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AN EMPERICAL ANALYSIS OF HOUSEHOLD'S INCOME INEQUALITY IN PAKISTAN

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Abstract

The research attempts to examine the disparity in wealth at household level in Pakistan by using Household Integrated Economic Survey (HIES) 2018–2019 data. A sample of 24,804 households from the 4 areas of Pakistan; Punjab, Khyber Pakhtunkhwa, Sindh, additionally Baluchistan have included in the collection of information. Based on the data, the average annual family income in Punjab is the highest at PKR 406,507, while the lowest is in Sindh at PKR 341,973 annually. The analysis of distribution of income is done using a range of inequality measures, including the Atkinson index It suggests a significant economic disparity and the Gini coefficient which indicates high inequality in income. Significantly higher Gini coefficients and associated ratings suggest that income The level of disparities increases in rural than in cities. Significant differences in income between provinces are also shown by the analysis, with Punjab showing the highest levels of economic inequality. Probability tests like t-tests over matching meant & Levene's test over similarity of deviations, confirm substantial differences in income variance and mean incomes between groups.

Keywords: Income inequality, Lorenz Curve, Gini coefficient, HIES

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INTRODUCTION

Income inequality refers to the unequal distribution of wealth among individuals, groups, or nations, driven by social divisions and hierarchy. significantly impacts disparities in social status, political influence, and well-being. Income, influenced by factors such as race, age, gender, and ethnicity, plays a critical role in determining quality of life and health. In developed countries like the US, most households rely on wages, while the wealthy benefit from investment gains. Income inequality exists within and across countries and is a major cause of social separation and class disparity, affecting wealth, political power, and social standing. While often attributed to individual traits, income inequality arises from systemic issues like fragmented labor markets, discrimination, gender roles, and unequal resource distribution. Legal and economic factors, such as minimum wage laws, corporate power, and government resource management, also contribute. The impact of wealth disparity on well-being varies depending on access to basic necessities and productive resources like land, water, and technology.

Global income inequality and extreme poverty persist, with 35% of the global population living on less than $3.10 daily and 13% surviving on under $1.90. Such poverty leads to child labor, poor health, malnutrition, low education, and high child mortality rates. Wealth distribution is highly unequal, with the richest 1% holding more wealth than the rest of the global population combined. Income inequality varies across nations, influenced by social factors such as labor market structures, discrimination, resource access, and regional disparities. Contractionary monetary policies often exacerbate income gaps, especially in countries lacking redistribution mechanisms. Conversely, expansionary monetary policies may temporarily increase earnings but could widen inequality due to uneven benefits among socioeconomic groups. In China, regional inequality is pronounced due to disparities in economic activity, resource distribution, and local policies. For example, per capita savings in Shanghai in 2010 were double those in Guizhou. Such regional imbalances extend to indicators like mortality and literacy rates.

In Pakistan, income inequality divides society into wealthy elites and economically vulnerable groups. The affluent enjoy better access to education, healthcare, and wealth accumulation, while the poor struggle for basic needs. Regional disparities also hinder development, with unequal access to justice, clean water, nutrition, and healthcare. Studies using Gini coefficients highlight stark income gaps, with estimates increasing from 0.319 to 0.419 after data refinement, revealing deeper inequality.

Addressing inequality requires evidence-based policies targeting regional and socioeconomic disparities. Improved data analysis, such as Haroon Jamal's refined Gini coefficient study, offers valuable insights for policymakers. These findings can guide the development of equitable social welfare programs and sustainable development strategies.

LITERATURE REVIEW

Research on income and wealth disparities in Pakistan reveals significant inequalities across occupations, regions, and socioeconomic groups. Ahmad (2002) used Gini coefficients with HIES data (1992–1993) to identify the highest disparities within professional groups and among provinces, with KP showing the greatest inequality and Baluchistan the least. Similarly, Tanveer et al. (2022) found that education contributes to disparities across provinces, while unskilled labor reduces inequality in Punjab and Baluchistan.

Regional studies, such as Munawar et al. (2017), emphasize higher incomes in large cities compared to smaller ones, advocating for equitable policy interventions. Nasir & Mahmood

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(1998) highlighted non-market influences and systemic discrimination as drivers of inequality, calling for better income distribution policies. Abdul Hamid & Naeem Akram (2014) analyzed multidimensional wealth disparities from 2001–2008, finding ineffective redistribution policies and rising inequality, especially in Sindh and Punjab.

Recent research by Khan & Himayatullah (2023) in KP identified significant income disparities in districts like Shangla, Haripur, and Torghar, while Swabi exhibited the least. Gazdar (2009) attributed structural inequalities to gender, class, and regional disparities, advocating for infrastructure development and equitable access to public services.

Talat & Balqees (2003) found increasing national inequality from 1998 to 2002, with urban areas experiencing improvement while rural disparities grew. Shahla Akram et al. (2021) demonstrated a positive correlation between educational and income inequality across Punjab, emphasizing the need for targeted educational reforms.

