Exploring Spatial Trends in Wealth Inequalities in Punjab, Pakistan

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Exploring Spatial Trends in Wealth Inequalities in Punjab, Pakistan*

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Abstract

This study examines the disparities in wealth inequality across districts in Punjab, Pakistan. The paper documents Gini coefficients of wealth inequality using disaggregate household data to assess disparities at the district level as well as disaggregated by urban and rural areas for each district. Furthermore, the paper deploys spatial statistical tools to explore the spatial disparities in wealth inequality in Punjab.

This study finds the existence of spatial clustering in wealth inequality in districts at aggregate, urban, and rural area levels. The study emphasizes the need to allocate resources for eradication of disparities among regions and districts. Furthermore, policies and decision-making aimed at reducing regional disparities and in enhancing equity are needed. Given the spatial clustering in economic depravity, the remedial policies must be spatially aware and sensitive to spatial interdependencies discovered in this paper.

Keywords: Wealth Disparity, Wealth Inequality, Spatial Patterns, Spatial Clustering, Spatial Auto-Correlation, LISA, Moran's I, MICS, Punjab, Pakistan

Introduction

Wealth inequality or disparity, also termed as the wealth gap, is described as the unequal distribution of wealth or assets among the individuals, households, or residents of a country, region or a specific area. Income and wealth inequality is a serious concern not only for the developing world but for developed countries as well. For instance, income inequality between the rich and the poor is more acute in the United States than any other developed nation (Institute for Policy Studies, 2017). Similarly, more than 75 percent of the population in developing countries lives in communities where income was more

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unequally distributed recently than it was in the 1990s (United Nations, 2015).

Pakistan has historically been a serious victim of horizontal and vertical inequalities (Saboor, 2016). Bengali (2016) estimated that the income shares of the richest 20 percent of the population increased by 12 percent (from 43.5 percent in 1987-88 to 48.7 percent in 2010-11) whereas the income share of the poorest 20 percent declined by 21 percent (from 8.8 percent to 7.0 percent). A study of wealth disparity in a developing country like Pakistan is crucial to assist in devising policies and decision-making aimed at reducing regional disparities and in enhancing equity. The study of wealth disparities can inform policy makers and governments to prioritize and coordinate expenditures on social development projects to achieve equitable and balanced development.

Gini coefficient[1] is the most commonly used indicator for measuring income inequalities. It measures the distribution of income or wealth (Gini, 1912). This paper studies wealth disparities in the districts of Punjab in Pakistan. The paper estimates Gini Coefficient using the Multiple Indicator Cluster Survey (MICS) 2014 micro-data to rank and compare districts. Furthermore, it reports Global Moran's I and Local Indicators of Spatial Association (LISA), to examine the spatial patterns of disparities across the districts.

This paper is organized as follows. Section 2 describes data and methodology. Section 3 discusses results and findings. The concluding section presents policy recommendations.

Data and Methodology

Data Source and Unit of Analysis

Unit of Analysis and Area of Study: The study area comprises Punjab province. The unit of analysis is the district. The districts have been studied at the three levels:

1. Overall District (at administrative boundary level)
2. Urban areas in districts (as a proxy for cities)
3. Rural areas in districts (rural UCs/ villages)

Data Source and Sample Size: The present study uses the latest available survey data "Multiple Indicator Cluster Survey" (MICS) from 2014 covering all districts in Punjab. UNICEF (2016) provided access to the micro data set. The survey comprises three questionnaires: (i) household questionnaire; (ii) child questionnaire; and (iii) female questionnaire. This study uses data from the household survey covering 41,413 households. After eliminating the 3,008 missing records for wealth index, the valid sample size reduced to 38,405.

Measurement of Wealth Disparity: Gini Coefficient

Gini Coefficient is the ratio of the area between the Lorenz Curve (a wealth distribution curve) and the

[1] Gini coefficient ranges from 0 – 1, where 0 represents perfect equality and 1 represents perfect inequality. Sometimes, it is also referred as 'Gini Index.' For instance, World Bank terms it as index which ranges from 0 – 100 where 100 represents perfect inequality and 0 represents perfect equality.

line of equal distribution to the total area under this equal distribution line. Basically, the Lorenz Curve is the cumulative distribution function (CDF) of wealth or income, arranged in ascending order. Each point on the Lorenz Curve shows what percentage of wealth is owned by what percentage of the population divided into groups. Mathematically, the formula for the Gini coefficient is presented in Eq. 1:

$$G = \frac{n+1}{n} - \frac{2\sum_1^n (n+1-i)\,x_i}{n\sum_1^n x_i} \quad \ldots\ldots\ldots\ldots \text{Eq. 1}$$

Where;

G = Gini Coefficient

x_i = variable of interest (wealth index, in this case,) of the ith individual arranged in ascending order (from lowest to highest value)

n = Total number of individuals (sample population)

Spatial Pattern Analysis Wealth Disparity: Global and Local Measures of Spatial Autocorrelation

<u>*Global Measure of Spatial Autocorrelation:*</u> Global Moran's I is an aggregate measure of spatial autocorrelation and is a broadly used in statistics to test for the presence of spatial dependence in a variable of interest (Moran, 1950). It tests the null hypothesis that the data are independent and the rejection of the null hypothesis suggests the existence of spatial dependence (Li, Calder and Cressie, 2007). Moran's I is presented below

$$I^0 \equiv \frac{\sum_{i=1}^{n}\sum_{j=1}^{n}\delta_{ij}(X_i-\bar{X})(X_j-\bar{X})}{\sum_{i=1}^{n}(X_i-\bar{X})^2} \quad \ldots\ldots\ldots\ldots\ldots \text{Eq.2}$$

Where;

X_i = is the variable of interest (for which the spatial autocorrelation is to be checked)

δij = an indicator of Spatial Weight such that $\delta\ ij$ =1 *if the ith and* j^{th} *locations are "adjacent" (neighbor), and* δij =0 otherwise.

