Journal of Infrastructure, Policy and Development 2024, 8(7), 4195.
https://doi.org/10.24294/jipd.v8i7.4195

Article

Spatial dependence and poverty factors: A study of Pantura Regions in East Java Province, Indonesia

Khoirul Ifa[1,2,*], Sebastiana Viphindrartin[1,*], Edy Santoso[1], Teguh Hadi Priyono[1]

[1] Faculty of Economics and Business, University of Jember, Kabupaten Jember, Jawa Timur 68121, Indonesia
[2] Widya Gama Lumajang Institute of Technology and Business, Kabupaten Lumajang, Jawa Timur 67352, Indonesia
*** Corresponding authors:** Khoirul Ifa, khoirul.ifa@gmail.com; Sebastiana Viphindrartin, sebastiana@unej.ac.id

CITATION

Ifa K, Viphindrartin S, Santoso E, Priyono TH. (2024). Spatial dependence and poverty factors: A study of Pantura Regions in East Java Province, Indonesia. Journal of Infrastructure, Policy and Development. 8(7): 4195. https://doi.org/10.24294/jipd.v8i7.4195

ARTICLE INFO

Received: 12 January 2024
Accepted: 23 February 2024
Available online: 23 July 2024

Abstract: Poverty is still a problem in various countries in the world, so eradicating poverty and hunger by 2030 is the backbone of the goals of the sustainable development agenda. Poverty, which is the main goal of the Millennium Development Goals (MDGs), is again the main goal in the Sustainable Development Goals (SDGs). This research aims to determine the spatial dependence of poverty in the Pantura Region of East Java Province and to determine the influence of economic growth, education, unemployment, natural resources, health and accessibility on poverty in the Pantura Region of East Java Province. This research uses a quantitative approach, with data analysis methods using Moran's index analysis, and spatial panel regression by selecting the best model from four models, namely the spatial autoregressive model (SAR), the spatial error model (SEM), the spatial Durbin model (SDM), and spatial autoregressive combined (SAC) model. The research results show that there is spatial interaction between coastal areas through endogenous and exogenous interactions between independent variables. Based on the selection of the best model, the spatial Durbin model (SDM) was selected for the Pantura Region. Economic growth has a negative effect on poverty. Education has a negative effect on poverty. Unemployment has no effect on poverty. Natural resources have a positive effect on poverty. Health has no effect. Accessibility has a negative effect on poverty in the Pantura Region. This research provides a new and important contribution in understanding the spatial patterns of poverty and the factors that influence it in the Pantura Region, which is a strategic and vulnerable area in East Java. This research also faces several limitations and challenges, such as data quality, model assumptions, and spatial validity. Future research could expand this analysis using more complete data, more flexible models, and more sophisticated techniques.

Keywords: spatial dependence; poverty; Pantura Regions

1. Introduction

East Java Province's economic growth in the fourth quarter of 2021 improved by 0.14 percent (q-to-q) compared to the third quarter of 2021, indicating that it is one of the provinces in Indonesia with a fairly good economic level. In terms of production, the highest growth occurred in the transportation and warehousing business field, which grew by 19.62 percent. In terms of expenditure, the highest growth occurred in the government consumption expenditure component, which grew by 9.61 percent (BPS, 2021). However, even though the economic growth is positive, this is not the only indicator that East Java Province does not have economic problems. East Java is the province that contributes the poorest people in Indonesia. Poverty is a multidimensional problem that sets the poverty line for each dimension of poverty and considers whether a person is below the poverty line or not

(Bourguignon and Chakravarty, 2003).