Studies on poverty reveal acute challenges. Akhtar et al. (2020) focused on Bannu, KP, linking unemployment to poverty and low standards of healthcare and education. Asian Development Bank reports (2002–2021) highlight persistent poverty, with malnutrition and stunting affecting children despite poverty alleviation efforts.This body of research underscores the critical need for evidence-based policies addressing occupational, regional, and systemic income disparities in Pakistan to promote sustainable development and social equity.

Kruijik (1987) analyzed wealth disparities using the 1979 Household Income and Expenditure Survey (HIES) data for urban and rural areas at the provincial level, which was reported in the 1981 population census. Using the Theil index to measure inequality, Kruijik found that overall inequality increased, with the Theil coefficient rising from 0.17 to 0.23, driven by changes in income sources. Similarly, Pasha (2022) conducted a study titled *"The True Wealth Inequality in Pakistan,"* utilizing data from the HIES and labor force surveys by Pakistan Bureau of Statistics (PBS) from 2018–2019. Pasha applied the Gini coefficient and Pashum ratio, finding that income disparities across regions were significantly pronounced, with the Gini coefficient rising by over 30% and the Pashum ratio by 42%. Merchand (2019) explored regional wealth disparities in Canada between 1981 and 2011 using a panel dataset covering 284 locations over 5-year intervals. His findings attributed rising cross-regional inequality to socioeconomic factors, labor market shifts, and variations in industrial compositions, such as the higher prevalence of tertiary and knowledge-intensive sectors correlating with greater income disparity.

Marcel Boyer (2020) focused on wealth and income disparities over time since 1920, noting that consumption inequality has declined due to social transfers, which bolstered the lowest income quintile's resources. Boyer highlighted that the top 1% of earners' share of the economy, after an initial decline in the 1970s, has risen, reaching levels close to those of the 1920s by 2010–2019, with similar patterns observed in wealth disparities, particularly in sports and entertainment sectors. Ho-fung Hung (2021) examined the role of globalization in shaping income disparities, noting that while within-country inequality has increased since the 1980s, between-country inequality has declined. The rise of middle-class populations in countries like China and India and the labor market shifts in wealthy nations have shaped these trends, with political responses and international crises also influencing income distribution patterns.

Mumtaz & Syed (2023) studied income inequality in Pakistan over two periods, 2001–02 and 2018–19, using the HIES and generalized entropy measurements. Their findings identified key contributors to income disparities, including gender, education, job

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type, and asset ownership. They further explored how paid work, female labor participation, and shifts in asset ownership impacted income inequality. The findings offered insights into policy strategies for social welfare, taxation, and inclusive growth. Lastly, Petri Roikonen (2022) analyzed income inequality in Finland from 1865 to 2019. Roikonen noted that industrialization initially increased income inequality until the early 20th century. Economic crises and increased taxation reduced income inequality in the mid-1900s, while tax reforms and capital income contributed to renewed disparities during the 1990s. However, from the early 1980s onward, state welfare policies and income redistribution significantly reduced income disparities, stabilizing inequality levels into the 21st century.

3. DATA AND METHODOLOGY

The Household Income and Expenditure Survey (HIES)/Pakistan Social and Living Standards Measurement (PSLM), compiled by Pakistan's Institute of Statistics, serves as the primary resource for information on Pakistani households' economic activity. This nationwide survey for the 2018-2019 period includes data from 24,804 households across the country, providing detailed insights into income patterns across all provinces. Of these, 11,780 households are from Punjab, 4,483 from Khyber Pakhtunkhwa, 6,215 from Sindh, and 2,326 from Balochistan. The data is categorized into urban and rural households, with 15,934 households representing rural areas and 8,870 households representing urban areas. This comprehensive survey offers an in-depth analysis of income distributions across Pakistan's provinces and urban-rural divides.

TABLE 1: ***PROVINCE WISE DISTRIBUTION OF SAMPLE***

Province	Frequency	Percent	Cumulative percent
Khyber Pakhtunkhwa	4483	18.1	18.1
Punjab	11780	47.5	65.6
Sindh	6215	25.1	90.6
Baluchistan	2326	9.4	100.0
Total	**24804**	**100.0**	

TABLE 2:REGION WISE DISTRIBUTION OF SAMPLE

Region	Frequency	Percent	Cumulative percent
Rural	15934	64.2	64.2
Urban	8870	35.8	100.0
Total	**24804**	**100.0**	