<u>*Local Measure of Spatial Autocorrelation:*</u> The global measure of spatial autocorrelation (Moran's I) provides a single summary measure of spatial autocorrelation (Sowunmi, 2012). Anselin (1995) developed the Local Moran's I as a local spatial autocorrelation measure to explore spatial clusters at the local level. The formula for Anselin (1995)'s Local Moran's I is given as:

$$I_i \equiv \frac{z_i}{m_2}\sum_{j=1}^{n} w_{ij} z_j \quad \ldots\ldots\ldots\ldots \text{Eq.3}$$

Where;

z_i,z_j = deviations from the mean,

$wj_{,ij}$ = the spatial weights between observations *i* and

m_2 = the second moment (a consistent, but not unbiased estimate of the variance).

Results and Discussions

Measurement of Wealth Disparity: Results of Gini Coefficient

Wealth Disparity at the Provincial Level: Table 1 present the Gini coefficient at three levels (aggregate, rural and urban) for Punjab.

Table 1: Wealth Disparity in Punjab at Provincial Level

Sr. No.	Area / Province	Gini Coefficient
1	Punjab (Aggregate Level)	0.27
2	Punjab (Urban)	0.13
3	Punjab (Rural)	0.28

Source: Calculations Based on MICS 2014 Data

The province-wide Gini Coefficient for Punjab in 2013-14 is estimated at 0.27 suggesting a moderate distribution of wealth in the province. These estimates are similar to the findings from the Pakistan Demographic and Health Survey (DHS) 2012-13 for Punjab that reported Gini coefficients of 0.20 and 0.30 for urban and rural Punjab respectively (NIPS, 2013). Similarly, the World Bank (2014) reported the Gini Index of 30 (i.e. Gini coefficient of 0.30) for Pakistan in 2013.

Wealth Inequality at District Level: Wealth inequality across districts is presented in the Figure 1. The Gini Coefficient varies from a low of 0.09 for one district to a high of 0.32. Districts lying along the western provincial border (D.G. Khan, Muzzafargarh, Jhang, Khushab and Chiont) and some districts in Southern Punjab (Bahawalpur and Rahim Yar Khan) experience the most unequal distribution of wealth wherein the wealth Gini coefficients ranges from 0.30 to 0.32. Whereas, the northern districts (Lahore, Rawalpindi, Sialkot, Gujrat, Gujranwala, Chakwal and Sheikhupura) exhibit a more equitable distribution of wealth wherein the Gini coefficient ranges from 0.08 to 0.20. Spatial autocorrelation is evident from the figure such that neighbouring districts report similar Gini seems.

