), Theil (1967), CV measure, and Generalized Entropy measure:

- Gini Index:
$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2n^2 \bar{x}}$$
- Ricci-Schutz Index:
$$R = \frac{\sum_{i=1}^n |x_i - \bar{x}|}{2n\bar{x}}$$
- Atkinson Index:
$$A = 1 - \frac{\prod_{i=1}^n \{x_i^{(1/n)}\}}{\bar{x}}$$

- Theil-T Index: $T = \frac{1}{n} \sum_{i=1}^n \frac{x_i}{\bar{x}} \ln \left(\frac{x_i}{\bar{x}} \right)$
- CV Measure: $C = \frac{\sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2}}{\bar{x}}$
- Entropy Measure: $E = \frac{1}{\alpha(1-\alpha)} \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{x_i}{\bar{x}} \right)^\alpha - 1 \right]; \alpha \neq 0, 1$

In these indexes, x_i is the observed income for the i -th district, n is the number of districts and $\bar{x}$ is the mean income of all the districts. Each of the indexes was determined at all the available points in time. The extent of harmony among the indexes was assessed through correlation analysis. And relative superiority of the indexes was gauged through their temporal sensitivity.

III. Result and Discussion

This section of the study is divided in to five parts, parts one explains the inequalities of income from primary sector, part two define inequalities from secondary sector, third part analyses their inequalities from tertiary sector, forth part explain the inequalities from aggregated district domestic products and fifth part describe the inequalities of income from best indices that is Thiel's Index.

III.1 Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Primary Sector

Table 1 reveals that from various alternative indexes used for the measurement of inequalities, Thiel's index selected as the best index for the analysis of inequalities of per capita income (PCIN) from the primary sector.

Table 1
Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Primary Sector

YEAR	GNC	RSC	ATK	THL	VRC	ENT
2012	0.291	0.208	0.068	0.139	0.554	0.137
2013	0.336	0.260	0.089	0.186	0.652	0.181
2014	0.305	0.231	0.072	0.148	0.564	0.148
2015	0.312	0.236	0.076	0.155	0.582	0.154
2016	0.297	0.225	0.073	0.155	0.610	0.148
2017	0.264	0.204	0.056	0.116	0.503	0.113
2018	0.268	0.205	0.055	0.114	0.495	0.113
CV	8.488	9.163	16.632	17.307	9.841	16.939

Source: Author's Computations

Because it has associated with the higher CV value (17.03), then the other indexes used. The Thiel's index showed that inequalities of per capita income from the primary sector were increasing very slightly up to 2016 and then these started decline. Where the linear trendline displayed decreasing trend overall. The declining per capita income inequalities in Himachal Pradesh may be due to the inclusive patterns of agriculture, diversification in horticulture as well as agriculture, non-seasonable vegetable cultivations, effective government policies like subsidies for seeds, machinery, irrigations and fertilizers etc.

Fig. I
Inequalities of PCIN for Districts of Himachal Pradesh- Primary Sector

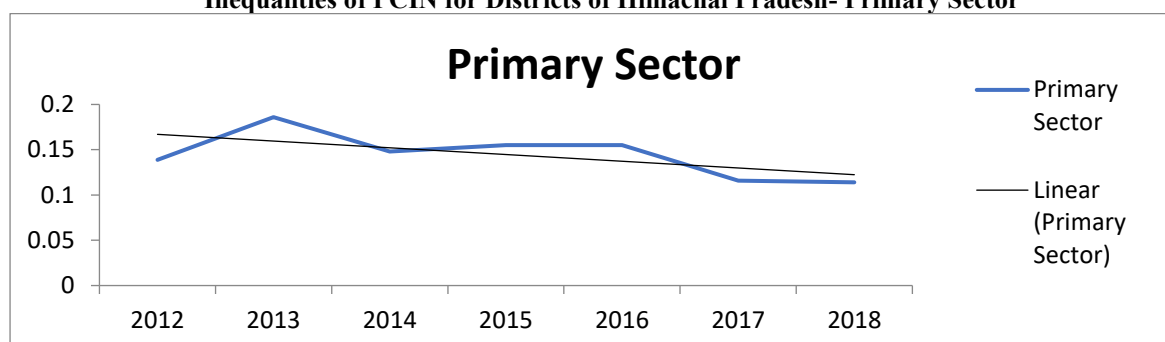


Figure I reveal that the concentration of per capita income calculated to the primary sector increased from 2012 to 2013, then it declined from 2013 to 2014. From 2014 it again starts increasing up to 2015. After that, it remains constant for 2015 to 2016. Again, it increased from 2016 to 2017 and then initiated declining. A view on the trend line showed that inequalities of per capita income from the primary sector decreased overall from 2012 to 2018 at a plodding pace.

