Indonesia's Crime Rate Analysis Using Spatial Analysis Method

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Abstract

The crime rate in Indonesia is increasing every year. One of the causes is the indonesian population who tend to lack of education received so doing all the ways to commit crime is one of the shortcuts. This makes most people in Indonesia feel insecure, lowering the level of trust to the government that ensures the security of the community. In this study will find out what factors affect the level of crime that occurred in 2015. See the extent of the spread of crime in Indonesia in 2015 by using thematic maps. The analysis and modeling used are Moran Index Method, Spatial Lag Model (Spatial Auto-Regressive/SAR) and Spatial Error Model (SEM).

Keywords

Rate of Crime , Moran Index, Spatial Lag, Spatial Error

1. PRELIMINARY

1.1 Background

In the era of globalization accompanied by the dynamics of cultural growth and the rapidity of science and technology has spawned competition in various things, whether in the field of ideology, economy, and society. The very basic issue lies in the invasion of culture, at least the values contained in it, such as, matrealism, hedonism and so on, which in some way affect the values prevailing in society. The prevailing values will result in changing human behavior and changes that have a negative impact seen from the emergence of behaviors that cause unrest in society, such as the desire of the fulfillment of abundant material needs without balanced ability to achieve in a natural way, so that humans take all means to realize the desired such as through crime (Kartono 1992)

There are two factors that can cause crime, namely internal factors that include the special nature and general nature in the individual, and external factors (Abdulsyani, 1987) in Astuti (2014). The special nature in the individual among others; mental illness, emotional power, low mental, and anatomy, while the general nature in the individual among others; age, physical strength, individual position in society, individual education, and individual entertainment. External factors may include economic factors (price changes, unemployment, urbanization), religious factors, reading factors and film factors.

Crime is a problem that seems familiar to people living in any area. A diverse community environment can affect a person in committing a crime. As well as a busy and busy environment with a variety of activities provide a great opportunity for a non-crime. Crime becomes a complex issue that has become a consequence for society, government and law enforcement officers in an area. A crime case

happens in today's society is increasingly diverse. Conventional crime cases that disturb security and order in society include murder, theft by violence, theft with theft, theft of motor vehicles, fire, rape, drug abuse, juvenile delinquency, and many others. Generally conventional crime can be classified into several groups by their nature. And most often heard is a type of property rights crime or commonly called

property crime and violent crime. Property obscurity generally aims to take the goods or property of others. In the police, property crimes include among others: theft with a weighting, violent theft, robbery, mugging, burglary, and motor vehicle theft. While violent crime generally aims to harm even as well as to injure physical the victims such as, killing, rape, and severe persecution.
The rise of crimes that occur to the unrest of citizens to become public relations for the government, especially the police in reducing the unrest in the indonesian citizens. It is appropriate that citizens gain security in the state so that they become a peaceful and peaceful country. In previous research has done the research of the influence of education, unemployment ratio of age ginim and number of police per capita to property dignity number in central java province in year 2010-2012 by Yudho Dito Arsono. It states that the greatest caused of crime is the lack of per capita income and education so that the property crime rate increases. So the authors did research about "Indonesia's Crime Rate Analysis Using Spatial Analysis Method".

1.2. State of the Problems

Based on the above background it can be drawn some questions as the formulation of the problem in this study:

1. Does Monthly Spend, Amount of People Working, Unemployment Number and Human Development Index variables affect crime rates in each province in Indonesia?
2. What is the general picture of the development of Crimes that occurred in Indonesia based on provinces?
3. Are there spatial influences from each region affecting the crime rate in each province?

2. LITERATURE REVIEW

2.1. Law Normatif Research

This type of legal research method is also commonly referred to as a doctrine law research or library research. Named doctrinal law research because this research is only intended for written regulations so this study is very closely related to the library because it will require secondary data on the library.
In law research, normative law is examined from various aspects such as theoretical aspects, philosophy, comparison, structure / composition, consistency, general explanation and clarification on each article, formality and strength of binding a law and language used are the legal language. So we can conclude that normative law research has wide coverage (Sanders et al, 2001).

2.2. Crime Terminology

The terminology of criminal offense is the translation of the Dutch "strafbaar feit", the Criminal Act in English, Actus Reus in Latin. In translating the word Strafbaar Feit there are various terms used by some scholars and also in various legislation. Moeljatno said the crime was "an act prohibited by a rule of law, a ban on which sanctions (sanctions) are in the form of certain crimes for those who violate the prohibition.
Another term often used to denote criminal acts is criminality. Crime is all kinds of acts and deeds that are economically and psychologically harmful that violate the prevailing laws of Indonesia and social and religious norms. It may be interpreted that criminality is anything that violates the law and violates social norms, so the public is opposed to it.
In criminology, one of the theories that can be used to view the causes of crimes or criminal acts is Cartography theory. Graphic kartography theory evolved in France, England and Germany. This theory developed in 1830-1880 M. This theory is often referred to as ecological conservation. What is being taught by this teaching is the distribution of crime in certain areas, both geographically and socially.
Cartography theory not only examines the number of criminals in general, but also conducts a special study on juvenile delinquency committed to a profound professional crime that was quite prominent. This trend is concerned with the spread of crime in a particular region based on geographic and social factors, which are named by crime is an embodiment of existing social conditions (Sanders et al, 2001).