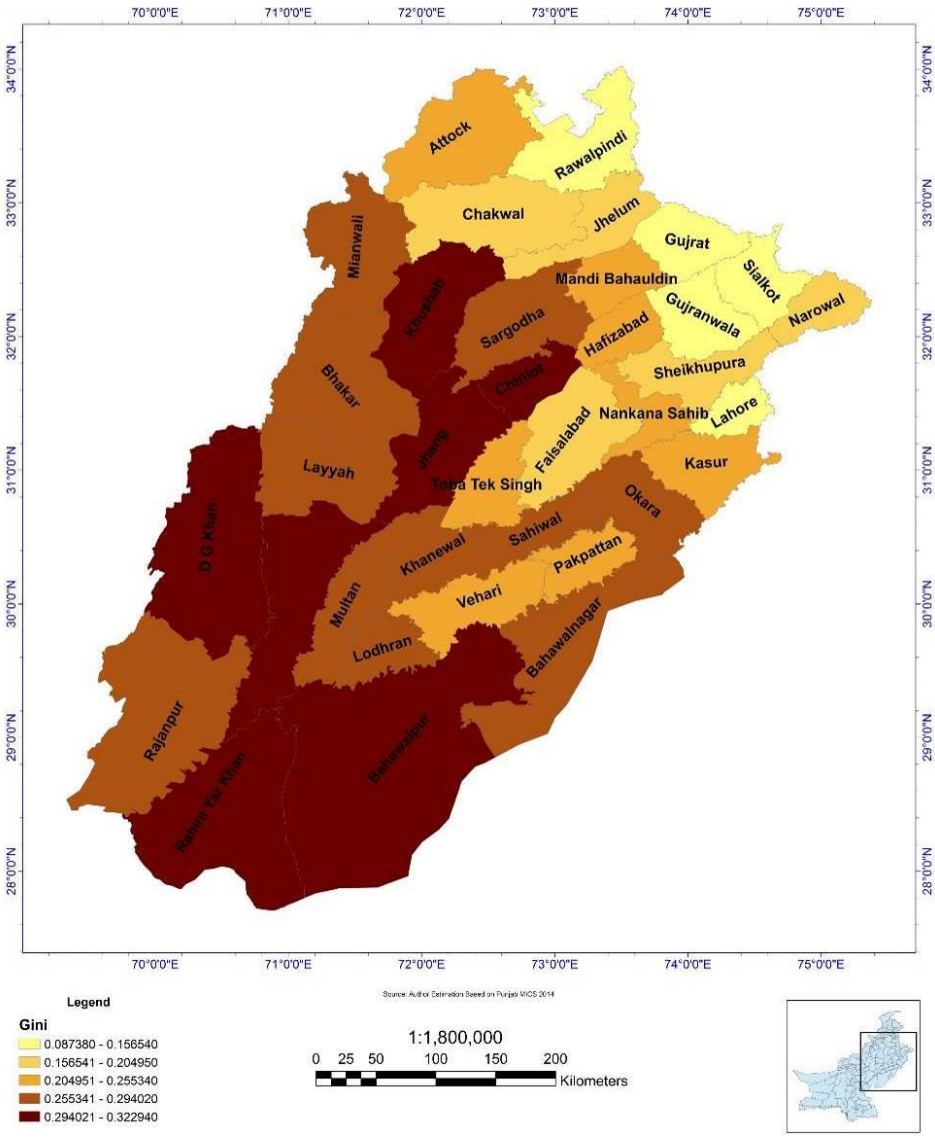

Figure 1: Spatial Representation of Wealth Gini Coefficients in Districts of Punjab
Source: Calculations Based on MICS 2014 Data

Wealth Inequaility in Urban Areas of Districts: The wealth inequality across urban areas of the districts is plotted in Figure 2. The Gini Coefficient ranges from 0.06 to 0.27 across the urban areas of districts and is lower than Gini coefficient at aggregate level.

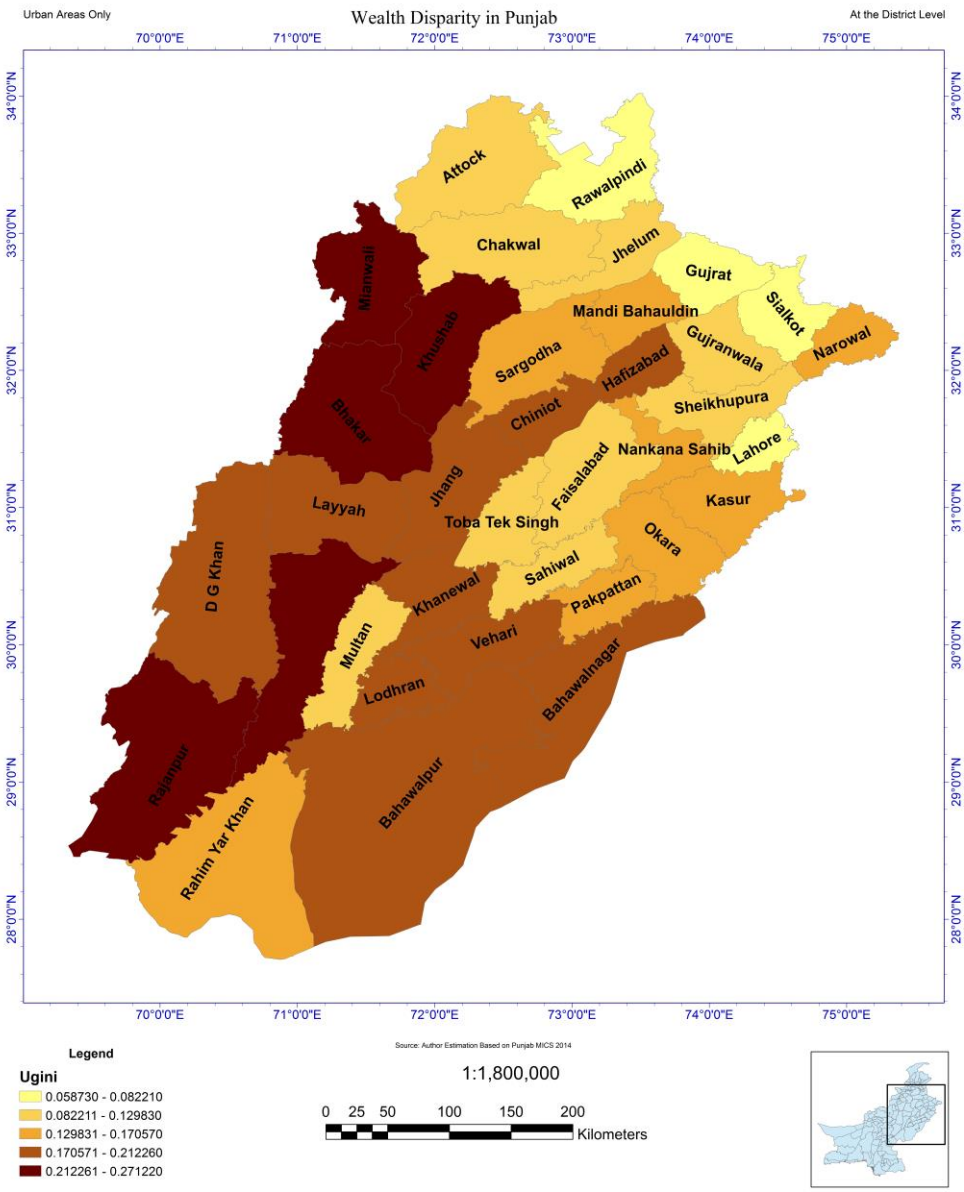

Figure 2: Spatial Representation of Wealth Gini Coefficients in Urban Areas of Districts
Source: Calculations Based on MICS 2014 Data

