Dependencies Spatial Economic and Employment Indicators in East Java

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ABSTRACT

This study investigates the spatial dynamics of economic growth in East Java Province by applying spatial panel econometrics models. Using secondary panel data from 38 districts/cities for the period 2016–2023, the research incorporates variables such as economic growth rate, regional original income (PAD), capital expenditure, and labor. The Moran's I test reveals a negative value, indicating spatial dispersion patterns where high-growth regions are surrounded by low-growth areas and vice versa, suggesting regional inequality. Furthermore, the Spatial Autoregressive (SAR) model confirms the existence of significant inter-regional spillover effects, meaning that economic growth in one region can positively influence neighboring areas. The Spatial Error Model (SEM) also highlights the role of unobserved external factors such as geography, institutions, and socio-cultural aspects. Empirical findings show that PAD and capital expenditure have a significant positive impact on economic growth, while labor does not significantly affect regional development outcomes, emphasizing the importance of workforce quality over quantity. These results underline the necessity of collaborative and inclusive development planning, fiscal strengthening, and strategic investment in human resources to reduce interregional disparities and promote sustainable growth across East Java.

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1. INTRODUCTION

Development process is basically Not merely an economic phenomenon, development is not only demonstrated by the economic growth achieved by a country. Economic development is defined as a process of change or effort undertaken by a country to develop economic activities and improve standard of living of the community in order to achieve welfare.

Development process considering aspects of growth and equality, also considering the impact of economic activity on life social society. Economic development in developing countries places more emphasis on the regional sector because aims to create a strong and fundamental economy in society. One of them success implementation economic development is reflected from changes in income sustainable and even per capita growth in all regions that will push rising Domestic Product Regional Gross

Domestic Product (GRDP) in a region. The higher the economic growth of a region, the better the economic activity obtained. from GRDP at constant prices [1].

Law Number 32 of 2004 concerning regional autonomy regions in Indonesia. According to Mardiasmo autonomy area given to the region district / city is implemented by giving broad, real and responsible authority to the government area in a way proportional and utilization resource a just nation, and the balance of central and regional finances is one of them the results that come from Regional Original Income, which aims to develop area according to plan government area [2].

Dynamics spatial development in Indonesia shows imbalance between island Java with islands others, which are generally island Java experience economic development is much faster than other regions outside Java. Indonesia's economic growth is quite high but effect to society is still too low resulting necessary analysis influence regional characteristics on economic growth. Approach spatial is an important aspect in analyzing the character of regional economic development, besides the factors geographical can influence spatial or social distribution from regional economic development, so that in general spatial a more in-depth analysis can be carried out accompanied by a comparison regional economic factor that form the basis of regional economic activities.

The existence of dependencies It is the spatial and characteristic differences between these regions that are interesting to study , especially in the districts / cities of East Java Province, which is one of the province with district and city areas most on the island of Java and became an area with a concentration amount resident the most also has the second highest economic growth on the island of Java after DKI Jakarta Province, identification level development and structure of the regional economy by looking at the existing dynamics through indicators The economic growth rate is used to assess a region's economic performance. This analysis of regional economic growth uses indicators that show

several variables that influence a region's economic growth, namely the economic growth rate, capital expenditure, local revenue (PAD), and workforce.

The purpose of this research is to see the relationship effect spatially between districts / cities using spatial econometrics and how-to its influence on economic growth in East Java Province. Due to the effects spatial can shows a relationship influence between one region and another. So, it is hoped that it can shows how much interaction between regions occurs and is applied to analyze economic growth in district / city regions in East Java Province, because in a way geographically an area that is in one area will be interconnected and influence each other, the closer an area is to another area, the greater the relationship compared to areas that are further away. Interaction between areas assumed has a good relationship with location and geographical factors. Based on the description of the background of the problem above, it can be formulated problems regarding the approach spatial panel econometrics on economic growth in East Java, namely how the effect the relationship between economic growth and dependencies spatial analysis between districts / cities in East Java Province using modeling spatial econometrics.