Table 2
Inter-Correlation Matrix among the Indexes for Primary Sector

	GNC	RSC	ATK	THL	VRC	ENT
GNC	1.000	0.959	0.989	0.977	0.926	0.993
RSC	0.959	1.000	0.947	0.946	0.893	0.955
ATK	0.989	0.947	1.000	0.996	0.968	0.999
THL	0.977	0.946	0.996	1.000	0.983	0.996
VRC	0.926	0.893	0.968	0.983	1.000	0.964
ENT	0.993	0.955	0.999	0.996	0.964	1.000

Source: Author's Computations

D.F. for each value of r: 5 Critical r at 5%, 1% and 0.1% l.o.s.: 0.755 0.875 0.951

The extent of harmony among the alternative measures has assessed through correlation analysis showed in the Table 2. This table revealed that a high degree of positive correlation has found between Thiel's index and Ginni coefficient, Ricci-Schutz, Atkinson, Variation of coefficient, and Entropy.

III.2 Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Secondary Sector

Table 3 reveals that from various alternative indexes used for the measurement of inequalities, Thiel's index has selected as the best index for the measurement of the concentration of gross value added (GVA) from the secondary sector because it has been associated with the higher CV value (8.384) then the other indexes used. Thiel's index showed that the concentration of gross value added from the secondary sector was decreasing first and then start increasing over the period. In 2003 the Himachal Pradesh was declared as a special category state by center government facilitated by financial assistance and tax incentives, but due to geographical constraints the industries developed only in Baddi – Barotiwala - Nalagarh of district Solan and some part of district Una rest of the state remains industrial backward. These reasons lead to the rise in the inequalities of income from secondary sector.

Table 3
Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Secondary Sector

YEAR	GNC	RSC	ATK	THL	VRC	ENT
2012	0.478	0.365	0.198	0.477	1.243	0.418
2013	0.476	0.367	0.194	0.463	1.217	0.408
2014	0.483	0.373	0.199	0.479	1.243	0.421
2015	0.496	0.380	0.209	0.502	1.276	0.443
2016	0.495	0.381	0.209	0.504	1.282	0.443

2017	0.514	0.397	0.227	0.553	1.361	0.482
2018	0.526	0.410	0.236	0.579	1.397	0.505
CV	3.779	4.292	7.520	8.384	5.168	8.013

Source: Author's Computations

Figure. II
Inequalities of PCIN for Districts of Himachal Pradesh- Secondary Sector

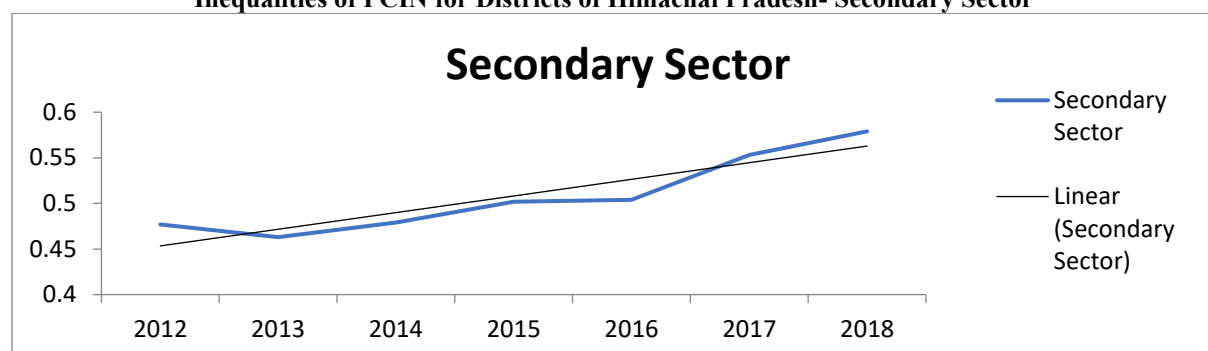


Figure II reveals that the concentration of per capita income calculated to the secondary sector decreased from 2012 to 2013, then it increased from 2013 to 2015. From 2015 to 2016 it becomes constant. After 2016, inequalities again displayed decreasing trend. A view on the trend line showed that inequalities of per capita income from the secondary sector increased overall from 2012 to 2018.