It is evident from Figure 2 that some districts along the Western provincial border (Rajanpur, Muzzafargarh, Layyah, Bhakkar, Khushab and Miawali) and one district from Southern Punjab Bahawalnagar) depict the most unequal distribution of wealth in urban parts of the districts wherein the wealth Gini coefficients range from 0.20 to 0.27. Whereas, the northern districts (Lahore, Rawalpindi, Attock, Gujrat, Sialkot) and some centrally located districts (Faisalabad, Sahiwal and Toba Tek Singh) depict a more equitable distribution of wealth wherein the wealth Gini coefficients range from 0.06 to 0.11. Figure 2 also reveals the same spatial clustering of wealth inequality as seen earlier in Figure 1.

Wealth Inequality in Rural Areas of Districts: The wealth inequality across districts (rural areas only) is presented in Figure 3, which depicts that wealth Gini Coefficients range from 0.15 to 0.30 in rural areas of districts. By comparing Figures 2 and 3 we can conclude that wealth inequalities are worse in rural areas than they are in urban areas. Figure 3 shows that some central districts, ones along the Southern belt (Bahawalpur, Lodhran, Multan, Khanewal, Jhang and Chiniot) and one district from Central Punjab (Okara) depict the most unequal distribution of wealth in rural Punjab wherein the wealth Gini coefficients range from 0.26 to 0.30. Whereas, Northern districts (Lahore, Jhelum, Chakwal, Gujrat, Sialkot, Narowal, Sheikhupura and Gujranwala) exhibit relatively equitable distribution of wealth wherein the wealth Gini coefficient ranges from 0.15 to 0.20. Similar to Figures 1 and 2, Figure 3 also reveals spatial clustering in wealth Gini coefficients in rural parts of districts.

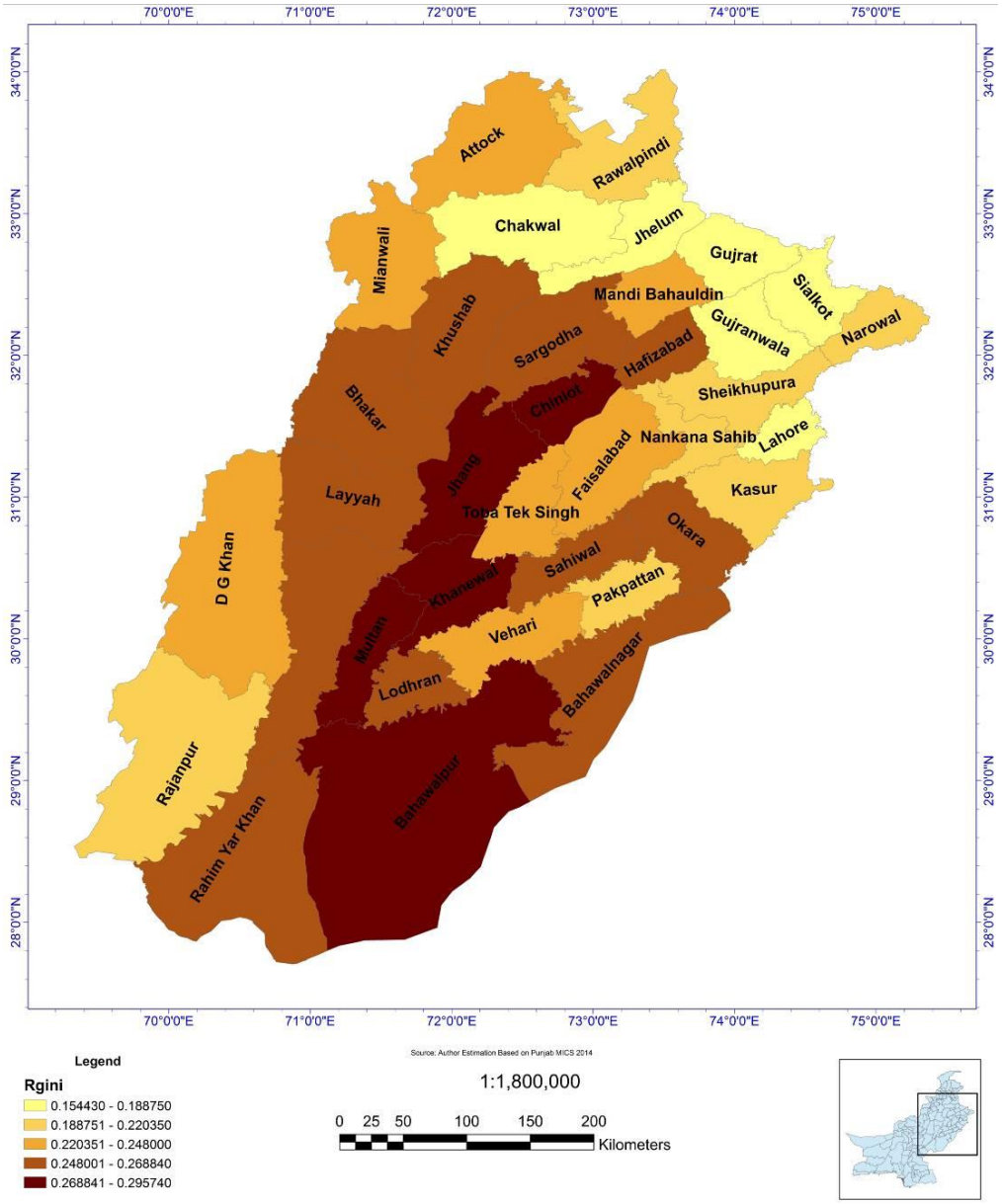

Figure 3: Spatial Representation of Wealth Gini Coefficients in Rural Areas of Districts
Source: Calculations Based on MICS 2014 Data

