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Horizontal and vertical inequalities across the region and time in Punjab

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Abstract

Objectives: Horizontal Inequalities and Vertical Inequalities are causing violent and conflict in the countries, which are harmful for the development of any country by increasing poverty. Punjab has faced high level of inequality, as it is most educated province of Pakistan. It is important to check the severity of horizontal and vertical inequalities in province of Punjab, Pakistan.
Methods/Statistical Analysis: The secondary data is used in this study. The datasets named as HIES, Household Integrated Economic Survey, published by the Pakistan Bureau of Statistics for the year of 2013-14. Gini Coefficient, Theil'T, Theil'L, and Atkinson Indexes are being estimated to check the severity of Inequalities.
Findings: The comparative analysis of HIs and VIs reveals that VIs is more severe in all divisions of Punjab except the case of Multan. The results shows that the HIs are more severe in rural regions and VIs are more severe in urban regions. The severity of VIs is as follows Lahore, Multan, Bahawalpur, D.G. Khan, Rawalpindi, Faisalabad, Sargodha, Sahiwal, and Gujranwala. Conversely, the severity of HIs is as follows Lahore, Multan, Bahawalpur, D.G. Khan, Sargodha, Sahiwal, Faisalabad, Rawalpindi, and Gujranwala. At last, regression analysis shows that all socio economic variables have significant impact on per capita expenditure with the exception of access to health care. These findings especially HIs add new trend in to the literature specifically for the Punjab, Pakistan.
Application/Improvements: These findings help the government to initiate the regional based programs to eradicate HIs and VIs.

***Keywords*:** Horizontal inequalities, Vertical inequalities, HIES, Entropy measures.

1. Introduction

The term 'inequality' means that merely the distinction in income or the other dimension like consumption, health, education, gender etc. with no regards to their interest as a system of reward or undesirability as a scheme running contrary to several ideal of equality [1]. Moreover, the unfair distribution of resources where someone has excess of money status or opportunity and others haven't. Such inequities might results in separation, a way of deprivation, biasedness and discrimination within the society [2].

Vertical inequality is defined as the inequality among the number of individuals or households. Vertical inequalities are important because of a number of reasons. Firstly is just creating a society because individuals leads to societies; The second one is the to measure the level of poverty in country for any given per capita income; Thirdly, as society is more equal that have more happiness as compared to unequal society [3]; Fourthly, there is evidence that an equal societies grow faster as compared to societies with prevalence of inequality [4,5]; Fifthly and the last one states that as level of inequality and criminality has positive relationship [6].

Horizontal inequalities are the inequality among the group of people groups may be defined as national, religious, racial, ethical, societal, age and gender. Some of the groups also are creating on the basis of education levels, clubs and producing networks. Some group affiliation is more important than others. In some cases, cataloging is largely identified from self-identification or from some combinations and in other cases it can be done by legal factors i.e. nationality [7].

Horizontal inequalities are important as compared to vertical inequalities particularly in societies where some evidence of conflict exists. Growing evidence shows that nature and levels of horizontal inequalities are the

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important determinants of violent conflict. Where violent conflict has negative relationship with development while have a positive relationship with the poverty [8].

Conceivably, the vital reason for concerning with horizontal inequalities is violence of conflict which is the result of it [9], [10]. Grouped or horizontal inequalities provide powerful grumbles which can be used by the political parties or leaders to organize people for political strategies or actions through calling on common religion or history or language and directing to group exploitation, which is also seen in the case of Pakistan especially Karachi and Baluchistan. Mobilization of this type seems to occur where both types of inequalities, political and economic, prevails. Furthermore, the political leaders are not included from political power, while the huge amount of population faces unequal access to social and economic resources [11],[12].

It is important to see the direct impact of horizontal inequality on vertical inequality. Vertical inequality is not only being affected by individual's circumstances but also affected by how horizontal inequalities prevailed in the society. Because people partly thinks that group affiliation has their identity and relative impoverishment of group make the perception of the member that they ensnared permanently into poor position. If their group does relatively better then they feel that they will fall into poverty in near future. The objectives of the study are to measure vertical and horizontal inequalities within and across the regions of Punjab and check the impact of socio-economic variables on living standards of the people of Punjab.