Table 4
Inter-Correlation Matrix among the Indexes for Secondary Sector

	GNC	RSC	ATK	THL	VRC	ENT
GNC	1.000	0.994	0.996	0.993	0.990	0.997
RSC	0.994	1.000	0.989	0.987	0.982	0.990
ATK	0.996	0.989	1.000	0.999	0.998	1.000
THL	0.993	0.987	0.999	1.000	0.999	0.999
VRC	0.990	0.982	0.998	0.999	1.000	0.998
ENT	0.997	0.990	1.000	0.999	0.998	1.000

Source: Author's Computations

D.F. for each value of r: 5 Critical r at 5%, 1% and 0.1% l.o.s.: 0.755 0.875 0.951

The extent of harmony among the alternative measures has assessed through correlation analysis showed in the Table 4. This table revealed that a high degree of positive correlation has found between Thiel's index and Ginni coefficient, Ricci-Schutz, Atkinson, Variation of coefficient, and Entropy. A perfect positive correlation found between Atkinson and Entropy.

III.3 Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Tertiary Sector

Table 5 reveals that from various alternative indexes used for the measurement of inequalities, Thiel's index has selected as the best index for the measurement of inequalities of per capita income from the tertiary sector.

Table 5
Inequalities of PCIN from GVA for Districts of Himachal Pradesh- Tertiary Sector

YEAR	GNC	RSC	ATK	THL	VRC	ENT
2012	0.144	0.103	0.017	0.034	0.271	0.034
2013	0.144	0.102	0.017	0.035	0.273	0.034
2014	0.138	0.098	0.015	0.031	0.257	0.031
2015	0.135	0.095	0.014	0.029	0.248	0.029
2016	0.132	0.094	0.014	0.028	0.244	0.028
2017	0.134	0.096	0.014	0.029	0.249	0.029

2018	0.138	0.098	0.015	0.032	0.260	0.031
CV	3.468	3.481	7.652	8.042	4.437	7.682

Source: Author's Computations

Because it has been associated with the higher CV value (8.042), then the other indexes used. The Thiel's index showed that inequalities of per capita income from the tertiary sector were increasing and then starts decreasing and again start increasing over the period. In tertiary sector, Himachal Pradesh mainly depends on government sector employment which is dispersed in all the state, rural as well as urban areas. This reason leads to the decline of the inequalities of income from tertiary sector over the time.

Fig. III
Inequalities of PCIN for Districts of Himachal Pradesh- Tertiary Sector

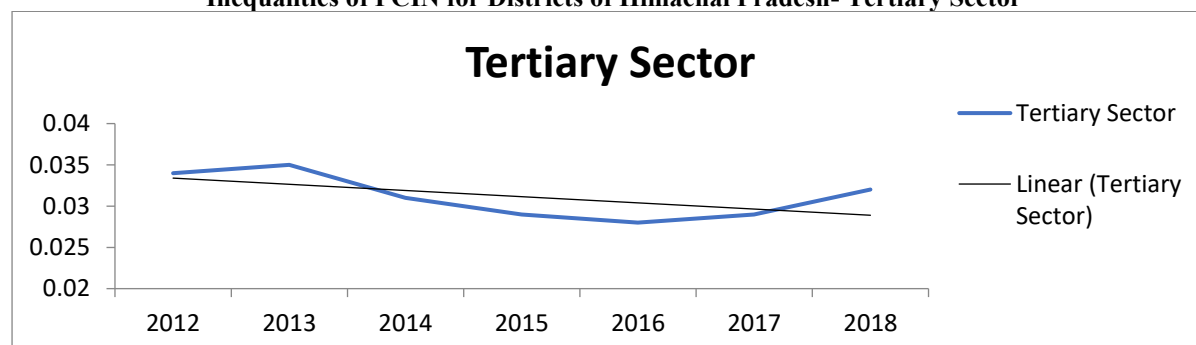


Figure III reveals that inequalities of per capita income calculated to tertiary sector first increased from 2012 to 2013, then it starts decreasing from 2013 to 2016. Again, it starts growing from 2016 onward. Inequalities of per capita income from the tertiary sector showed a U-shaped curve. A view on the trend line showed that differences between per capita income from the tertiary sector decreased overall from 2012 to 2018.