Spatial Pattern Analysis of Gini Coefficient

Global Measure of Spatial Autocorrelation: Global Moran's I Result: Table 2 shows the test statistics for the Global Moran's I, which confirms presence of spatial autocorrelation. Wealth inequality is more correlated spatially in rural areas than it is in urban areas.

Table 2: Global Moran's I Test Results

NHD	Variable	Moran's Index	Z- Score	P-Value
1	Aggregate District Level	0.560636	4.853065	0.000001
2	District (Urban Area only)	0.285496	3.136658	0.001709
3	District (Rural Area only)	0.489340	4.237583	0.000023

Local Indicators of Spatial Association (LISA): Local Moran's I present a spatially disaggregate measure of spatial autocorrelation.

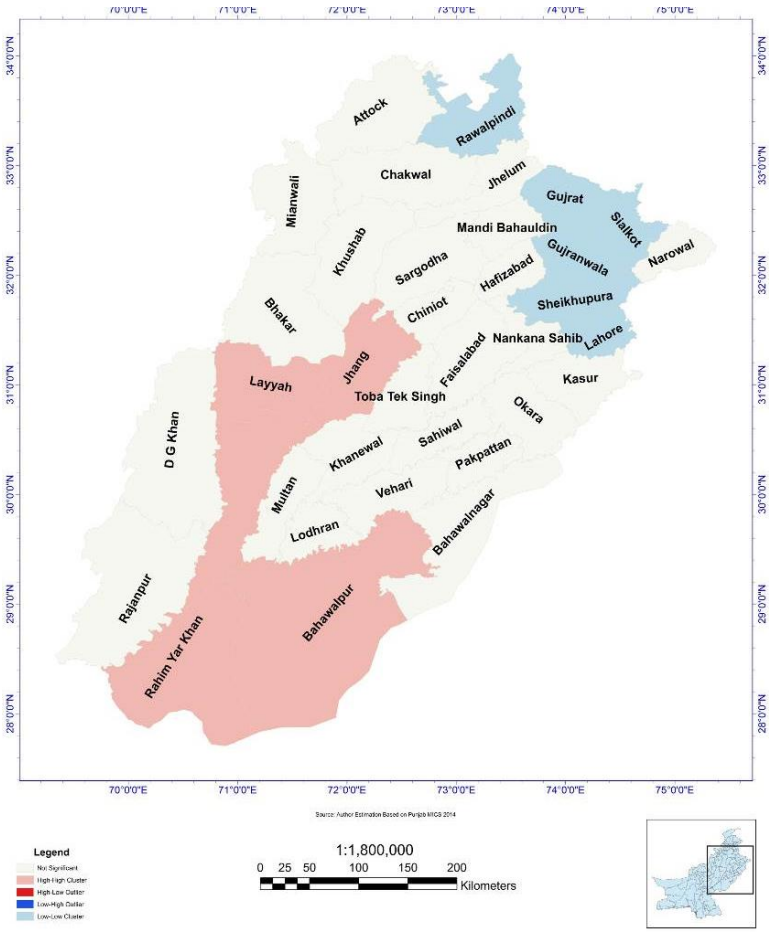

Figure 4: Local Moran`s I Punjab (Aggregate Level)
Source: Based on Anselin Local Moran`s I test

Figure 4 shows a high-high cluster comprising of contiguous districts Bahawalpur, Rahim Yar Khan, Layyah and Jhang where there is high unequal distribution of wealth. Similarly, a low cluster of contiguous districts showing relatively equitable distribution of wealth comprises Lahore, Rawalpindi, Gujrat, Sialkot and Gujranwala districts. Both clusters show presence of spatial dependence.

Figure 5 shows that there exists a high cluster of high wealth inequality in urban parts of the districts that include Rajanpur, Layyah, Muzafargarh and Bhakkar. Similarly, there is also a low-low cluster of lower wealth inequality comprising urban areas in Rawalpindi, Gujrat, and Sialkot districts. Both clusters suggest presence of spatial dependence.