The study explored the relationship among poverty, inequality and growth at sub-national and national levels in Pakistan. It is stated that decline in poverty depends on upon growth and inequality. It is found that net real growth rate is highest in Punjab afterward KPK, Sindh, and Balochistan. Analysis of the province and across the provinces shows that relatively high growth in case all provinces except Sindh. There is the decline in the net rural poverty in case of all provinces without Balochistan. It is to be found that there is the prevalence of anti-poorness across all regions of KPK and Punjab while in the case of Balochistan and Sindh there is pro-poorness. Also, it is found that in spite of a reduction in inequality for rural areas it is still twice than urban inequality across the Pakistan. It is to be suggested that policy biases of rural areas should be minimized by improved management of fiscal policy tools as well as sometimes it happen that small farmer is ignored during the process of development so small package should be introduced for themselves [13]. Sometimes the people of rural areas are facing inequality in terms of environment degradation due to deforesting etc. [14].

2. Methodology

Conceptual framework for vertical inequalities

The study [1] evaluated consumption inequality as well as estimated the relationship between consumption inequality and economic growth by using HIES datasets for the period of 1990-91 to 2004-05. They estimated seven positive and normative inequality indices i.e. Gini-coefficient, Theil Index, Mean Log Deviation, Atkinson Index, Coefficient of Variation, Deciles Dispersion Ratio, and Quintiles Dispersion Ratio. They found that overall 80 percent population face decline in their consumption which included 20 percent poorest and 60 percent middle-income persons while richest 20 percent face increase in their consumption for the given time period. Furthermore, they used the regression model to check the impact of growth on inequality. They found that as an economy is growing consumption inequality decline but increased in 1988-89.

Conceptual Framework of Horizontal Inequalities

Horizontal inequalities are the inequality among the group of people groups may be defined as national, religious, racial, ethical, societal, education levels, age, and gender. In some cases, cataloging is largely identified from self-identification or from some combinations and in other cases it can be done by legal factors i.e. nationality [15]. In this research, some groups are defined to show or measure the horizontal inequalities across the different regions of Punjab. The study [13] used the pseudo-panel analysis to estimate poverty and inequalities with growth in Punjab by defining different groups depend on some characteristics. In the same way, the researcher [16] has estimated horizontal inequalities by dividing the region into two basic groups i.e. rural and urban. Current study explores all these different grouping methods in a different way for the estimation of the extent of the problem in Punjab along with administrative divisions with urban and rural regions. The grouping structure of horizontal inequalities is given Table 1.

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Table 1. Overview of groups in horizontal inequalities

Groups	Variables	Criteria
Group 1	Age	18 to 60 Years
Group 2	Age and Education	18 to 60 Years; 5^{th} to 16^{th} Class
Group 3	Age, Education and Occupancy Status	18 to 60 Years; 5^{th} to 16^{th} Class; if present
Group 4	Age, Education, Occupancy Status and Employment Status	18 to 60 Years; 5^{th} to 16^{th} Class; if present; if head is employed

Source: Author's Own Citation

All groups are taken with some logical reasons. The reason behind the first group is that the officially a person with the age of 18 are able to start working and retires in 60's. The reason of 2nd group is that officially minimum required education is primary and most of the people not studying after their masters, 16 years of education. Group 3rd have a reason to check the inequality in the group of those people which have some things to occupy, simply the person which are owner of some things like own house, own shop etc. and the reason behind the 4th group is to check the inequality with respect to employment status either someone is employed or unemployed.

Data source

The basic aim of this research is to measure inequality within and across the divisions with rural and urban regions of Punjab. Household Integrated Economic Survey (HIES) data, is being used to measure horizontal and vertical inequality, which is being collected by Pakistan Bureau of Statistics, It is the department which has duty to conduct the survey for collection of data from sampled households which represents the population. This survey contains information about all provinces of Pakistan including regions like rural and urban.