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FIGURE 1: PROVINCE WISE DISTRIBUTION OF SAMPLE

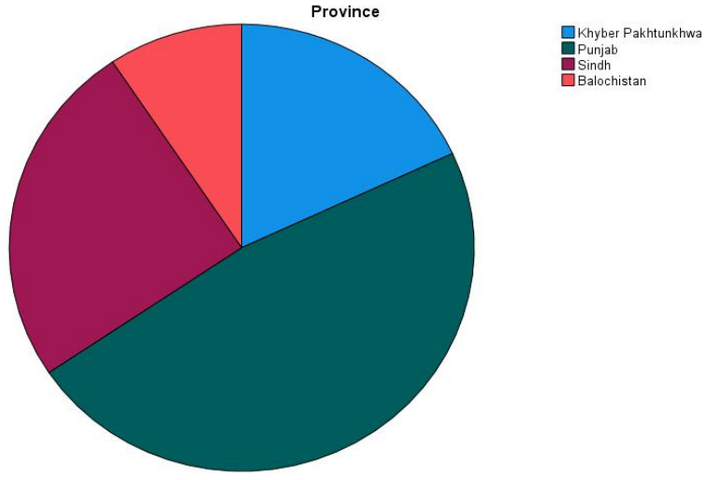
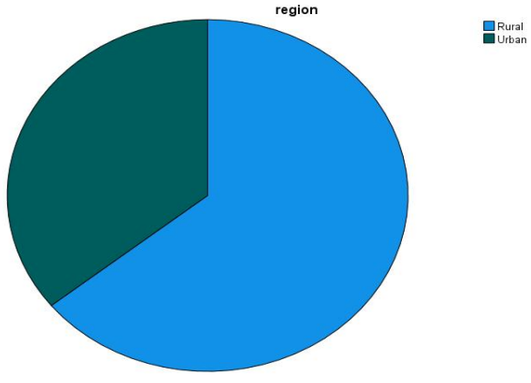


FIGURE 2: REGION WISE DISTRIBUTION OF SAMPLE



DESCRIPTIVE STATISTICS

Descriptive statistics are used to summarize and describe the main features of a dataset. One key measure is the average, which represents the central value of a dataset. However, relying solely on the average can be problematic because different datasets may share the same average without being comparable. To address this issue, the concept of dispersion is introduced. Dispersion refers to the degree of scatteredness or variability of data points from their average. It provides insights into how data values are distributed around the central point. Measures of dispersion quantify this spread and are essential for a more comprehensive analysis of data variability.

PIE CHART

A pie chart is a circular statistical graphic divided into slices, illustrating numerical proportion. Its arc length, central angle, and area are proportional to the quantity that represents.

$$\text{Angel} = \frac{Quantity}{Total} * 360^{o}$$

FREQUENCY DISTRIBUTION

A frequency distribution is a graphical or tabular representation of the frequency of a variable within a given interval.

INEQUALITY MEASURE

DECILE DISPERSION RATIO

The decile dispersion ratio measures income or consumption inequality by comparing the average income/consumption of the richest 10% to that of the poorest 10%. Variations can

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include ratios like comparing the richest 5% (95th percentile) to the poorest 5% (5th percentile). While intuitive and widely used, it overlooks middle-income disparities and intra-decile income distribution.

LORENZ CURVE

The Lorenz curve visually represents income or wealth distribution. A straight diagonal line symbolizes perfect equality, while deviations from this line represent inequality. The area between the Lorenz curve and the diagonal line forms the **Gini coefficient**, a scalar measure of inequality. The farther the Lorenz curve deviates from the diagonal, the greater the economic inequality.

GINI COEFFICIENT

Among the most often used indicators of income disparity is the Gini coefficient, it initially emerged presented by GINI (1912) to quantify the allocation of cash and assets. To define GINI COEFFICIENT, at least three methods are commonly used. The first method is known as the geometric approach, and it uses the Lorenz curve to derive the gini coefficient geometrically .It is described as the ratio of the entire area below the equality line to the area above it. Rao (1969) provided the following formula to determine the gini coefficient using a geometric method:

$$G = \sum_{i=1}^{n-1} \left(P_i q_{i+1} - P_{i+1} q_{i+1}{}_{\ldots}\right)$$

The cumulative population share (P) and the cumulative income share (q_i) are calculated when income units are sorted in ascending order.

GENERALIZED ENTROPY MEASURE

Many indicators of income disparity meet each of the six requirements. The mean logs deviation metric and the Theil indexes are two of the most used ones .Both are members of the Generalized Entropy (GE) inequality measure family. ..Here is the standard calculation:...

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

Numerous measures of income inequality satisfy all six criteria. Among the most popular are the Theil indexes and the mean logs deviation measure.The Generalized Entropy (GE) inequality measure family includes both of them. GE(1) is Theils T index which may be written as:

$$GE(1) = \frac{1}{N} \sum_{i=1}^{N} \frac{y_i}{y} \ln\left(\frac{y_i}{y}\right)$$

GE (o) also known as Theils L and sometime referred to as too mean log deviation measure s given as;

$$GE(0) = \frac{1}{N} \sum_{i=1}^{N} \ln\left(\frac{\bar{y}}{y_i}\right)$$

KAKWANI MEASURE

The Kakwani index named after the Indian economist Nanak Kakwani is another measure of income inequality. The Kakwani score is determined through comparison the progressivity of the tax or transfer system with the overall income inequality.