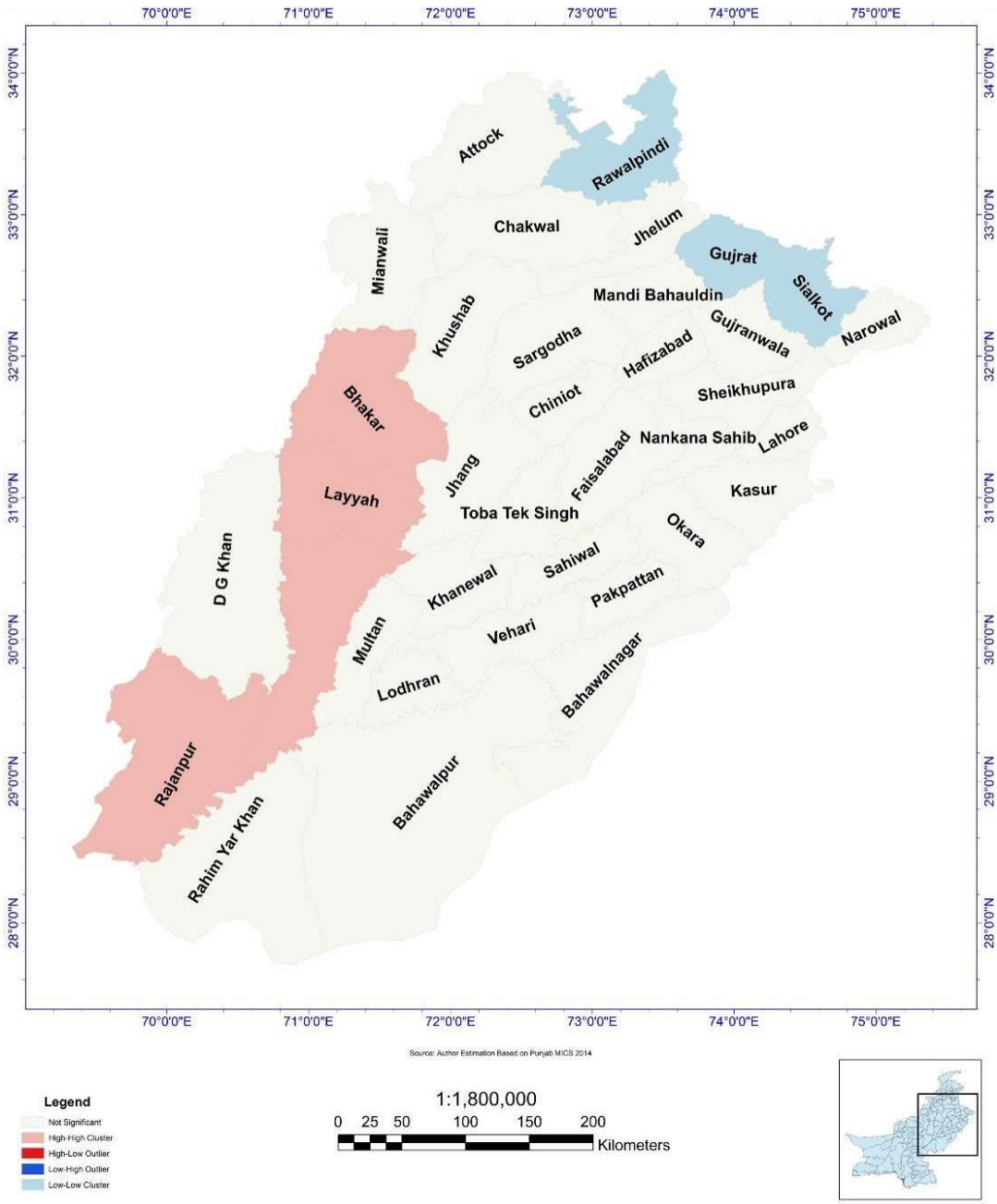

Figure 5: Local Moran`s I Punjab (Urban Area)

Source: Based on Anselin Local Moran`s I

Figure 6 also reveals a high cluster of higher wealth inequality in rural areas of Bahawalpur, Multan, Khanewal and Jhang districts. Similarly, a low-low cluster of lower wealth inequality in rural areas of Lahore, Gujranwala, Gujrat, Sialkot and Sheikhupura districts is also visible. Both clusters depict presence of spatial dependence.

