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MORAN I AUTOCORRELATION STUDY FOR LEVEL SPATIAL PATTERN ANALYSIS

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ABSTRACT

Unemployment is a serious challenge faced by developing countries such as Indonesia. These challenges involve complex factors interacting with each other and can have a negative impact on social and economic stability. This study focused on East Java Province as a case in point, with the aim of analyzing the geographical distribution of open unemployment (TPT) and the relationship between regions in that context. Using a spatial analysis approach, specifically the Moran's I autocorrelation method, this study seeks to uncover spatial patterns and spatial interactions related to TPT levels. Quantitative data were used to identify TPT distribution patterns in this region. The results of spatial autocorrelation analysis indicate that the distribution of TPT in East Java Province tends to be random. Although there are spatial patterns that can be identified based on the Moran index, the z-score results show that they are not significantly different from random patterns. From the results of the Moran's I quadrant, it can be seen that there are several areas with high TPT rates around other regions that also have high TPT rates. Thus, this research contributes to formulating policies and actions aimed at reducing unemployment, improving people's welfare, and preventing potential social insecurity and poverty.

Introduction

Indonesia, as one of the developing countries, faces the challenge of unemployment as one of the common problems faced by similar countries. Unemployment is a complicated problem because it is influenced by various factors that interact with each other with complex and elusive patterns (Muslim, 2014). If not addressed immediately, unemployment can lead to social insecurity and potentially lead to poverty. Open unemployment has a significant influence on economic development, especially to increase per capita income in a country which ultimately results in improving people's welfare (Arifin & Fadllan, 2021).

East Java Province is one of the provinces with a fairly developed economic growth rate in several regencies and cities, especially in big cities such as Surabaya City, Gresik Regency and Malang City, these cities are relatively large and have very many resources to support regional economic development. East Java Province as one of the provinces with a growing pace of economic development certainly has similar problems related to open unemployment as other provinces in Indonesia (Giovanni, 2018). Primary poverty is included in the category of poor in asset ownership, low

participation in social and political organizations, and limited knowledge and skills. Meanwhile, in the aspect of secondary poverty, it involves poor conditions in terms of social networks, limited financial resources, and limited access to information. The influence of open unemployment here plays a considerable role in the impact on this aspect.

This study aims to analyze regional distribution and inter-regional relations related to the open unemployment rate of East Java province, with studies using regional analysis methods becoming increasingly important. In this study, this study applies a spatial analysis approach centered on Moran's I autocorrelation study to identify spatial patterns of regional open unemployment rates and spatial interaction rates. Moran's I autocorrelation study is a powerful statistical method for finding spatial patterns in geospatial data (Ningrum, 2017). Using this method, the study can determine whether there are groups of regions that have the same open unemployment rate (positive autocorrelation) or random distribution (negative autocorrelation). The results of this study are expected to provide a deeper understanding of the characteristics of open unemployment areas in East Java Province and open opportunities to identify areas that require more attention to overcome unemployment problems.

According to the National Central Statistics Agency (BPS), the open unemployment rate is a percentage of the number of unemployed in the labor force (Ningrum, 2017). The open unemployment rate refers to four aspects, namely residents who are actively looking for work, residents who are preparing new businesses or jobs, residents who are not looking for work because they find it difficult to find work, and groups of residents who are not actively looking for work because they already have a job but have not started it. The open unemployment rate arises because the problem of unemployment is a complex and multi-dimensional problem (Ningrum, 2017).

In this study, testing was carried out using the Moran Index method. The Moran index is a commonly used method for calculating global-scale autocorrelation. This usage refers to the indication of spatial patterns in TPT in East Java Province (Wuryandari et al., 2014). The Moran Index calculates the difference in the average value of all attributes and the difference in attribute values in each neighbor with reference to the average value. The calculation is carried out by the following formula:

$$\boldsymbol{\mu = \frac{N}{\sum i \sum j wij} \frac{\sum i \sum j ((Xi - \bar{X})(Xi - \bar{X})}{\sum i \sum j wij}}$$

Information:

I = Moran's I assessment
N = number of locations
Xi = assessment at location i
Xj = assessment at location j
$\bar{X}$ = average of variable calculations
Wij = element on weighting between regions i and j

Assessment on Moran I can be assessed to determine indications of spatial patterns in the attributes tested. The shape of the pattern is classified into three parts can be in Table 1.