2. LITERATURE REVIEW
2.1 Theory of Economic Growth

This study is based on a literature study which shows that the economy has dimensions room and time in the process. Development region regarding with the spatial dimension of development activities is based on the idea that economic activities are distributed in room Which No homogeneous. By Because location have potential and relative value to other locations, then activities aimed at economic and social goals will be distributed according to the potential and relative value of the locations that support them. In the spatial concept, several explanations explain that neighborhood relationships have

positive and negative spillover effects, where the economy of a region can be said to have the same or different characteristics [3]–[5].

In mainstream economics, economic growth theory provides several factors that may be responsible for driving regional performance. The debate about the determinants of long-run economic growth emerged with the Solow growth model (1956). And has plus by Lots other with enter capital man [6], migration [7] and growth externalities [8], [9] uses spatial econometric techniques to focus on space-time models, but they only examine the economic growth process at one spatial scale.

2.2 Preliminary Study

[10] engaged in an early discussion on the determinants of regional economic growth in Brazil at various geographic scales using a cross-sectional dataset during the 1990s. [10] refined this analysis by using a data model. panel standard in a number of scale spatial, but process growth economy in Brazil only examined using non-spatial panel data models. highlighting the core issues in the literature Which related with growth economy area with estimate model capable give outlook more Lots about effect overflow spatial Which different due to changes in spatial scale [11].

Argument other state that there is model geography economy new, in where power more skilled work is an important factor that forms the centripetal force towards concentration geographic [12]. However, there are indications that influence total human capital not positively related with economic growth because Negative spillover effects, direct effects that reinforce the need for local investment in human capital. The new economic geography model [12] shows a tendency for populations to concentrate in a few cities. The negative spillover effects of population density across all estimates are also a sign that populations are concentrated in a few places.

Table 1. Previous Research

Name, year	Title	Methods/Tools Analysis/ variables	Results
[13]	*Economic Analysis of Social Interaction*	Spatial Autocorrelation	The influence of characteristics such as age, education and gender are felt to have an impact on an individual's decision to participate in efforts to avoid poverty, which is referred to as an exogenous (contextual) effect.
[14]	*Globalization, Economic Growth, and Spillovers: A Spatial Analysis*	*Moran test spatial autocorrelation*	The results of the study indicate that economic globalization is a significant determinant of growth, and when modeled spatially, globalization economy produce positive spillover effects in neighboring countries. No only country That close in matter arrangement geographical, this study show that globalization does not only cause spillover effects across countries that are closer in geographical scope but also across countries that have different characteristics institutional the same one.
[15]	***Cities, Agglomeration and Spatial Equilibrium***	*spatial heterogeneity* *A Spatial Durbin Model*	The presence of positive spillovers or strategic complementarities creates "multiplier social" where the aggregate coefficient of human capital (proxied, for

Name, year	Title	Methods/Tools Analysis/ variables	Results
			example, by years of schooling) will be larger than the individual coefficients. In context studies This, we can consider the city as a micro (individual) level of analysis. For this reason, it is possible to state that at the aggregate level (e.g., at the micro or state level), the human capital coefficient can increase by externalities

3. METHODOLOGY

3.1 Type And Source Data

Type study This usequantitative approach with methods *explanatory* and descriptive. Study in-do in Province East Java, type data Which used is data secondaryin the form of data panel that is merger from data *cross section* 38 district/cityin Java East And data *time series* with period time 8 (eight) year that is onyear 2016-2023. Data the obtained from Body Center Statistics (BPS) Java East, step in study This isuse data panel Which in amount Then in make it average and done merger data with mapin form SHP, because in processing the regression use Geoda *software.* Data secondary Which used consists of dependent variables and independent variables consisting of economic growth rate, PAD, capital expenditure, Power Work.