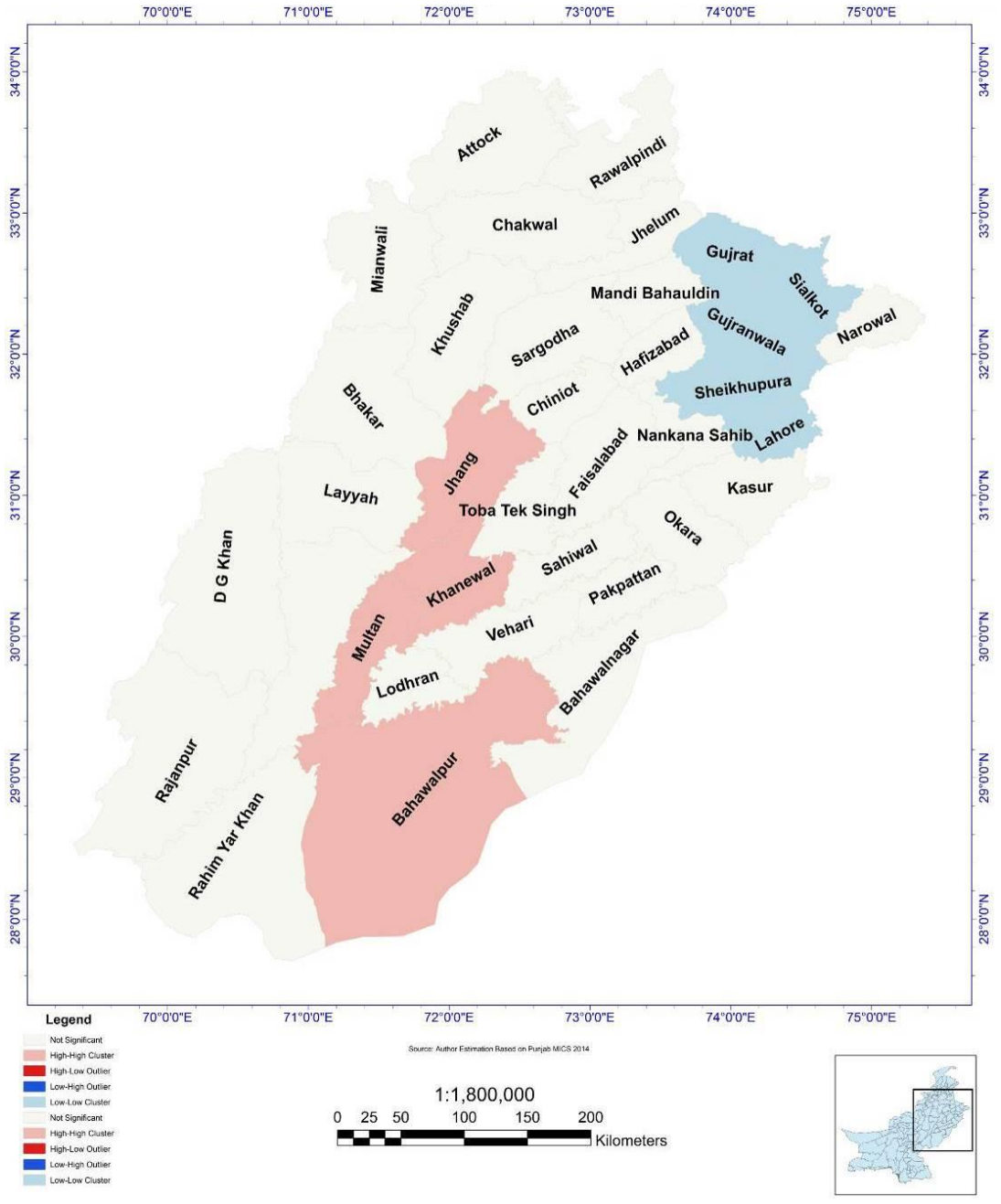

Figure 6: Local Moran`s I Punjab (Rural Area)
Source: Based on Anselin Local Moran`s I

Conclusion and Recommendations

This paper has presented an analysis of Gini Coefficients across districts in Punjab. Furthermore, the paper has examined spatial patterns in regional wealth disparity. This district level wealth inequality indicator provides a picture of intra-district distribution of wealth. The paper has also presented evidence in support of the presence of inter-district wealth inequalities. The study has found that wealth disparity estimated here is in moderate range and similar to the levels observed nationally (World Bank, 2014) and in other studies (NIPS, 2013). Disparity is significantly higher in rural areas compared to urban areas of districts. Using local indicators of spatial autocorrelation, this paper has found evidence in support of the presence of spatial clustering among high wealth inequality contiguous districts on one end and lower wealth inequality contiguous districts on the other end. These trends were obvious for the aggregate data, urban areas, as well as rural areas.

This study emphasizes the need to target resources for the eradication of disparities among regions and districts. The study also encourages policy makers to prioritize public investment in socio-economic development in economically lagging districts. Given the spatial clustering of wealth inequality that cuts across contiguous districts, the paper advocates the need to adopt a regional approach to target policies at similar and contiguous districts so that they may benefit from spatial spill overs.

References

Anselin, L. (1995) Local Indicators of Spatial Association – LISA. Geographical Analysis, 27(2), 93-115.

Bengali, K. (2016) Inequality and its Discontents. Development Advocate Pakistan, 3(2): 10-13.

Gini, C. (1912) Variabilità e mutabilità. Reprinted in Pizetti, E.; Salvemini, T., eds. (1955). Memorie di metodologica statistica. Rome: Libreria Eredi Virgilio Veschi.

Institute for Policy Studies (2017) Wealth Inequality. Inequality.org, a project of the Institute for Policy Studies. Retrieved from http://inequality.org/wealth-inequality/ on 05.01.2017.

Li, H., Calder, C. A., and Cressie, N. (2007) Beyond Moran's I: Testing for Spatial Dependence Based on the Spatial Autoregressive Model. Geographical Analysis, 39(4), 357–375.

Moran, P. A. P. (1950) Notes on Continuous Stochastic Phenomena. Biometrika, 37(1), 17-23.

NIPS (2013) Pakistan Demographic and Health Survey 2012-13. National Institute of Population Studies (NIPS), Islamabad, Pakistan.

Saboor, A. (2016) The Drivers and Policy Narratives of Income Inequality in Pakistan. Development Advocate Pakistan, 3(2): 10-13.

Sowunmi, F. A., Akinyosoye, V. O., Okoruwa, V. O., and Omonona, B. T. (2012) The Landscape of

Poverty in Nigeria: A Spatial Analysis Using Senatorial Districts- level Data. American Journal of Economics, 2(5), 61-74.

United Nations (2015) Goal 10: Reduce inequality within and among countries. Sustainable Development Goals, United Nations. Retrieved from http://www.un.org/sustainabledevelopment/inequality/ on 22.12.2016.