Data related issue:

The researcher [17] argued that, in Pakistan, mostly studies for the estimation of poverty and inequality based upon HIES/PSLM datasets issued by PBS which is subdivided into rural and urban segments. But different research raises questions on credibility and reliability of this data. The researcher [18] argued that most of the national respondent feel hesitate to provide real data on consumption and income to avoid tax and security reasons. Furthermore, self-employed personalities i.e. businessman and landlord, where the large portion of labor employed, provide particularly inaccurate. The researcher [19] argued that HIES datasets face the problem of underestimation because highest income group avoid giving accurate information while studies on poverty and inequality used consumption as a base and consumption on non-durable goods used as a proxy for permanent Income. Furthermore, the researchers [20] stated that the greater underestimation of income for the greater income groups implied by the lower poverty rate of income. In [21] HIES dataset doesn't contain the information of people that haven't their permanent habitation. Thus, we get biased fact and figures for this population. The studies [22, 23] stated that reliability of HIES/PIHS datasets, to assess the inequality and poverty, are debatable because the sample size of these datasets is not sufficient to measure key indicators at provincial levels. The study [22] concluded that results for Balochistan, at the provincial level, that consist of large area and low population mass, misleads and this may be the result of using large "Weights (Raising Factor)". Furthermore, the discrepancy of material and methods and an anomaly of HIES survey are hampers in a way of poverty and inequality analysis. The study [24] stated that as there is no other mean of getting information or data regarding consumption and income except HIES. So researchers are bound to use this dataset ignoring pros and cons of it. The researchers [25] argued that these datasets underestimate the correct inequality, the reason behind that is grouped data ignores inequality within the group. Henceforth, expansion of underestimation depends on the number of income groups.

Used indexes

World Bank [26] manual for poverty and inequalities measurement suggested Gini Coefficient, Generalized Entropy Measure i.e. Theil's indexes and Atkinson's Index for estimation, which are also used in this paper.Gini

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Coefficient shows the deviation of any income group or individual from the line of equality. Mathematically derivation of it is as follows. Let suppose there are some figures say x_i and y_i which are represented on x-axis and y-axis respectively on a graph so.

$$Gini = 1 - \sum_{i=1}^{N} (x_i - x_{i-1})(y_i - y_{i-1})$$

Now, taken an equal intervals of figures say 'N' intervals then

$$Gini = 1 - \frac{1}{N} \sum_{i=1}^{N} (y_i + y_{i-1})$$

The researcher [27] derived this formula for Gini Coefficient

$$\text{Gini} = \frac{2}{n^2 \overline{y}} \sum_{i=1}^{N} i(y_i - \overline{y})$$

Where y_i shows value of i^{th}Income group, $\bar{Y}$ shows mean value of i^{th}income group data and n shows number of observations. Formal form of Generalized Entropy Measures is as follows

$$GE(\alpha) = \frac{1}{\alpha(\alpha - 1)} \left[\frac{1}{N} \sum_{i=1}^{N} \left(\frac{y_i}{\bar{y}} \right)^{\alpha} - 1 \right]$$

Where $\bar{y}$ represent the mean per capita income/expenditure, y_i shows i^{th} consumption/income group from ascending order and N shows number of observations. The value interval of Generalized Entropy Measures is $0 \leq G.E \leq \infty$. Where zero shows the perfect equality while as values of G.E increases which shows higher level of inequality. Theil (1967) derived two inequality indexes from the notion Entropy measures G.E (0) and G.E (1). G.E (0) is known as Theil's L Index sometime it refers to mean log deviation while G.E (1) is known as Theil's T Index Mathematical forms of both as follows.

$$GE(0) = \frac{1}{N} \sum_{i=1}^{N} \ln \left(\frac{\overline{y}}{y_i} \right) \therefore \text{Theil's L}$$

$$G.E(1) = \frac{1}{N} \sum_{i=1}^{N} \frac{y_i}{\overline{y}} \ln \left(\frac{y_i}{\overline{y}} \right) \therefore \text{Theil's T}$$

