Hot spot analysis of per capita income during 2013 at district level in Uttar Pradesh.

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Abstract

In this work GDP at district level was analysed at urban areas in Uttar Pradesh. The GDP data was collected from The District Level Database (DLD), tata cornell institute. The pattern of GDP/capita distribution was identified using High/Low Clustering (Getis-Ord General G) statistics. The hot and cold spots were found using Hot Spot Analysis tool was used to calculates the Getis-Ord Gi Hot spots. The Hot Spot Analysis tool calculates the Getis-Ord Gi* statistic (pronounced G-i-star) for each feature in a dataset. The result shows the pattern of GDP at district level was found highly clustered because the given z-score of 3.24 confirm, that there is a less than 1% likelihood that this high-clustered pattern could be the result of random chance. The hot and cold spots results show the fifteen districts under low GDP category with more than 90% of confidence level, however fourteen districts were found under high GDP category with more than 95% of confidence level. The work is useful for the planners to develop the districts having low GDP/capita. This work will open the new windows for father research in academic environment.

Key Words: Per capita income**,** Getis-Ord Gi Hot spots, Spatial Pattern.

1. Introduction

Uttar Pradesh is divided into 75 districts under these 18 divisions [1]. The economy of Uttar Pradesh is the third-largest state economy in India with ₹17.05 lakh crore (US$210 billion) in gross domestic product and a per capita GSDP of ₹65,431 (US$820) [2]. Agriculture is the leading occupation in Uttar Pradesh and plays a vital role in the economic development of the state.[3] In terms of net state domestic product (NSDP), Uttar Pradesh is the second-largest economy in India after Maharashtra, with an estimated gross state domestic product of ₹14.89 lakh crore (US$190 billion) [4]. State industries are localised in the Kanpur region, the fertile purvanchal lands and the Noida region. The Mughalsarai is home to several major locomotive plants. Major manufacturing products include engineering products, electronics, electrical

equipment, cables, steel, leather, textiles, jewellery, frigates, automobiles, railway coaches, and wagons. Meerut is the sports capital of India and also a jewellery hub. More small-scale industrial units is situated in Uttar Pradesh than in any other state, with 12 per cent of over 2.3 million units.[5] With 359 manufacturing clusters, cement is the top sector of SMEs in Uttar Pradesh.[6] The Uttar Pradesh Financial Corporation (UPFC) was established in the year 1954 under the SFCs Act of 1951 mainly to develop small- and medium-scale industries in the state.[7] The UPFC also provides working capital to existing units with a sound track record and to new units under a single window scheme.[8]

Objectives

1. To find the pattern of GDP/ capita distribution at district level in Uttar Pradesh.
2. To find the hot spots of GDP/ capita at district level in Uttar Pradesh.

2. Material and Methods

2.1 Study Area

Uttar Pradesh is a state in northern India. With over 200 million inhabitants, it is the most populated state in India [9]. Uttar Pradesh has a large population and a high population growth rate. From 1991 to 2001 its population increased by over 26%.[10] Uttar Pradesh is the most populous state in India, with 199,581,477 people on 1 March 2011.[11] The state contributes to 16.2% of India's population. The population density is 828 people per square kilometer, making it one of the most densely populated states in the country.[12] Uttar Pradesh has the largest scheduled caste population whereas scheduled tribes are less than 1 per cent of the total population.[13][14]
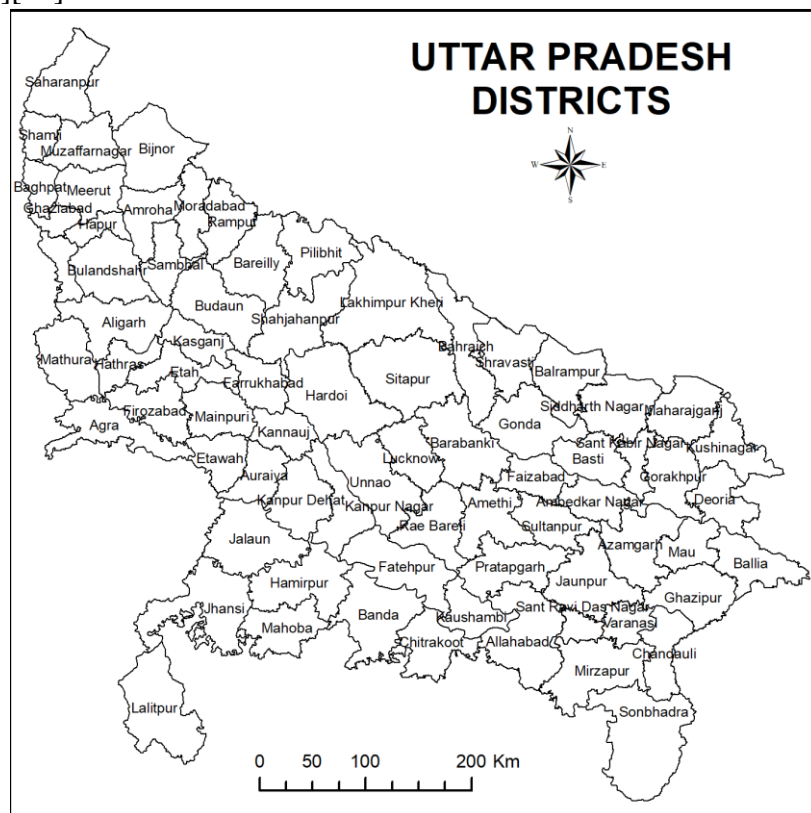