World Bank (2014) World Development Indicators. The World Bank Group, Washington DC.

Appendix

Table A.1: Estimated Gini Coefficients (Districts of Punjab, Pakistan)

Sr. No.	District	Gini coefficient (Aggregate)	Gini coefficient (Urban Area)	Gini coefficient (Rural Area)
1	Attock	0.22	0.22	0.22
2	Bahawalnagar	0.29	0.29	0.29
3	Bahawalpur	0.30	0.30	0.30
4	Bhakar	0.29	0.29	0.29
5	Chakwal	0.19	0.19	0.19
6	Chiniot	0.30	0.30	0.30
7	Dera Ghazi Khan	0.32	0.32	0.32
8	Faisalabad	0.20	0.20	0.20
9	Gujranwala	0.16	0.16	0.16
10	Gujrat	0.15	0.15	0.15
11	Hafizabad	0.24	0.24	0.24
12	Jhang	0.31	0.31	0.31
13	Jhelum	0.18	0.18	0.18
14	Kasur	0.23	0.23	0.23
15	Khanewal	0.29	0.29	0.29
16	Khushab	0.31	0.31	0.31
17	Lahore	0.09	0.09	0.09
18	Layyah	0.29	0.29	0.29
19	Lodhran	0.28	0.28	0.28
20	Mandi Bahauddin	0.23	0.23	0.23
21	Mianwali	0.27	0.27	0.27
22	Multan	0.28	0.28	0.28
23	Muzaffargarh	0.30	0.30	0.30
24	Nankana	0.23	0.23	0.23
25	Narowal	0.20	0.20	0.20
26	Okara	0.28	0.28	0.28
27	Pakpattan	0.24	0.24	0.24
28	Rahim Yar Khan	0.32	0.32	0.32
29	Rajanpur	0.28	0.28	0.28
30	Rawalpindi	0.15	0.15	0.15
31	Sahiwal	0.27	0.27	0.27
32	Sargodha	0.28	0.28	0.28
33	Sheikhupura	0.20	0.20	0.20

34	Sialkot	0.15	0.15	0.15
35	Toba Tek Singh	0.24	0.24	0.24
36	Vehari	0.26	0.26	0.26

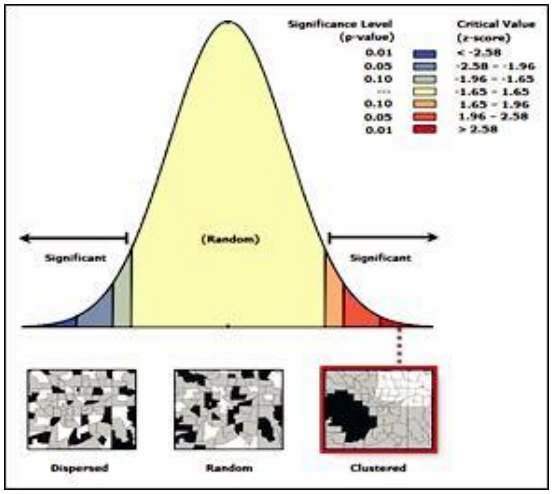

Figure A. 1: Global Spatial Autocorrelation Report Aggregate District Level

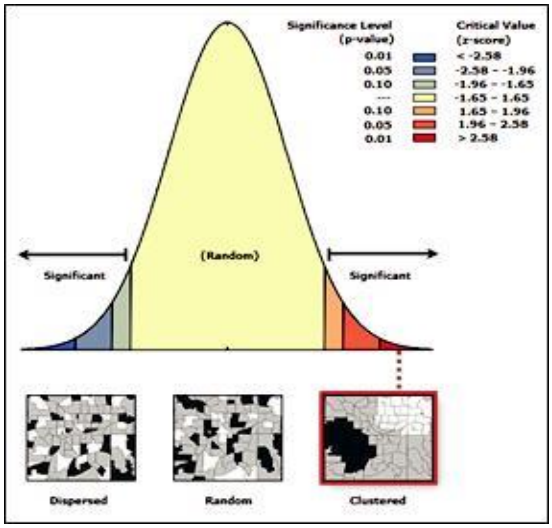

Figure A.2: Global Spatial Autocorrelation Report District (Urban) Level

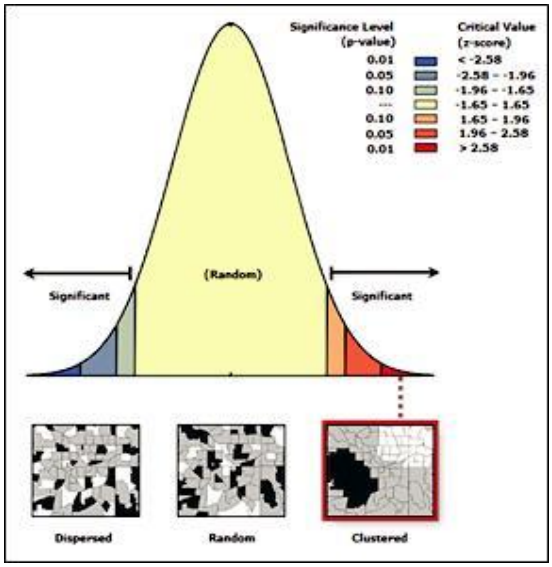

Figure A.3: Global Spatial Autocorrelation Report District (Rural) Level