The formula for the Kakwani index is:

$$K = C - G$$

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Where K is the Kakwani index, C is the post-tax financial concentration index, G is the Gini coefficient of post-tax income. The concentration index measures income inequality within a population while the Gini coefficient measures overall income inequality. Subtracting the Gini coefficient from the concentration index provides a measure of the progressivity (or regressivity) of the tax or transfer system. A positive value indicates progressivity meaning the system reduces income inequality while a negative value suggests regressivity meaning the system exacerbates income inequality.

PIESCH MEASURE

The Piesch measure of inequality, also known as the generalized entropy index, is a family of inequality measures that generalize the Theil index. It's a way to quantify income or wealth distribution within a population.

The Piesch measure is defined as:

$$p_\lambda = \frac{1}{\lambda(\lambda-1)} \sum_{i=1}^{n} \omega_i^\lambda \ln\left(\frac{\omega i}{\bar{\omega}}\right)$$

Where P is the Piesch measure of inequality. λ is a parameter that determines the measure's sensitivity to different parts of the income or wealth distribution. w is the income or wealth of individual. $\bar{w}$ is the mean income or wealth in the population. I is the number of individuals in the population. The parameter λ affects the sensitivity of the measure to different parts of the income or wealth distribution. When λ=1 the Piesch measure reduces to the Theil index. Different values of λ can give different insights into inequality based on the context and the distribution being analysed.

MEHRAN MEASURE

In order to estimate the inequality in the distribution of wealth or income within a population, economists and social scientists employ the Mehran measure of inequality. It bears the name of Farhad Mehran, the economist who suggested this policy. The Mehran measure, which compares inequality between populations or greater time within a single population, addresses the degree of inequality among people.

The Lorenz curve, which shows the distribution of wealth or income graphically and the Mehran measure are closely related concepts. It is susceptible to shifts in the distribution of income, particularly when transfers take place between people. The regions within the Lorenz curve and a straight line of perfect equality serve as its foundation. The Mehran measure can be calculated as:

$$M = \frac{1}{2}\int_0^1 |p - L(p)|\,dp$$

Let L (p) be the Lorenz curve function, where p represents the cumulative proportion of the population (from 0 to 1), and L (p) is the cumulative proportion of income held by the bottom proportion of the population.

DESCRIPTIVE ANALYSIS

The average annual income of household is 396829 with a standard deviation of 413635.The maximum household annual income is 18000000 and minimum household income is 8000. The lowest annual income for any household in a rural location is 8,000.00. 12,391,200 is the highest annual income earned by any household in rural areas. The average annual income for households in rural areas is 331,036. Household income in rural areas usually ranges or distributes about annually by about 305,080. In cities, the lowest yearly wealth made by any household is 8,870. In cities, the highest annual income made by any household is $18,000,000. The mean or average annual household income in urban regions is 515,020 on average. The income of urban households tends to change or spread

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out by approximately 538,079.these statistics provide in understanding the range and average income levels of households in both urban and rural regions together with the amount of difference from the average income.

The table shows a comparative examination of household incomes in Sindh, Baluchistan, Punjab, and Khyber Pakhtunkhwa. The average household income in Punjab is approximately 406,507 per year with variations ranging from 9,000 to 18,000,000. Similar distributions can be seen in Khyber Pakhtunkhwa where the range of incomes is from 13,000 to 12,040,008 and the mean is approximately 467,926. In contrast the average household income in Sindh is a little lower at approximately 341,973, with incomes ranging from 21,300 to 6,000,000. Baluchistan shows a similar pattern with a household income ranging from 8,000 to 4,440,000 with an average of around 357,363. The standard deviations which show how earnings vary from the mean are significant for every province and point to different levels of income inequality among the people living there.

TABLE 3: *SUMMARY STATISTICS*

	N	Minimum	Maximum	Mean	Std. Dev.
Pakistan					
Annual household income	24804	8000	18000000	396829.41	413635.82
Rural					
Annual household income	15934	8000	12391200	331036.01	305080.48
Urban					
Annual household income	8870	22000	18000000	515020.17	538078.64
Punjab					
Annual household income	11780	9000	18000000	406507.14	458944.09
Khyber Pakhtunkhwa					
Annual household income	4483	13000	12040008	467926.25	469693.99
Sindh					
Annual household income	6215	21300	6000000	341972.97	301203.65
Baluchistan					
Annual household income	2326	8000	4440000	357363.33	265606.63

DISPERSION RATIO FOR OVERALL SAMPLE (PAKISTAN)