2.3. Spatial Data

Spatial data is a geographically oriented data and has a coordinate system as the reference base (Ward and Gleditsch, 2008). Most of the data to be handled in the GIS is spatial data that is geographically oriented data, has a certain coordinate system as the reference base and has two important parts that make it different from other data, ie location information (spatial) and descriptive information (attributes). Location information (spatial) is information related to a coordinate good coordinates geography (latitude and longitude) or Cartesian XYZ coordinates (abscissa, ordinate and altitude), including the projection system. Descriptive information (attributes) or non-spatial information is the information of a location that has some information relating to that location, eg vegetation type, population, area, zip code, and so on. Attribute information is often used to express the quality of the location.

2.4. Moran Indexs

The Moran Index is one of the statistics commonly used to calculate spatial autocorrelation and measure of correlation or relationship between close observations (Fotheringham and Rogerson, 2009). Index Moran is one of the oldest indicators from spatial autocorrelation and statistics compare the observed value at a areas with observational values in the regions others . The Moran Index score is equal to the correlation coefficient ranges between -1 and +1. When the Moran Index value approaches +1 or -1, the autocorrelation is high. Ika J Moran index value $0 < I \leq 1$,indicates positive spatial autocorrelation. And if the value obtained Index Moran $-1 \leq I < 0$, then indicates autocorrelation spatial negative.If Moran Index 0 is obtained, then indicate the absence of spatial autocorrelation (Haining, 2004)

2.5. Spatial Error Model (SEM)

Spatial Error Model is a spatial error model where in error there is a spatial correlation, this model developed by Anselin (1988). Model spation error occurs when $W\ 1 = 0$ and $\rho = 0$, so this model assumes that the autoregressive process is only in the model error. The development of this SEM model can be applied in the economic field. The advantage of the SEM model is to provide a better model for interconnected observations .

2.6. Lagrange Multiplier Test (LM)

The Lagrange Multiplier (LM) test is used as a basis for selecting the appropriate spatial model (Fotheringham, 2009). The first stage in this test is to make a simple regression model through Ordinary Least Square (OLS). Then the spatial model is identified by using LM test. If LMerror is significant then the corresponding model is SEM, and if LMlag is significant then the corresponding model is SAR. If both are significant then the corresponding model is Spatial Autoregressive MovingAverage (SARMA). Robust Lagrange Multiplier Test is also done when both are significant. This test consists of Robust LMerror and Robust LMlag.

3. RESEARCH METHODOLOGY

3.1. Data Source

Data in this research, got from the official website Statistics Bureau of Indonesia (www.bps.go.id). Data is taken on social pages and economy with this research variable:
Dependent Variables :
Crime Rate (Y), Code: KJHT15

Independent Variables :
- Monthly Spend (X1), Code: PGLRN15
- Amount of People Working (X2), Code: BKRJ15
- Unemployment (X3), Code: PGGRN15

- Human Development Index (X4), Code: IPM15

Variable Name	Function as	Code
Crime Rate	Dependent Varieble (Y)	KJHT15
Monthly Spend	Independent Varieble (X1)	PGLRN15
Amount of People Working	Independent Varieble (X2)	BKRJ15
Unemployment Number	Independent Varieble (X3)	PGGRN15
Human Development Index (HDI)	Independent Varieble (X4)	IPM15

3.2. Methods of Analysis

First of all will be created map thematic for look picture on general deployment level crime in Indonesia on year 2015. Then , continued with using Moran Index for knowing correlation value of the province with average value of their neighbours. This study uses two model to be developed, that is Spatial Lag and Spatial Error Model.