Table 6
Inter-Correlation Matrix among the Indexes for Tertiary Sector

	GNC	RSC	ATK	THL	VRC	ENT
GNC	1.000	0.985	0.978	0.983	0.99	0.997
RSC	0.985	1.000	0.979	0.968	0.984	0.992
ATK	0.978	0.979	1.000	0.967	0.977	0.984
THL	0.983	0.968	0.967	1.000	0.997	0.987
VRC	0.99	0.984	0.977	0.997	1.000	0.995
ENT	0.997	0.992	0.984	0.987	0.995	1.000

Source: Author's Computations

D.F. for each value of r: 5 Critical r at 5%, 1% and 0.1% l.o.s.: 0.755 0.875 0.951

The extent of harmony among the alternative measures has assessed through correlation analysis showed in the Table 5.23. This table revealed that a high degree of positive correlation has found between Thiel's index and Ginni coefficient, Ricci-Schutz, Atkinson, Variation of coefficient, and Entropy.

III.4 Inequalities of PCIN from GVA for Districts of Himachal Pradesh- ADDP

Table 7 reveals that from various alternative indexes used for the measurement of inequalities, Thiel's index has selected as the best index for the analysis of inequalities of per capita income from the tertiary sector. Because it has been associated with the higher CV value 6.384, then the other indexes used. The Thiel's index showed that inequalities of per capita income from aggregate district domestic product (ADDP) were decreased first and then starts increasing and again start reducing and rising over the period.

Table 7
Inequalities of PCIN from GVA for Districts of Himachal Pradesh –ADDP

YEAR	GNC	RSC	ATK	THL	VRC	ENT
2012	0.274	0.208	0.062	0.135	0.578	0.126
2013	0.275	0.211	0.061	0.132	0.565	0.125

2014	0.274	0.206	0.062	0.135	0.579	0.126
2015	0.270	0.205	0.061	0.134	0.579	0.124
2016	0.272	0.206	0.062	0.136	0.583	0.126
2017	0.276	0.211	0.067	0.149	0.623	0.136
2018	0.281	0.211	0.069	0.156	0.641	0.141
CV	1.304	1.341	5.101	6.384	4.709	5.190

Source: Author's Computations

Fig. IV
Inequalities of PCIN for Districts of Himachal Pradesh– ADDP

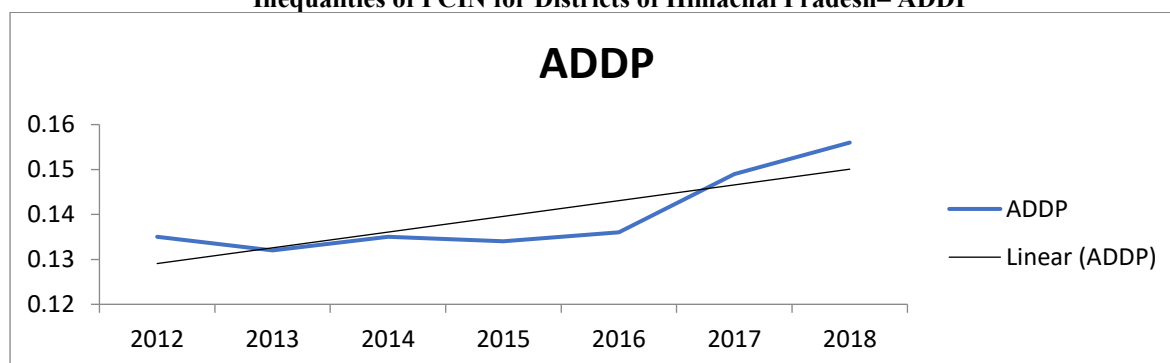


Figure IV reveals that inequalities of per capita income calculated from aggregate district domestic product first decreased from 2012 to 2013, then it increased from 2013 to 2014. Again, reduced from 2015 to 2016 and then increased afterward. A view on the trend line showed that inequalities of per capita income from the tertiary sector increased overall from 2012 to 2018.

Table 8
Inter–Correlation Matrix among the Indexes for ADDP

	GNC	RSC	ATK	THL	VRC	ENT
GNC	1.000	0.804	0.846	0.821	0.767	0.873
RSC	0.804	1.000	0.641	0.595	0.533	0.674
ATK	0.846	0.640	1.000	0.996	0.988	0.998
THL	0.821	0.595	0.996	1.000	0.996	0.994
VRC	0.767	0.533	0.988	0.996	1.000	0.980
ENT	0.873	0.674	0.998	0.994	0.980	1.000

Source: Author's Computations

D.F. for each value of r: 5 Critical r at 5%, 1% and 0.1% l.o.s.: 0.755 0.875 0.951

The extent of harmony among the alternative measures has assessed through correlation analysis showed in the Table 8. This table revealed that a high degree of positive correlation has found between Thiel's index and Ginni coefficient, Ricci-Schutz, Atkinson, Variation of coefficient, and Entropy.