The table shows various income groups and are the papulations percentiles ranging from 5 to 100. The matching percentiles of the populations cumulative proportion of the total income is shown in the Table 3. Household receive about 1.15 % (0.0115) of the total income in the 5th percentiles. Household receives about 2.27% (0.0276) of the total income at the 10th percentile. Households receives about 4.46% (0.046) of the total income in the15th percentiles. Households receives about 6.82% (0.0682) of the total income at the 20th percentile. Households receives about 9.16% (0.0916)of the total income in the25th percentiles .Households receives about 1.17%(0.01176143) of the total income at the 30th percentile. Households recives about 14.57 % (0.1457242) of the total income in the 35th percentiles. Households receive about 17.62% (0.1762138) of the total income at the 40th percentile. Households recives about 20.9 % (0.209148) of the total income in the 45th percentiles. Households receives about 24.52% (0.2452183) of the total income at the 50th percentile. Households recives about 28.38 % (0.2838284) of the total income in the 55th percentiles. Households receive about 32.61% (0.326112) of the total income at the 60th percentile. Household's recives about 37.19 % (0.3719468) of the total income in the 65th percentiles .Households receives about 42.23% (0.4223508) of the total income at the 70th

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percentile. Household recives about 47.78 % (0.4778976) of the total income in the 75th percentiles .Households receives about 53.9 %(0.539964) of the total income at the 80th percentile.

Household's recives about 61.06 % (0.6106154) of the total income in the 85th percentiles .Households receives about 69.33% (0.693352) of the total income at the 90th percentile. Household's recives about 79.85 % (0.79852266) of the total income in the 95th percentiles .Households receives about 1% of the total income at the 100th percentile.

TABLE:

Income of Household	Co efficient	Std. error	95% confidence interval	
0	0	Omitted	0	0
5	0.115057	.0001293	.0112521	.0117592
10	.0276809	.0002437	.0272033	.0281585
15	.0466402	.0003609	.0459328	.0473475
20	.0682094	.0004991	.0672312	.0691875
25	.0916951	.000637	.0904466	.0929436
30	.1176143	.0007934	.1160593	.1191694
35	.1457242	.0009547	.143853	.1475954
40	.1762138	.0011219	.1740149	.1784127
45	.209148	.0013015	.206597	.2116989
50	.2452183	.0014939	.2422902	.2481464
55	.2838284	.0016897	.2805165	.2871404
60	.326112	.0018978	.3223923	.3298318
65	.3719468	.0021159	.3677995	.3760941
70	.4223508	.0023415	.4177614	.4269402
75	.4778936	.0025739	.4728487	.4829385
80	.539964	.002819	.5344386	.5454894
85	.6106154	.0030681	.6046018	.616629
90	.693352	.0033009	.6868821	.6998219
95	.7985226	.0034577	.7917453	.8052998
100	1	.	.	.

LORENZ CURVE FOR OVERALL SAMPLE

The curve of Lorenz is seen to be a particularly helpful tool for giving detailed information on how revenues are distributed as a percentage of the mean. It provides a thorough and contrasting explanation of the level of living for different family groupings. This statistic allows us to distinguish between regional disparities in income. Measurement of income disparity within and across Pakistani provinces is our primary goal, as it is in this study. The Lorenz curve adds depth to our research. The The number of people % is shown below horizontal axis and the cumulative result proportion of the income of households is displayed on the vertical axis of the Lorenz curve graphic below. Higher levels of income inequality are indicated by a Lorenz curve that is farther from the 45° line than one that is closer to the line of complete equality.

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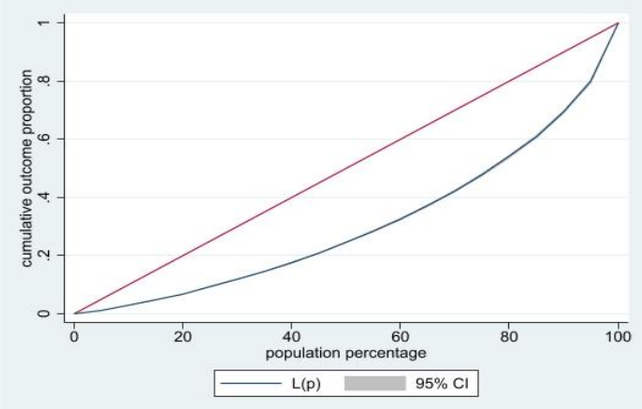

OTHER MEASURES OF INCOME INEQUALITY FOR OVERALL SAMPLE

The Gini coefficient is a number between 0 and 1, where 0 denotes perfect equality, or that is, when everyone has the same wealth or income. and 1 represents perfect inequality (one person has all the income or wealth while everyone else has none). In current study analysis the gini coefficient is (0.38696) indicates that income distribution in Pakistani households income is in equal therefore it shows that there is a moderate inequality in household income in Pakistan (moderate inequality). This indicates that although there is an income gap between between households income in Pakistan.

A mean deviation of 0.27851 for household income in Pakistan indicates that on average household incomes differ by about 27.8 units from the mean income. While a smaller mean deviation denotes less variability a bigger mean deviation shows greater variability or dispersion in household incomes around the mean. As a result in this case a mean deviation of 0.27851 indicates that family incomes in Pakistan vary significantly from the mean income.