4. RESULTS AND DISCUSSION

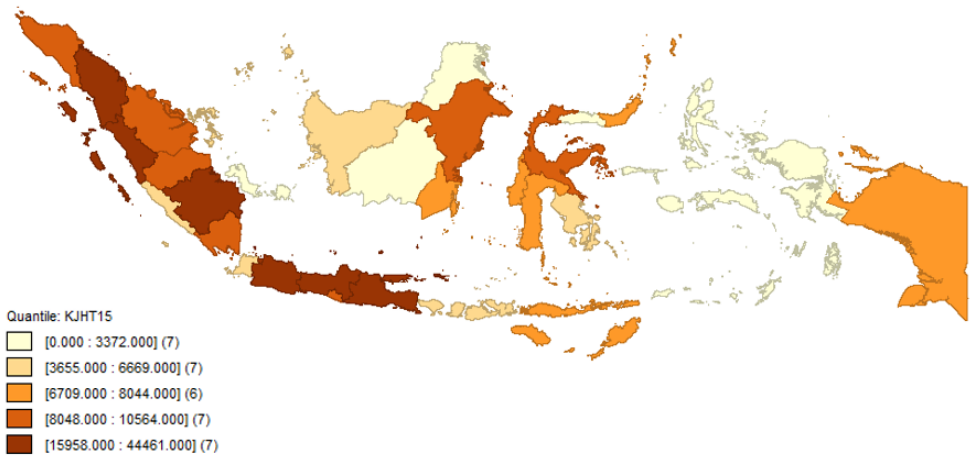

Figure 1. Thematic map of crime level distribution

Based on distribution level of crime can be seen in some region has the highest crime rate on Java island and Sumatra, then the area with a small crime rate in comparison with the other is the island of Maluku and some provinces in Kalimantan. But more specifically the island of Java has a high crime rate, this can be caused because the density of the population on Java island.

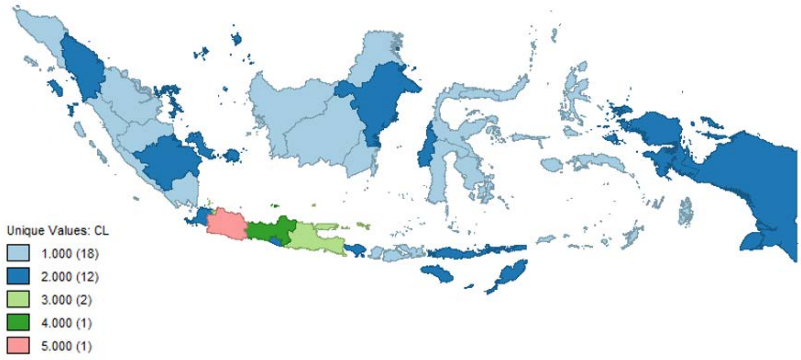

Figure 2. Clustering Area based on five variables

In the picture above is a picture of grouping results based on several variables, in get into 5 groups. The first group is light blue and the second is dark blue, the third group is the light green color which is more precisely the east java area and then there is dark green color which is the middle java area. Then there is the pink color for the 5th cluster which is the west java area and DKI Jakarta.

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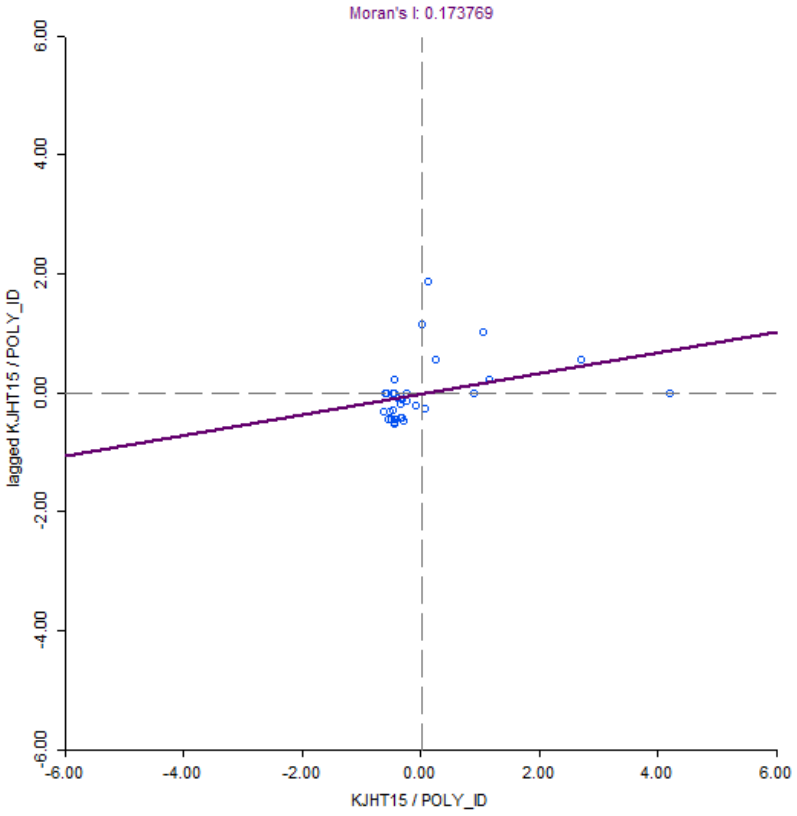

Figure 3. Moran Index

Based on the picture above in get an information that there are provinces adjacent to the province, it can be said to have an equally high autocorrelation value. Moran index method is used to determine the magnitude of the correlation between the value of a province with the average value of surrounding provinces. Several provinces gather where they have low crime rates but are correlated with each other. But globally of 0.173 this can be said low, with a range of correlation values from -1 to 1.