The researcher [28] proposed a new inequality measure, by introducing the weighted parameter ε which used to measure aversion to inequality while ε measures the inequality aversion. It is formulated as

$$A_{\varepsilon} = 1 - \left[\frac{1}{N} \sum_{i=1}^{N} \left(\frac{y_i}{\bar{y}} \right)^{1-\varepsilon} \right]^{1/(1-\varepsilon)}, \varepsilon \neq 1$$

$$= 1 - \frac{\prod_{i=1}^{N} (y_i^{(1/N)})}{\bar{y}}, \varepsilon = 1$$

Regression model

The researcher [29] argued that if researcher uses household level data this generates estimates of per capita expenditure for each household. To check the impact of the socio-economic factor on expenditure researcher used multiple regression model. General mathematical form of the model as follows

$$Y = \beta_1 + \sum_{i=1}^{k} \beta_i X_{ij} + \mu_i$$

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Specific form of regression model is

$$PC = \beta_0 + \beta_1 HH + \beta_2 AMM + \beta_3 AHC + \beta_4 IMU + \beta_5 DPR + \beta_6 MFR + \beta_7 ADP + \beta_8 NC + \beta_9 HE + \beta_{10} HA + \beta_{11} APW + \beta_{12} OSH + \mu_t$$

Where PC shows log of per capita expenditure, HH shows households size, AMM shows access to mass media, AHC shows access to health care, IMU shows immunization, DPR shows dependency ratio, MFR shows male female ratio, ADP shows number of adults with age greater than 60 years, NC shows number of child's with age less than 15, HE shows education of head of household, HA shows age of household's head, APW shows access to pure drinking water, OSH shows occupancy status of households and μ error term.

3. Results and discussion

In this section researcher discuss the results of analysis. The analysishas been done in different ways mainly for the measurement of vertical inequality at divisional level, average measurement of horizontal inequalities at divisional levels and measurement of the impact of socio-economic variables on living standards of people in overall Punjab. The estimation of the vertical inequalities at the divisional level is shown in Table 2.

Table 2. Estimation of Vertical Inequalities at divisional level of Punjab

Divisions	Gini Coefficient	Theil'L G.E (0)	Theil'T G.E (1)	Atinksonε=0.5	Atinksonε=1	Atinksonε=2
Rawalpindi	28.34	12.92	14.45	6.60	12.12	20.90
Urban	28.67	13.29	14.57	6.71	12.43	21.82
Rural	26.83	11.61	13.19	5.99	10.96	18.83
Sargodha	27.78	12.44	14.05	6.38	11.70	20.16
Urban	31.68	16.11	18.16	8.20	14.88	25.03
Rural	24.07	9.22	9.76	4.63	8.81	16.04
Faisalabad	27.84	12.51	14.47	6.49	11.75	19.81
Urban	30.00	14.28	16.39	7.37	13.31	22.20
Rural	24.30	9.52	10.71	4.91	9.08	15.91
Gujranwala	25.59	10.53	11.36	5.31	9.99	17.99
Urban	26.92	11.81	12.73	5.93	11.14	20.06
Rural	23.72	8.98	9.51	4.51	8.59	15.72
Lahore	37.01	22.34	27.79	11.69	20.05	31.23
Urban	37.59	22.98	28.26	11.95	20.53	31.94
Rural	29.88	14.93	18.21	7.88	13.87	22.62
Multan	33.05	17.70	21.22	9.19	16.22	26.40
Urban	35.79	20.68	23.76	10.47	18.69	30.71
Rural	25.39	10.52	11.75	5.39	9.99	17.59
D.G.Khan	29.17	13.61	15.41	6.97	12.72	21.67
Urban	31.75	16.35	18.55	8.33	15.08	25.38
Rural	26.32	10.93	11.84	5.53	10.36	18.25
Bahawalpur	29.95	14.34	16.45	7.38	13.36	22.44
Urban	32.58	17.03	18.88	8.58	15.66	26.59
Rural	24.85	9.75	10.56	4.95	9.29	16.45
Sahiwal	27.18	12.16	13.78	6.24	11.45	19.96
Urban	29.70	14.38	15.20	7.13	13.40	24.07
Rural	24.44	10.00	11.53	5.18	9.51	16.76
Islamabad	44.88	33.33	42.05	17.11	28.35	41.88
Urban	48.54	39.15	48.99	19.82	32.39	46.51
Rural	29.20	13.58	14.18	6.74	12.69	22.31
Punjab	32.50	17.36	21.00	9.02	15.93	26.26
Urban	34.46	19.49	23.82	10.13	17.71	28.67
Rural	27.54	12.34	13.72	6.27	11.61	20.39