Figure 01 Study Area Map

2.2 **Work Flow**

The workflow is given in Fig. 02.

Data Analysis

Data Preparation
• Coordinate Calculation
• Projection Transformation
• Entered into GIS
• Data Joined with Urban Shp.

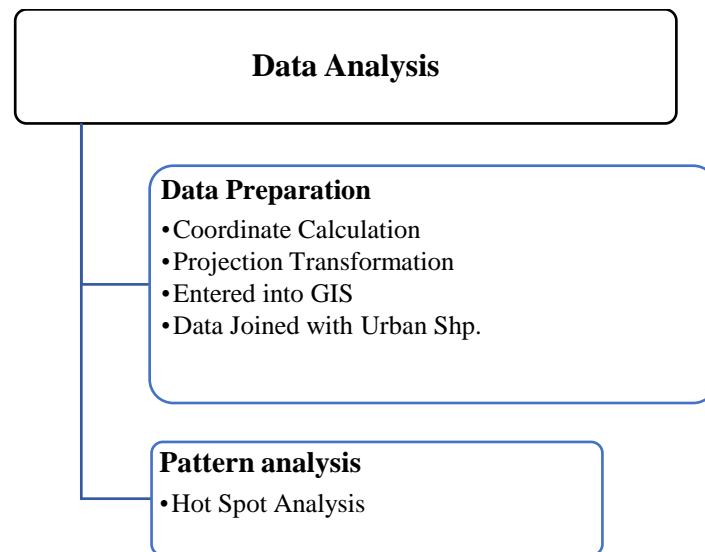**Pattern analysis**
• Hot Spot Analysis

Figure 2 Work Flow

2.3 **Data Used**

The District Level Database (DLD) developed by TCI was used in this study. This data is for Indian economic sectors provides a comprehensive for research hypotheses, identification of relevant districts / regions for technology dissemination, promoting rural pro-poor programs / development initiatives and identification of relevant representative districts for micro level assessment. It acts as a link between country-level macro data and household-level micro data. The consistent recording and detail at district level makes it a powerful research response tool for priority setting and in tracking inter-district and intra-district economic changes.

2.4 Data Processing

Hot Spot Analysis tool was used to calculates the Getis-Ord Gi Hot spots. The Hot Spot Analysis tool calculates the Getis-Ord Gi* statistic (pronounced G-i-star) for each feature in a dataset. The resultant z-scores and p-values tell you where features with either high or low values cluster spatially. This tool works by looking at each feature within the context of neighboring features. A feature with a high value is interesting but may not be a statistically significant hot spot. To be a statistically significant hot spot, a feature will have a high value and be surrounded by other features with high values as well. The local sum for a feature and its neighbors is compared proportionally to the sum of all features; when the local sum is very different from the expected local sum, and when that difference is too large to be the result of random chance, a statistically significant z-score results. When the FDR correction is applied, statistical significance is adjusted to account for multiple testing and spatial dependency.