Table 1. Classification of Formed Patterns

Moran's I	Information
I>0	Cluster
I<0	Random
I=0	Spread

After the assessment using the Moran Index is carried out, the next step is to test the autocorrelation to see the presence of positive or negative values. Pattern testing can be done using Moran's Scatterplot to see grouping and distribution patterns between locations with standard provisions to test with an average of assessments taken based on locations neighboring the location concerned. Figure 1 will present the quadrant on Mora's Scatterplot. According to Moran's Scatterplot is divided into four quadrants.

Table 2
KuadranMoran's Scatterplot

	Quadrant II (Low-High)	**Quadrant I (High-High)**
WZstd		
	Quadrant III (Low-Low)	**Quadrant IV (High-Low)**
	Zstd	

The four quadrants indicate an assessment of the high and low grouping of observation areas. Quadrant I (High-High) indicates a high value of observations surrounded by a high observation area, Quadrant II (Low-High) indicates a low value of observations surrounded by a high observation area, Quadrant III (Low-Low) indicates a low value of observations surrounded by a low observation area and Quadrant IV (High-Low) indicates a high value of observations surrounded by a high observation area.

Method
Research Location

The location in this study is located in East Java Province. East Java Province is one of the easternmost provinces of Java Island. East Java Province has an area of 48,033 km2, with absolute locations at 111°0' – 114°4' East Longitude and 7°12' – 8°48' South Latitude.

Data Sources

This research was conducted using quantitative data with the aim of determining the number of TPT in East Java Province and its spatial pattern.

Stages of Data Processing

The research phase began with the collection of TPT data in East Java Province in 2022 and RBI data for East Java Province. The second is the incorporation of TPT Data into RBI Data attributes, at this stage the data merger is assisted by ArcGIS software to further adjust TPT data according to districts and cities in East Java Province, as well as to calculate the spatial autocorrelation of the Moran index using the spatial statistics tools feature. The third calculates the moran index, at this stage data processing is assisted using GeoDa software, the processing results at this stage are moran scatter plot and moran scatterplot map. The last stage in this study is drawing conclusions based on the results of data processing.

Results and Discussion

a. Results of spatial autocorrelation calculation

The results obtained from the calculation of spatial autocorrelation found information about spatial patterns based on the Moran index, This pattern is formed based on the results of autocorrelation and relates the results to three classification patterns formed according to the Moran Index (Table 1). Assessment on the spatial patterns formed can later be used to determine the distribution pattern of TPT in East Java Province by district.

The results of the spatial autocorrelation calculation of the Moran TPT Index in East Java Province can be seen in Table 1.

Table 1
Calculation ResultsAutocorrelationSpatialSpatial

		P-Value
0,122161	**Variance**	**Z-Score**
0,053637	0,002723	1,545767

Based on the results in Table 1, there is an assessment used to determine the shape of spatial patterns of TPT in East Java Province. Based on the results obtained, it is known that the value of Moran's Index is 0.053637 or indicates a random distribution pattern. Based on the results of the z-score found to be 1.54576675529, the pattern does not seem to differ significantly from random. The Z-score is used to measure the degree to which data differs from the mean in units of standard deviation. If the z-score is close

to 0, then the data shows a pattern that is not significantly different from the expected random data. In Figure 1 will be visualized a map of the Moran's Index I test results.

b. Hasil Moran's Scatterplot

Based on the results of Moran's Scatterplot used to see the distribution of regions between quadrants. Moran's Scatterplot processing is done using GeoDa software. The results of the TPT distribution pattern in East Java Province will be visualized in Figure 1 as follows.