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SUMMARY OF OUTPUT: SPATIAL LAG MODEL - MAXIMUM LIKELIHOOD ESTIMATION
Data set            : IDN_adm1
Spatial Weight      : IDN_adm1
Dependent Variable  :      KJHT15  Number of Observations:   34
Mean dependent var  :     10380.5  Number of Variables   :    6
S.D. dependent var  :     10407.1  Degrees of Freedom    :   28
Lag coeff.   (Rho)  : 0.000297777

R-squared           :    0.533422  Log likelihood        :    -349.793
Sq. Correlation     : -            Akaike info criterion :     711.585
Sigma-square        :5.05339e+007  Schwarz criterion     :     720.743
S.E of regression   :     7108.72

------------------------------------------------------------------------------
       Variable       Coefficient     Std.Error       z-value    Probability
------------------------------------------------------------------------------
         W_KJHT15   0.000297777       0.144073     0.00206684     0.99835
         CONSTANT      -26419.7          24025       -1.09968     0.27147
          PGLRN15      0.011051     0.00708328        1.56016     0.11872
           BKRJ15    0.00158643    0.000633061        2.50596     0.01221
          PGGRN15   -0.00405658     0.00861229      -0.471023     0.63762
            IPM15       324.303        404.845       0.801055     0.42310
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Figure 4. Spatial Lag Model

From figure 4, in the variable section it is found that only the variable number of forces that work in 2015 affects the crime rate occurring in each province. Then get the R-Squared value and spatial lag model is 0.53. Its Aic value is 711.585. Then for Spatial eror model produce the following output.

```
SUMMARY OF OUTPUT: SPATIAL ERROR MODEL - MAXIMUM LIKELIHOOD ESTIMATION
Data set            : IDN_adm1
Spatial Weight      : IDN_adm1
Dependent Variable  :      KJHT15  Number of Observations:   34
Mean dependent var  :10380.470588  Number of Variables   :    5
S.D. dependent var  :10407.087354  Degrees of Freedom    :   29
Lag coeff. (Lambda) :   -0.030452

R-squared           :    0.533860  R-squared (BUSE)      : -
Sq. Correlation     : -            Log likelihood        : -349.782037
Sigma-square        :5.04865e+007  Akaike info criterion :     709.564
S.E of regression   :     7105.38  Schwarz criterion     :     717.196

------------------------------------------------------------------------------
       Variable       Coefficient     Std.Error       z-value    Probability
------------------------------------------------------------------------------
         CONSTANT      -26402.1        22990.6       -1.14839     0.25081
          PGLRN15     0.0105813      0.0069753        1.51697     0.12927
           BKRJ15    0.00153421    0.000600275        2.55585     0.01059
          PGGRN15   -0.00342641     0.00856624       -0.39999     0.68916
            IPM15        331.54        387.577       0.855416     0.39232
           LAMBDA    -0.0304523       0.195512      -0.155757     0.87622


REGRESSION DIAGNOSTICS
DIAGNOSTICS FOR HETEROSKEDASTICITY
RANDOM COEFFICIENTS
TEST                                DF      VALUE        PROB
Breusch-Pagan test                  4        13.9898     0.00733
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Figure 5. Spatial Error Model

Look at figure 5 in probabality column LAMBDA value is 0.876 . The LAMBDA value is less than 0.05 which means the LAMBDA variable has no significant effect to the model. R-squared regression Spatial Error is 0.53386 and the AIC value regression Spatial Error is 709 . PROB value in Diagnostic for heteroskedasticit is 0.00733 . The PROB value is greater than 0.05, meaning there is no effect of spatial heterogeneity in this spatial error model.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Based on the results of the analysis that has been done, then got the following conclusion:

a. The level of crime in Indonesia year 2015 is mostly more in areas with more population such as Jakarta and around Java island.
b. Provinces with high crime rates have influence to the neighbours, so that crime rates can affect the surrounding area
c. R-squared from regression Spatial Error is smaller than R-squared regression Spatial Lag and the AIC value regression SEM greater than SAR. Judging from these two values, it can be concluded that a better model used is SAR.

5.2. Recomendations

The government needs to maximize their efforts to find solutions to reduce crime rates, this can be done by increasing the number of jobs and increasing the level of education so as to reduce the crime rate in each province.

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Biographies

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