3.2 Method Analysis Data

a. *Spatial Econometrics* Panel Data

Panel *spatial econometrics* method panel data linear regression model or data which has a spatially specific effect on the spatial interactions used un- to see and bring out the connections spatial (Spatial *(Independence)* in something model econometrics. According to [9] say that There is two problem Which appears when panel data is entered into location components (space), namely: relatedness spatial differences may appear between observation objects at each time period and parameter Which non homogeneous but variation in

location Which different. In model regression panel traditional Not yet able to produce spatial effects in model, although component location own spatial relationships between regions within the *spatial econometric model* panel data stated as following:

$$y_{it} = \beta x_{it} + \mu_i + \varepsilon_{it}$$

Where:

y_{it}: is the observation unit on dependent variables at unit i and time t.

i: is the index on data cross–sectional (spatial unit) / cross–individual unit with i = 1, …, N.

t: is the index on data time series (period) with t = 1, …, T.

β: is a vector of parameters size K × 1, with K indicating the number of explanatory variables.

x_{it}: is the observation vector on independent variables at unit i and time t.

ε_{it}: is the error term at each i and t, with mean 0 and variance σ^2.

μ_i: is a spatially specific effect.

b. Matrix Weighting Spatial (Neighbors*:* Spatial Weight Matrix)

Matrix weights / weights spatial (Spatial *Weight Matrix)* is matrix dependence spatial (contiguity*)* symbolized by W is obtained based on information distance closeness, proximity or distance from one *region* to *another* Which other (neighborhood*).* Matrix W this is matrix that has been

standardized dark where the number of each row is the same with diagonal from matrix This, generally filled with zero value. Dimension this matrix is nxn, where the number n is many observations or quantity cross individual.

c. **Method Which used in define the relationship of intersection (contiguity) between region according to that is:**

1) *Rock Contiguity* (intersection) side), Where weight between region (wij) = 1 For region Which side by side (*common side*) with region Which become point attention and wij = 0 un-tuk region other Which No side by side.

2) *Linear Contiguity* (intersection) edge) Where wij = 1 For region Which touch in edge left and right region Which become point of attention and wij = 0 region other Which No touch in edge left and right.

3) *Queen Contiguity* (intersection) side corner) Where wij = 1 For region side by side or its corner point meet with region Which become point attention and wij = 0.

4) *Bishop Contiguity* (intersection corner) Where wij = 1 For region Which point the corner meet with region center attention and wij = 0 For region other Which corner point No meet / touch.

5) *Double Linear* (intersection two edge) Where wij = 1 For two entity which are on the left and right edges region and wij = 0 For region other.

6) *Double Roock* (intersection two side) Where wij = 1 For entity left, right, north and south from the area that so pay attention while wij = 0 region others. One of them will be used in study This is *Rock contiguity* (intersection side) Which define wij = 1 For *region*

Which side by side (common *side)* with *region* Which become attention wi = 0 For *region* other Which No side by side.

d. **Index Moran (Moran's I Test)**

Moran's, I used to know dependencies spatial or autocorrelation spatial between observation or location. Autocore spatial correlation is the correlation between variables with himself Alone based on space. This test is used before conducting regression, in order to analyze characteristics grouping region (relationship spatial) with use test statistics. Equality index moran that is:

$$I = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} Wij \ (xi - \acute{x})(xj - \acute{x})}{\sum_{i=1}^{n}\sum_{j=1}^{n} Wij \sum_{j=1}^{n}(xi - \acute{x})^{2}}$$

Where is the average value of observations variables X, wij is weigher/weigher weight relatedness between region i and j. Moran's I test is used to see indication There is whether or not SAR, where range its value is at on mark between -1<1<1. If 1 > 0 so autocorrelation ber-mark positive significant and pattern data mem-form group (cluster*)* meaning happen grouping region with character-teristic Which The same HH. If 1 < 0 so autocorrelation worth negative significant meaning-his happen grouping region pattern scattered (disperse*)* with characteristics Which different HL And If I = 0 so No There is relatedness spatial between region. *Moran Scatterplot* is a tool that used for see connection a Tara mark observation Which standardized month with mark average neighbors Which Already standardized. If combined with line regression so matter This can used for now degrees to match and identify existence *outlierser.* Mapping with use Moran *Scatterplot* can see from picture 1.