The Getis-Ord local statistic is given as:

$$G_i^* = \frac{\sum\limits_{j=1}^{n} w_{i,j}x_j - \bar{X}\sum\limits_{j=1}^{n} w_{i,j}}{S\sqrt{\dfrac{\left[n\sum\limits_{j=1}^{n} w_{i,j}^2 - \left(\sum\limits_{j=1}^{n} w_{i,j}\right)^2\right]}{n-1}}} \qquad (1)$$

where x_j is the attribute value for feature j, $w_{i,j}$ is the spatial weight between feature i and j, n is equal to the total number of features and:

$$\bar{X} = \frac{\sum\limits_{j=1}^{n} x_j}{n} \qquad (2)$$

$$S = \sqrt{\frac{\sum\limits_{j=1}^{n} x_j^2}{n} - \left(\bar{X}\right)^2} \qquad (3)$$

The G_i^* statistic is a z-score so no further calculations are required.

3. Results and Discussion

3.1 GDP/ capita at district level in Uttar Pradesh

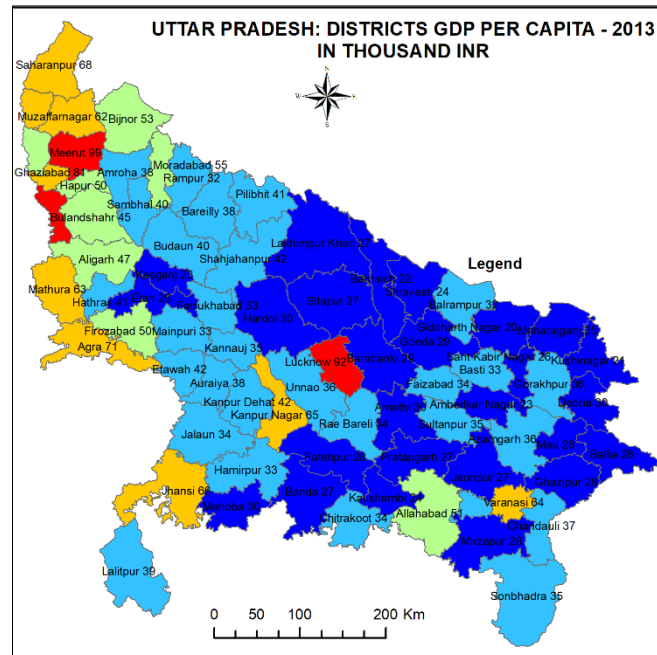Following figure shows GDP/ capita at district level in Uttar Pradesh.

Figure 3 Uttar Pradesh GDP per capita

3.1 GDP Pattern

Given the z-score of 3.26530357241, there is a less than 1% likelihood that this high-clustered pattern could be the result of random chance. The results of GDP/capita pattern at district level are given in the following table 01.

Table 01: General G Summary	
Observed General G:	0.000002
Expected General G:	0.000002
Variance:	0.000000
z-score:	3.265304
p-value:	0.001093

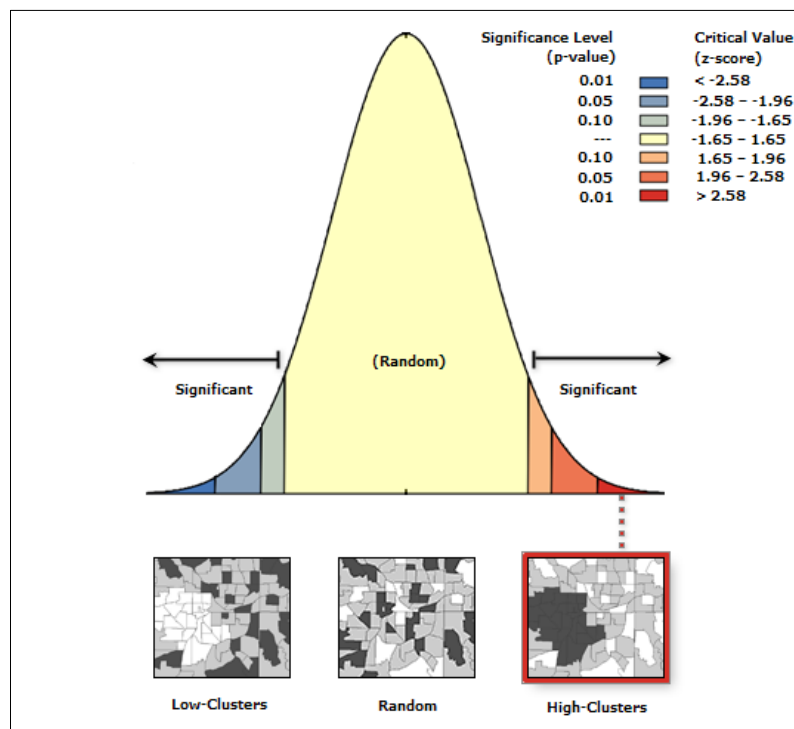Following is the figure shows the pattern:

Figure 4 High-Low Clustering

3.2 Cluster and Outlier analysis

The Cluster and Outlier of GDP at district level are shown in the following figure:
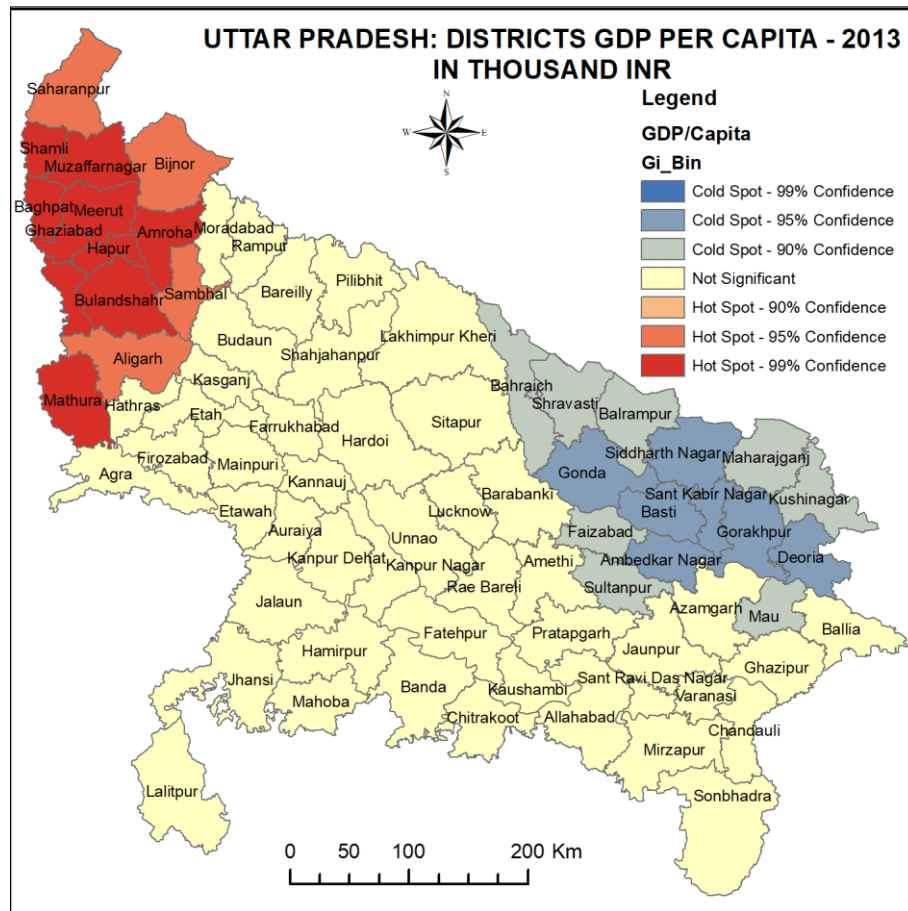

Figure 5 Per capita Income classes

Conclusion

The work was performed to identify the regional variation in the per capita income at district level in Uttar Pradesh. The pattern result shows the variation are too much because given the z-score of 3.26, there is a less than 1% likelihood that this high-clustered pattern could be the result of random chance. The results of GDP/capita pattern at district level are given in the following table 01. Similarly, the hot and cold spot map clearly shows the districts near Delhi have more per capita income than the districts lie in the eastern of the state.

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