In this instance, the standard deviation of household incomes is nearly 104.235% of the mean family income according to the family revenue factor of variance in Pakistan which is 1.04235. For interpreting Pakistani household income a coefficient of variation of 1.04235 shows there is moderate to high variation in household incomes from the mean. This may suggest that there is a large income gap in the population with some households making much more income or less than the mean.

Given a Mehran measure of 0.49987 this looks to be a significant level of income inequality. It shows that there is an unequal distribution of income in Pakistan with a larger percentage of the population earning a significantly greater share of Pakistan's total income and a larger number having lower incomes.

In Pakistan there is a moderate amount of income inequality among households as indicated by the Piesch measure of 0.33050 for household income inequality.

The Atkinson index's score of 0.22078 shows that Pakistani households showed significant levels of income inequality. It shows that the income levels of the various households in the Pakistan differ significantly from one another. A higher Atkinson index indicates higher income inequality. An Atkinson index of 0 would represent perfect equality (similar to a Gini coefficient of 0).

TABLE 4: ***MEASURES OF INEQUALITY AND THEIR COEFFICIENTS FOR OVERALL SAMPLE***

Inequality measures	Coefficient
Relative mean deviation	0.27851

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Coefficient of variation	1.04235
Standard deviation of logs	0.66590
Gini coefficient	0.38696
Mehran index	0.49987
Kakwani index	0.13147
Theil index (GE(α), α = 1)	0.28904
Log Deviation (GE(α), α = 0)	0.24947
Entropy index (GE(α), α = -1)	0.29320
Half (Coeff.Var. squared) (GE(α), α = 2)	0.54323
Atkinson inequality index (eps = 1)	0.22078

TABLE 5: LEVENE'S TEST FOR EQUALITY OF VARIANCES & T-TEST FOR EQUALITY OF MEANS

Variable		F	P –value	T	p-value
Total annual income of the household	Equal variances assumed	594.57	0.00	-34	0.00

LEVENE'S TEST FOR EQUALITY OF VARIANCES

This test analyses the equality of variances between the two groups. The test produces a highly significant result (p <.001) when equal variances are used showing a significant difference in the income variance between groups X and Y. The test yields a highly significant result (p <.001) when equal variances are not assumed showing a significant variation in variances between the two groups.

T-TEST FOR EQUALITY OF MEANS

The two group's averages are compared in this test. The test finds a highly significant difference (p <.001) with a t-value of -34 assuming equal variances. Given the negative t-value group Y surely has a lower mean income than group X. A highly significant difference (p <.001) with a t-value of -30 also results by not assuming equal variances supporting the possibility that group Y mean income is lower than group X. The results of both tests show that groups X and Y income distributions vary significantly. The negative t-values in both tests suggest that group Y mean income is significantly lower than group X.

REGION WISE LORENZ CURVES

The provided Lorenz curves illustrate the distribution of a specific outcome, potentially income or wealth, across rural and urban populations. Both graphs plot cumulative population percentage on the x-axis against the cumulative proportion of the outcome on the y-axis. The red line denotes absolute justice, when every percentage of the population holds an equivalent percentage of the outcome.

For the rural population, the Lorenz curve (blue line) lies further from the line of equality compared to the urban population, indicating a higher level of inequality in the distribution of the outcome. This means that in rural areas, A greater proportion of humanity is held by a smaller percentage of the outcome, while a larger proportion holds much less. The urban Lorenz shape indicates an allocation where the result is more equally distributed since it is more near the line of equality. The distribution of wealth or income between rural and urban populations for a certain outcome is depicted by the Lorenz curves above. On the x-axis of both graphs, the cumulative populations percentage is

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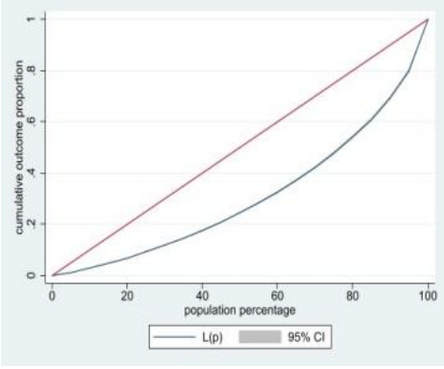
drawn, and on the y-axis, the cumulative outcome proportion. The red line, which represents perfect equality, shows that every percentage of everyone owns an equal share of the outcome. Compared to the urban population, the curve drawn by Lorenz (blue line) for the rural population is furthers away the line of equality, suggesting a larger degree of disparity in the outcome's distribution. This indicates that a smaller percentage of the people in rural regions have a higher part of the result but the total holds significantly less distributed among the population.