The coastal area in East Java Province consists of two regions: the north coast (Pantura) and the south coast (Pansela). So far, the north coast region has been a star in the East Java region because of its good accessibility and economic potential. The north coast region (Pantura) consists of 10 regencies and cities, namely Tuban Regency, Lamongan Regency, Gresik Regency, Surabaya City, Sidoarjo Regency, Pasuruan Regency, Pasuruan City, Probolinggo Regency, Probolinggo City, and Situbondo Regency. But even though there are several economic potentials, the pantura region is also not free from economic problems, one of which is poverty (Fitrianto and Samsuri, 2021). The following **Figure 1** presents the data on the average population of the north coast (Pantura) of East Java:

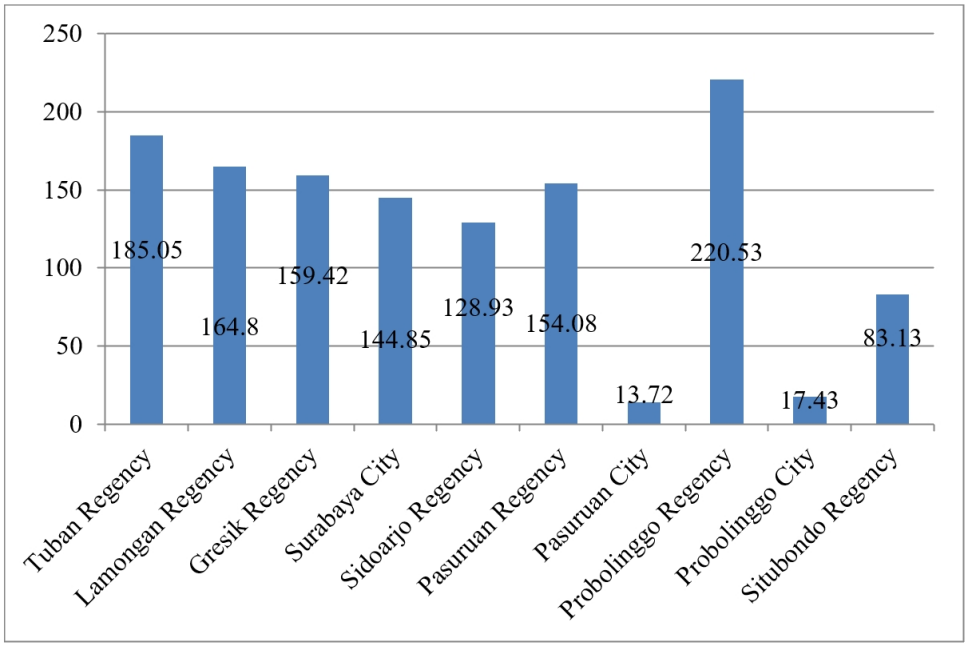

Figure 1. Average number of poor people in Pantura Region in 2017–2021 (thousand) (Central Bureau of Statistics (BPS), 2017, 2018, 2019, 2020, 2021).

Based on the data in **Figure 1** on the number of poor people in the north coast region from 2017 to 2021, the districts/cities with the poorest people are Probolinggo Regency and Tuban Regency, with 220.53 thousand and 185.05 thousand people respectively. Poverty is caused by individual and structural problems. The higher poverty rates in the north and south coast regions show that poverty is more caused by structural problems, such as differences in economic and social structures. Keynes (1936) said that structural differences cause weak socio-economic activities, based on the economic depression in 1920. The following is the data on poverty conditions in East Java Province. Based on **Figure 1** in the data from the Central Bureau of Statistics and TNP2K for East Java Province in 2021, the percentage of poor people in East Java is 16.59 percent of the number of poor people in Indonesia. Compared to the national poverty percentage of only 10.14 percent, the poverty condition in East Java needs to be a priority for the East Java Provincial Government.

The phenomenon of poverty has so far only focused on socioeconomic factors

and ignored spatial factors. Spatial poverty studies can also reveal the factors that influence poverty. Physical/natural and social variables are used as variables, because poverty is related to various aspects of socio-cultural, economic, political, technological, regional accessibility, demographic, geophysical and regional climate-botany (Zhao and Xu, 2024).