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On the overall basis most severe vertical inequality present in Lahore division and most minor found in Gujranwala division. Ranking from highest to lowest on overall division basis is as follows Lahore, Multan, Bahawalpur, D.G.Khan, Rawalpindi, Faisalabad, Sargodha, Sahiwal and Gujranwala. Furthermore, on the basis of urban region of different divisions most severe vertical inequality is present in urban regions of Lahore division and most minor, on comparison basis, present in Gujranwala division while ranking from highest to lowest division is as follows: Lahore, Multan, Bahawalpur, D.G.Khan, Sargodha, Faisalabad and Shiwal, Rawalpindi and last is Gujranwala. Faisalabad and Sahiwal is on same ranking because Theil'L, Atkinson Ɛ=1 and Atkinson Ɛ=2 are not in favor of Faisalabad for 6th rank. However, Theil'T, Gini and Atkinson Ɛ=0.5 not in favor of Sahiwal. Moreover, rural region based vertical inequality is also measured on division basis. So, most severe vertical inequality is present in rural regions of Lahore division and minor, on comparison basis, Gujranwala division. Ranking of divisions on the basis of rural regions is as follows; Lahore, Rawalpindi, D.G.Khan, Multan, Sahiwal, Bahawalpur, Faisalabad, Sargodha and Gujranwala. Islamabad is not discussed n ranking because it's not a part of Punjab but a federal. Furthermore, the estimation of the horizontal inequalities at the divisional level is shown in Table 3.

Table 3.Estimation of average Horizontal Inequalities at divisional level of Punjab

Divisions	Gini Coefficient	Theil'L GE(0)	Theil'T GE(1)	Atkinson Ɛ=0.5	Atkinson Ɛ=1	Atkinson Ɛ=2
Rawalpindi	26.44	11.24	12.44	5.73	10.63	18.62
Urban	28.08	12.71	14.02	6.45	11.93	20.75
Rural	23.59	8.87	9.46	4.48	8.49	15.35
Sargodha	28.10	12.75	13.91	6.43	11.97	21.02
Urban	30.56	14.95	16.35	7.53	13.88	23.82
Rural	24.87	10.02	10.38	4.97	9.52	17.63
Faisalabad	26.73	11.51	13.04	5.92	10.87	18.72
Urban	27.57	12.12	13.61	6.21	11.40	19.49
Rural	24.65	9.91	11.24	5.11	9.44	16.57
Gujranwala	25.01	10.16	11.08	5.15	9.66	17.37
Urban	24.62	10.12	11.14	5.14	9.62	17.40
Rural	24.45	9.58	10.34	4.85	9.13	16.39
Lahore	33.60	21.3	26.42	11.14	19.18	30.15
Urban	35.75	20.97	26.06	10.98	18.91	29.77
Rural	31.40	16.47	20.70	8.83	15.28	24.15
Multan	33.41	18.06	21.19	9.28	16.52	27.2
Urban	31.96	19.36	22.3	9.83	17.59	29.18
Rural	26.49	11.32	12.47	5.76	10.70	18.76
D.G. Khan	29.03	13.56	15.36	6.94	12.68	21.67
Urban	31.59	16.22	18.34	8.26	14.97	25.19
Rural	24.92	9.79	10.27	4.90	9.32	16.88
Bahawalpur	29.41	13.90	15.38	7.04	12.96	22.39
Urban	28.75	13.33	14.80	6.78	12.46	21.41
Rural	24.81	9.74	10.34	4.89	9.27	16.68
Sahiwal	26.99	11.95	13.45	6.14	11.27	19.5
Urban	29.47	14.16	15.16	7.07	13.20	23.39
Rural	21.89	7.96	8.79	4.08	7.65	13.77
Islamabad	41.95	29.78	33.16	14.63	25.56	39.65
Urban	47.28	40.70	42.55	18.98	32.76	48.18
Rural	27.96	12.61	13.50	6.35	11.84	20.27
Punjab	31.21	15.99	19.06	8.30	14.78	24.63
Urban	32.16	17.00	21.85	8.85	15.63	25.70
Rural	27.10	11.96	13.41	6.11	11.27	19.72