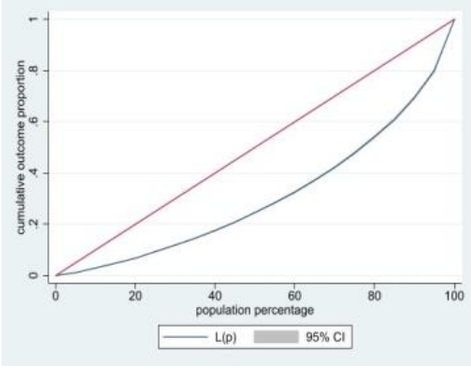
Additionally the shaded areas around the Lorenz curves represent the 95% confidence intervals, providing a range of possible values for the true Lorenz curve. This interval helps to understand the statistical uncertainty in the estimation of inequality.

In summary the comparison between rural and urban areas reveals a pronounced disparity in the distribution of the outcome, with rural areas experiencing greater inequality. Conversely urban areas exhibit a relatively more equal distribution. The confidence intervals suggest that these findings are statistically robust, highlighting the significant differences in inequality by Furthermore, the 95% confidence intervals are represented by the shaded regions surrounding the Lorenz curves these intervals offer a range of potential values for the actual Lorenz curve. Understanding the nature of statistical variation in the inequality estimation is aided by this period. In conclusion, there is a clear difference in the equitable distribution of results between both urban and rural regions, with rural areas seeing higher levels of inequality. On the other hand, metropolitan regions have a somewhat more uniform distribution. The statistical robustness of the data is indicated by the confidence intervals which also demonstrate the large disparities in inequality among the two groups, between these two populations.

URBAN



RURAL



OTHER MEASURES OF INCOME INEQUALITY ACROSS REGION

The related table which examines household annually income provides a thorough comparison of several inequality measurements between urban and rural regions. Differences in the distribution of income among various regions can be seen by these measures.

Urban areas show slightly higher values than rural areas in terms of the Relative Mean Deviation and the Coefficient of Variation both of which show the variability around the mean income. This suggests that if the average income of urban households may be more stable there is more variation or dispersion around this average as compared to rural households.

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TABLE 6: ***REGION WISE INCOME INEQUALITY COMPARISON***

Inequality measures	Rural	Urban
	Coefficient	Coefficient
Relative average deviation	0.27851	0.27405
Coefficient of variation	1.04235	1.04477
Standard deviation of logs	0.66590	0.65248
Gini coefficient	0.38696	0.38245
Mehran index	0.49987	0.49237
Piesch index	0.33050	0.32750
Kakwani index	0.13147	0.12922
Theil index (GE(α), = 1)	0.28904	0.28764
Average Log Deviation (GE(α), α = 0)	0.24947	0.24372
Entropy index (GE(α), α = -1)	0.29320	0.27963
Half (Coeff.Var. squared) (GE(α), α = 2)	0.54323	0.54571
Atkinson inequality index (eps = 1)	0.22078	0.21629

In rural areas the normal difference of records a log-transformed measure of income dispersion is larger. This suggests that while basic income data may vary more through urban and rural areas a logarithmic scale makes the distribution of income within rural areas clearer.A popular measurement of income inequality the Gini coefficient is somewhat higher in rural regions than in urban ones showing that the distribution of income in rural households is more inequitable. The Mehran and Piesch measures which also point to greater levels of inequality in income in rural areas provide more evidence for the current pattern.

A slightly more unfair system can be seen in rural areas by the slightly higher Kakwani scale, which examines the rate of progress or regressivity of income distribution. On the other the same direction, urban areas seem to have slightly larger inequality according on the Theil index, nother measure of inequality. In overall, rural areas tend to show larger levels of income inequality, even when urban areas may have greater income variability and dispersion around the mean. This suggests that although income changes are possible for urban households, there are more visible income distribution inequalities in rural areas. Policymakers and other stakeholders can use these findings to help create focused initiatives that address the particular difficulties that both urban and rural communities experience in attaining fair economic growth.

PROVINCE WISE LORENZE CURVE

The images depict Lorenz curves representing \the distribution of a specific outcome, such as income, health outcomes, or educational attainment, across Punjab, Khyber Pakhtunkhwa (KP), and Baluchistan. The cumulative percentage of people is displayed on the x-axis, while the y-axis represents the cumulative proportion of the outcome. The red 45-degree line signifies perfect equality, where each percentage of the population corresponds to the same percentage of the outcome, and the blue line shows the actual distribution.