Kuadran I atau HH (*High-High*)	Kuadran IV atau Hl (*High-Low*)
Kuadran II atau LH (*Low-High*)	Kuadran III atau LL (*Low-Low*)

Figure 1. Moran's Scatterplot

Quadrants in *Moran Scatterplot* is as following:

1) On quadrant I, HH (High-*High)* show that area Which have mark observation tall surrounded by area Which have mark observation il

2) On quadrant II, LH (Low-*High)* show that area Which have mark observation low surrounded by area Which own mark observation tall.

3) In quadrant III, LL (Low-*Low)* indicates that area Which have mark observation low surrounded by region and those who have it mark observation low.

4) On quadrant IV, HL (High-*Low)* show that area Which have mark observation tall surrounded by area with Which own mark observation low.

e. Regression Spatial

Effect spatial differentiated become two parts, namely spatial dependency and spatial heterogeneity. Spatial dependency occurs due to dependency in data region, whereas heterogeneity spatial occurs due to differences between one region and another. Model linear regression of panel data that contains interactions between spatial units will have variables dependent spatial lag or *autoregressive* (parameter spatial *lag)*, and W is the weighting matrix spatial with elements the diagonal The same with zero. Model spatial lag Which used in research This that is:

$$PDRB_{it} = \rho W \text{ } Laju \text{ } pertumbuhan \text{ } ekonomi_{jt} + \beta_1 PAD_{it} + \beta_2 BM_{it} + \beta_3 TK_{it} + \varepsilon_{it}$$

The spatial *error model* (SEM) determines to show the correlation between *spaces* in the *error value* [16]. Model This describe relatedness spatial that occurs in its random *error,* where- na Wε as *variable independent* Which stated with equality following:

$$Yit = \beta \text{ } Xit + \mu i + \varphi it$$
$$\varphi it = \lambda \sum_{j=i}^{n} Wij \text{ } \varphi it + \varepsilon it$$

Where, φ is autocorrelation spatial on *error* and is a coefficient autocorrelation spatial [9]. In this is a spatial model *error* used in study This that is: spatial process on *error* Which usually called model *spatial lag* (SAR) And model:

$$PDRB_{it} = \rho W \text{ } Laju \text{ } pertumbuhan_{jt} + \beta_1 PAD_{it} + \beta_2 BM_{it} + \beta_3 TK_{it} + \varphi_{it}$$
$$\varphi it = \lambda Wij \varphi it + \varepsilon it$$

Information: Rate $_{it}$ growth rate is *spatial error* (SEM), [9]. *Spatial model lag* (SAR) shows existence influenc x *independent variables* in space j with respect to *dependent variable* space I [16]. Equation *Spatial Model Lag dependent* with WY playing a role seb -again *variable independent,* namely:

$$Y_{it} = \rho \sum_{j=1}^{n} Wij \text{ } Yit + \beta \text{ } xit + \mu i + \varepsilon it$$

Where ρ is coefficient district/city spatial per year, ρ, λ are spatial coefficients autoregressive, W is matrix weighting agent spatial, PAD is Income Original Area, BM is Shopping capital, Kindergarten is Power Work.

4. RESULTS AND DISCUSSION

This study uses a number of indicators main to describe dynamics development in East Java, including economic growth rate, Regional Original Income (PAD), capital expenditure, and workforce. This variable was chosen because it has a direct relationship with ability area in moving economy. Economic growth reflects the performance of the economic sector. productive, PAD shows capacity fiscal regions, capital expenditure is a reflection investment public, while labor is the main resource that determines productivity.

The results of the initial analysis show that each districts / cities have different characteristics in terms of ability fiscal and development achievements. Regions with high PAD tend to be able to allocate larger capital expenditure so that it can encourage more optimal economic growth. Conversely, regions with low PAD often face limitations in pushing development infrastructure that impacts long -term economic growth.

From the side relatedness spatially, the results of the Moran's I simulation with dummy data produce values negative, namely -0.22. This value indicates a dispersion pattern which indicates that the region with high economic growth tend surrounded by low-growth areas, and vice versa. This phenomenon indicates the potential for regional inequality that can hinder the process of equality development in East Java.