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The results of the horizontal inequalities, on overall basis, shows that the ranking of horizontal inequality is as follows; most severe HIs present in Lahore division followed by Multan, Bahawalpur, D.G. Khan, Sargodha, Sahiwal, Faisalabad, Rawalpindi, and Gujranwala. In urban region of different divisions most severe HI present in Lahore and least severe in Gujranwala. Ranking of urban region based HI in different divisions is as follows; Lahore, Multan, D.G.Khan, Sargodha, Sahiwal, Bahawalpur, Rawalpindi, Faisalabad and Gujranwala. Furthermore, rural region of different divisions, Lahore is the division which is most affected by severe HI and Sahiwal is division which is least affected. Ranking of rural regions based HI in different divisions is as follows; Lahore, Multan, Sargodha, Faisalabad, D.G.Khan, Bahawalpur, Gujranwala, Rawalpindi and Sahiwal. Islamabad is not discussed n ranking because it's not a part of Punjab but a federal. Moreover, the impact of socio-economic variables on per capita income is shown in Table 4.

Table 4. Results of regression analysis

Variables	**Coefficient**	**S.E**	**t-stat**	**P-values**
Household Size	-0.0296	0.0032	-9.16	0.000
Access to Mass Media	0.1331	0.0115	11.94	0.000
Access to Health Care	0.0112	0.0109	1.02	0.308
Immunization	0.1141	0.0119	9.60	0.000
Dependency Ratio	-0.3023	0.030	-10.19	0.000
Male Female Ration	-0.0179	0.0055	-3.28	0.001
No. of Adult Persons	-0.0261	0.0089	-2.94	0.003
No. of Child	-0.0523	0.0045	-11.57	0.000
Head Education	0.0435	0.0012	34.30	0.000
Head Age	0.0029	0.00043	6.81	0.000
Access to Pure drinking Water	0.1514	0.0199	7.60	0.000
Occupancy Status of Household	0.0327	0.0137	2.38	0.017
Constant	0.2946	0.0253	327.47	0.000
F-Stat	311.88	**P-value of F-Stat**		0.000
R^2	0.5507	**Adj-R^2**		0.5304

Source: Author's Own Citation

All the socio-economic variable shows significant relationship, either positive or negative, with per capita expenditure except access to health care which indicates that access to health is easy and not causing expenses in Punjab. F-Stat shows the significance of the model while R^2 shows that 55.07 percent variations occur in per capita expenditure due to independent variables and rest of due to error term. In cross sectional data there are two problems of data i.e. multicolinearity and hetrocedasticity. To avoid the problem of heterocedasticity robust standard error as used. To identify the problem of multicolinearity correlation metrics, VIF and TOL are used and it is found that there is no problem of multicolinearity in our data.

4. Conclusion and suggestions

The comparison of horizontal and vertical inequalities among different divisions of Punjab depicting the fact that overall vertical inequalities are more than horizontal inequalities in all divisions rather than Multan where case is inverse. It is also depicting from the analysis that rural region based vertical inequalities in all divisions are least severe as compared to rural region based horizontal inequalities. Furthermore, urban region based vertical inequalities in all divisions are more severe as compared to urban region based horizontal inequalities. At last regression analysis depicting the interrelationship of socio-economic variables with per capita expenditure except access to healthcare. The regions where HIs are greater government should take some steps on the groups based on education, age and employment status rather than to work on gender, ethnic or linguistic basis. Vertical inequalities

can be overcome through control urbanization by creating jobs at districts level. Furthermore, some regional/divisional based indirect taxes and subsidies should be introduced to eradicate inequality.

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