For Punjab, the blue curve is closest to the red line, indicating a more equitable distribution. KP's curve is slightly more bowed away, suggesting moderate inequality. Baluchistan's curve deviates the most, highlighting significant disparity. The grey areas around each blue curve represent the 95% confidence intervals, reflecting the uncertainty of these distributions. Comparing these curves helps identify regions with varying levels of

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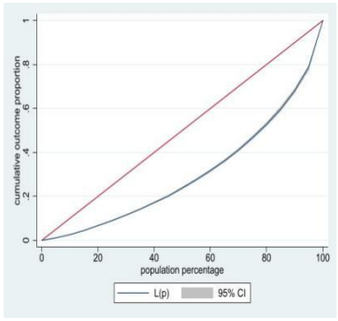
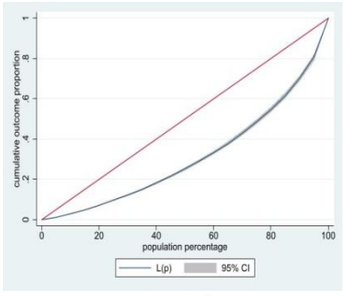
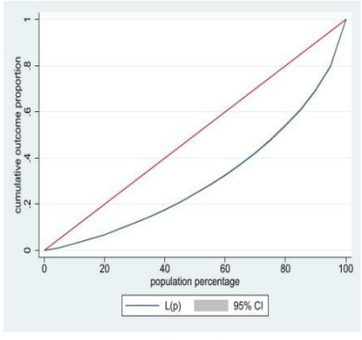
equality, guiding policymakers in addressing disparities and targeting interventions effectively.



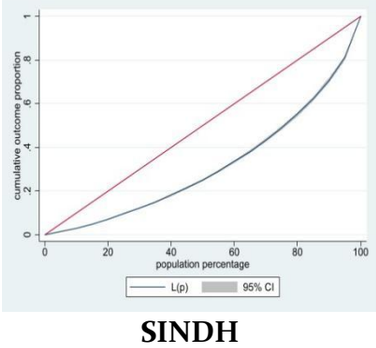
KP



Punjab



BALUCHISTAN



SINDH

PROVINCE WISE COMPARISON OF INCOME INEQUALITY

We can observe some interesting patterns when analysing these measurements of inequality between the four provinces of Pakistan, Punjab, Sindh, Baluchistan, and Khyber

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Pakhtunkhwa.First the "Relative Mean Deviation" indicates the amount to which the incomes of individual households in every location vary from the average. It looks like Sindh has the lowest difference from its average income whereas Punjab has the largest.

One common indicator of inequality of wealth is the "Gini Coefficient". Out of the four provinces Punjab has the largest amount of inequality in income whereas Sindh shows the lowest level.

Indicators of differences in income consist of the "Piesch Measure" and the "Mehran Measure,"where Punjab again shows the highest inequality and Sindh the lowest.

We can determine how progressive or regressive the tax system is by using the "Kakwani Measure". In comparison with the other regions Punjab's tax system looks to be slightly more.The "Atkinson Inequality Measure" provides information on how income is divided among different households. Once more Sindh has the lowest degree of inequality and Punjab has the highest. All things considered these measurements indicate different types of income inequality in Pakistan's different provinces, with Punjab generally showing higher levels of inequality than the other Provinces.

TABLE 7: ***PROVINCE WISE COMPARISON OF INCOME INEQUALITY***

Inequality measures	**Punjab**	**KP**	**Sindh**	**Baluchistan**
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**
Relative mean deviation	0.28885	0.27132	0.26882	0.27851
Co efficient of variation	1.12899	1.00378	0.88078	1.04235
Standard deviation of logs	0.68731	0.64999	0.63930	0.66590
Gini co efficient	0.40024	0.37645	0.37292	0.38696
Mehran measure	0.51320	0.48791	0.48565	0.49987
Piesch measure	0.34376	0.32072	0.31655	0.33050
Kakwani measure	0.14025	0.12498	0.12209	0.13147
Theil index (GE(a), a = 1)	0.31619	0.27319	0.25437	0.28904
Mean Log Deviation (GE(a), a = 0)	0.26847	0.233618	0.22759	0.24947
Entropy index (GE(a), a = -1)	0.32169	0.27686	0.25712	0.29320
Half (Coeff.Var. squared) (GE(2))	0.63726	0.50367	0.38783	0.23354
Atkinson inequality measures (ε=1)	0.23545	0.21037	0.20355	0.22078

CONCLUSION

The 2018–2019 Household Integrated Economic Survey (HIES/PSLM) data provides insights into income distribution across Pakistan's provinces and regions. The study analyzed 24,804 households, including 11,780 from Punjab, 6,215 from Sindh, 4,483 from Khyber Pakhtunkhwa, and 2,326 from Baluchistan, categorized into 15,934 rural and 8,870 urban households. The average yearly household income is approximately 396,829 PKR, with a standard deviation of 413,636 PKR, highlighting significant income variability. Pakistan's overall Gini coefficient of 0.387 indicates moderate income inequality, with rural areas experiencing slightly more disparity than urban regions. Among provinces, Punjab has the highest level of inequality (Gini = 0.40024), while Sindh shows the least. The Lorenz curve analysis reveals ongoing income disparities, emphasizing deviations from perfect equality. These findings underscore the urgent need for targeted government interventions to reduce economic inequities. Strategies should focus on fostering inclusive economic growth, improving access to education and healthcare, and supporting

marginalized groups, particularly in rural and unequal provinces, to address income gaps and promote equity in Pakistan.

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