III.5 Inequalities of PCIN for Districts of Himachal Pradesh – Thiel's Index

While measuring the inequalities in income among different districts of Himachal Pradesh. The extent of income inequalities has measured by the alternative quantitative indexes, like Gini, Ricci-Schutz, Atkinson, Thiel, Kolm, and Entropy. Thiel's index has found higher CV values for all calculations at the aggregated/disaggregated level. Therefore, Thiel's index has been associated with higher CV was preferred over the other indexes because that has (index with higher CV) more sensitive to temporal changes.

Table 9
Inequalities of PCIN for Districts of Himachal Pradesh – Thiel's Index

YEAR	PRMR	SCDR	TRTR	ADDP
2012	0.139	0.477	0.034	0.135
2013	0.186	0.463	0.035	0.132
2014	0.148	0.479	0.031	0.135
2015	0.155	0.502	0.029	0.134
2016	0.155	0.504	0.028	0.136
2017	0.116	0.553	0.029	0.149
2018	0.114	0.579	0.032	0.156
CV	17.307	8.384	8.042	6.384

Source: Author's Computations

Table 9 reveals the Thiel index values for various sectors. This shows that inequalities of per capita income from the primary sector remain more or less the same over the period. While in the secondary sector, inequalities of per capita income were decreasing first and then started increasing over time. The tertiary sector was showing increasing and decreasing and again increasing trends with minor fluctuations. Inequalities in aggregate district domestic product were showing a fluctuating trend. Per capita income was falling first and then start growing.

Fig. V
Inequalities of PCIN for Districts of Himachal Pradesh- Various Sectors

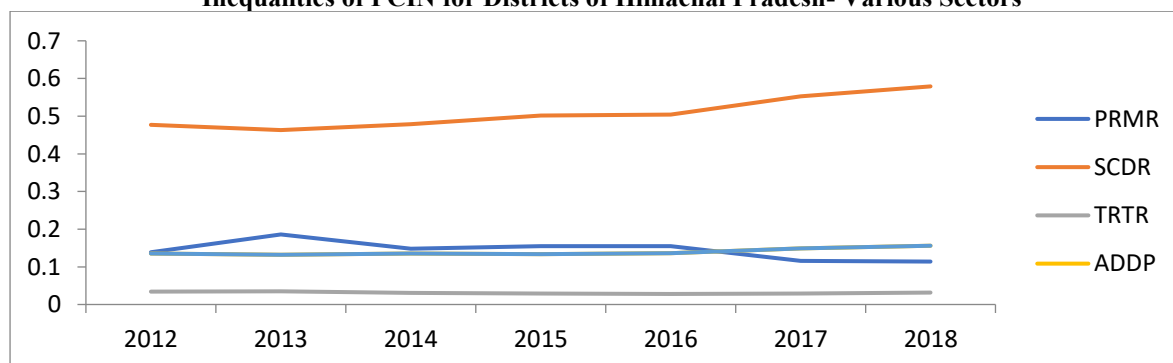


Figure V reveals that inequality of income from the secondary sector was high for the initial year 2012 as compared to secondary, tertiary, aggregate district domestic product, and per capita income. The inequality of income from the primary sector was also showing the increasing trend first and then declined. Aggregate district domestic product and per capita income were coinciding with the third number. Least inequality has found in the tertiary sector. The highest fluctuations in the inequality of income have found in the primary sector. Minimum variations in the disparity of income have found in the tertiary sector.

IV. Conclusion:

Himachal Pradesh's development experience shows a fascinating paradox of progress and disparity. Where the state has achieved remarkable success in industrial diversification, infrastructure and social sector indicators. Yet there is income inequalities derived from various alternative indexes used for the measurement of inequalities, Thiel's index selected as the best index for the analysis of inequalities of per capita income for all sectors and aggregated district domestic product. Which showed that inequalities of per capita income from agriculture and tertiary sector were decreasing, while it was increasing in secondary and aggregate district domestic product.

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