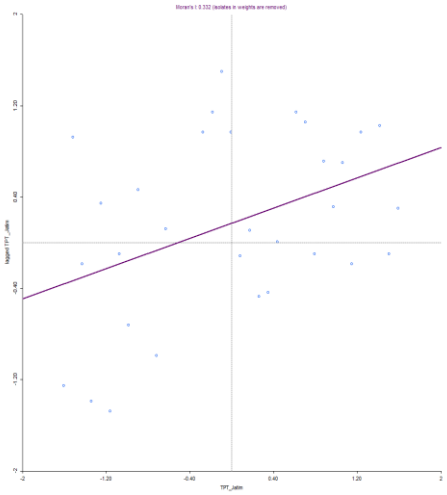

Figure 1. Results of Moran's Scatterplot

Based on the results obtained, it can be seen the spatial distribution of regencies and cities in East Java Province which are classified in each quadrant in the scatterplot moran. In Figure 2, the spatial pattern of TPT will be visualized based on the quadrant that has been tested.

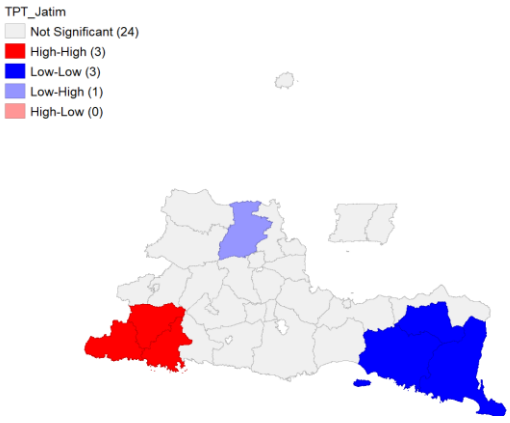

Figure 2. Moran Scatterplot Map

Referring to the results of Moran's quadrant I, the Quadrant I group is very high (High-High) there are 11 regions, namely, Lumajang, Magetan, Nganjuk, Pacitan, Pamekasan, Ponorogo, Probolinggo, Sampang, Situbondo, Trenggalek and Tulungagung. These districts and cities have high TPT values and are also surrounded by areas that have high TPT values as well so that they enter quadrant I.

Followed by Quadrant II, namely Low-High, there are 7 regions, including Blitar, Gresik, Lamongan and Batu Regency, Madiun City, Probolinggo City, Surabaya City. The regency has a TPT value that is not so high but is surrounded by other districts that have a high TPT value, one of which is Surabaya City.

In Quadrant III which means low-low, there are 7 regions, namely Banyuwangi, Bojonegoro, Bondowoso, Jember, Jombang, Kediri, and Kediri City. Quadrant III indicates that the area has a low TPT value and is surrounded by low regencies or cities as well.

Quadrant IV or High-Low. There are 6 regions, namely, Madiun, Mojokerto, Tuban, Pasuruan, Malang and Sidoarjo regencies. The district has a low TPT value but is surrounded by areas that have a high TPT disease value, one of which is the Sidoarjo Regency area.

Conclusion

This study aims to analyze the distribution of regions and relationships between regions related to the open unemployment rate in East Java Province. Unemployment is a complex problem that affects people's welfare and can lead to social insecurity and poverty. In this study, spatial analysis methods were used with Moran's I autocorrelation approach to identify spatial patterns and levels of spatial interaction. The results of spatial autocorrelation calculations show that the distribution of open unemployment rates in East Java Province tends to have a random pattern. This study provides a deeper understanding of the characteristics of the distribution of open unemployment rate in East Java Province. The results can be used as a basis for identifying areas that require more attention in addressing the unemployment problem. With a better understanding of the spatial pattern of unemployment, it is hoped that more effective policies and programs can be developed to reduce unemployment and improve people's welfare in East Java Province.

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