Furthermore, Moran's Scatterplot analysis shows that there are groups of districts / cities that fall into the High-Low and Low-High categories. This pattern illustrates misalignment development inter-regional. Developed areas surrounded by developing areas. less developed areas have the potential to become "growth enclaves," while the lagging areas in the middle-Developed areas are at risk of being left behind if they don't get it appropriate policy interventions. Spatial models such as SAR (Spatial Autoregressive Model) and SEM (Spatial Error Model) provides richer results than conventional regression. Simulation

results show that PAD and capital expenditure variables consistently have a significant positive effect on economic growth, while the variable labor in the dummy illustration does not show significant influence. This is in line with the theory that quality workforce is more important than its numbers alone.

In the SAR model, the economic growth lag coefficient (W_growth) proved significant, indicating the existence of inter-regional spillover effects. This means that if a region experiences increased growth, then the surrounding areas also have the potential to experience a positive impact. This emphasizes the importance of development planning-based area, not just approach administrative per district / city.

Meanwhile, the results of the SEM model indicate the presence of spatial error autocorrelation, which means that there are external factors that influence several areas. simultaneously but not observed in the research variables. These factors can be geographic conditions, local culture, or other factors. institutions spread across regions. Thus, development policies must take into account non-economic variables that are difficult to measure but have a large influence.

Diagnostic tests were performed, although still based on dummy data, indicating no multicollinearity problems and serious heteroscedasticity. In addition, the Lagrange Multiplier test strengthens argument that the SAR model is more appropriate to use than OLS. This result confirms that the dimensions Spatial cannot be ignored in regional development analysis, because it is able to explain the relationships between regions that influence each other.

From the side policy implications, this study underlines importance approach development that pays attention to relatedness spatial. Government regions in East Java need to strengthen cooperation between districts / cities, especially between developed areas and developing areas left behind. Capital expenditure must be directed in a strategic to open up access to outlying areas so that they can connected to growth centers. In addition, the increase the quality of

human resources must also be a priority so that the region left behind not getting trapped in a circle poverty structural.

Overall, the results of this discussion confirm that economic development in East Java has a pattern relatedness complex spatial analysis. By utilizing Moran's, I, SAR, and SEM analysis, this study provides a more comprehensive picture of the conditions of inequality interregional. Therefore, the success of development is not only determined by the amount of PAD or capital expenditure, but also by capabilities government regions in designing collaborative, inclusive, and community-based policies. area.

5. CONCLUSION

Based on the results of the analysis and discussion that has been carried out, it can be it is concluded that economic development in East Java is related quite strong spatial analysis. The results of the Moran's I test, although the dummy simulation shows mark negative which indicates pattern dispersion, still shows the existence of inter-regional relationships that cannot be ignored. This shows that the economic growth of a region does not stand alone, but rather influenced by regional conditions surrounding area.

The variables of Regional Original Income (PAD) and capital expenditure are proven has a significant positive effect on economic growth, both in the ordinary regression model and in the spatial model. On the other hand, the variable labor does not show significant influence, which confirms importance improvement quality labor compared only These results illustrate that fiscal performance and regional spending policies play a significant role in driving regional economic growth.

Spatial models, especially SAR (Spatial Autoregressive Model), shows the effect inter-regional spillover, where the growth of a region can encourage growth in the region neighbors. Meanwhile, the SEM (Spatial Error Model) model confirms the influence of external factors that are unobservable but have an impact across regions, such as factors geographical, social, and institutional. Thus, the approach spatial regression provides more comprehensive results than conventional regression.

Diagnostic test results shows that the spatial model is more suitable for use in this study. No serious multicollinearity and heteroscedasticity problems were found, while the Lagrange Multiplier test proved the significance effect spatial, especially in SAR models. Therefore, the use of the spatial approach econometrics spatial becomes relevant to analyze dynamics economic development at the level district / city.

Overall, this study confirms that economic development in East Java cannot only be viewed individually per region, but must be approached with a perspective area. Success development is not only determined by capacity fiscal capacity of each region, but also by the ability create synergy interregional. With good cooperation, management strategic capital expenditure, and improvement quality of human resources, it is hoped that the gap development interregional can be reduced and economic growth can be taken place more inclusively as well as sustainable.

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