The importance of spatial analysis in poverty reduction is to guide the implementation of poverty reduction policies by considering the characteristics and diversity of each region. This is consistent with the first law of geography proposed by Tobler (Anselin and Rey, 2010), which says that everything is connected, but things that are closer have more influence than things that are farther away.

Wang et al. (2020) did research that used variables of income, expenditure, and socioeconomic and demographic aspects of households, such as housing, victimization, employment rates, health services, education access, and poverty indicators, to measure poverty from a spatial perspective. Similarly, research by Akinyemi and Bigirimana (2012) measured spatial poverty from four poverty indicators: expenditure, health, education, and services. Their findings showed patterns of poverty and the existence of an urban-rural divide.

Zhou and Liu (2022) say that the spatial dimension of poverty is a topic for policy makers, who need to review how poverty varies across space and design policies to overcome poverty traps. Therefore, this research is important to recommend spatial poverty reduction policies. Ehrlich and Overman (2020) also say that different spatial factors are important in explaining the welfare level in different regions, which suggests targeted policies.

Booth (1998) says that there are five factors that cause poverty. The first is economic factors, which include a lack of capital and low technology. The second is socio-cultural factors, which include low skills and education, limited employment opportunities and a bad culture. The third factor is geography and environment, which include regional isolation, diseases and land infertility. The fourth factor is personal and physical, which include age, gender and individual health. The fifth factor is limited access to things like market products, public facilities and credit facilities.

Economic factors such as economic growth are important in reducing poverty. Several studies show the link between economic growth and poverty and say that economic growth can lower poverty (Adeleye et al., 2020; Fosu, 2017; Jr Adams, 2004; Perera and Lee, 2013). But some other researchers have different results, Dollar et al. (2016) say that there is no link between economic growth and poverty rate. Chen et al. (2015) say that economic growth cannot solve rural poverty. Other factors such as socio-cultural factors also matter in reducing poverty, which are seen in low education levels and unemployment. Education plays an important role in lowering poverty. As Bloom et al. (2006) say that education is widely recognized to play a major role through economic growth. Therefore, education should always be developed. This is because education can improve welfare and lower poverty. Through education, the quality of human resources can be improved, and education also increases the ability to gain knowledge even in the world of work. Therefore, education can be seen as an investment in development and the results can be enjoyed in the future. As a development of other fields, education is one of the main

fields after health and economy. This agrees with Hofmarcher (2021) who say that education sector spending affects poverty.

Garza-Rodriguez et al. (2021) and Tilak (2007) said that one of the reasons for the decline in poor households is having a higher level of education than primary school. Some other studies say different things. Zhang (2014) and Barham et al. (1995) explained that low- and middle-income families with better educated parents may decide to make unaffordable investments, expecting long-term benefits from education. Children from low- and middle-income families may have better opportunities for higher education, but the high cost of education has created a much higher burden for low- and middle-income households who end up unexpectedly trapped in a new educational poverty trap.

Unemployment is an important factor in reducing poverty. There is a significant increase in the influence of poverty over time, especially measured by the number of unemployed, because it is believed that someone who has a job will be able to reduce the risk of poverty (Liu et al., 2022; Ucha, 2010; Xue and Zhong, 2003). However, this contrasts with Quy's (2016) statement, which states that unemployment has a negative impact on poverty.

Poverty is a phenomenon that affects various aspects of human life. Besides socioeconomic factors, geography and environmental factors also affect poverty. Geography and environmental factors relate to natural resources, which influence the productivity and availability of food, jobs, and income (Gray and Moseley, 2005; Schleicher et al., 2018). Natural resources are one of the important natural factors because areas with fertile and productive land can improve the economy, including agricultural products. However, natural resources can also pose challenges, such as drought, flooding, and land degradation (Malerba, 2020). Kassa et al. (2018) stated that these challenges affect most of the poverty in their study area. Furthermore, Zhou and Xiong (2018) and Gao et al. (2020) mentioned that complex natural conditions have a positive driving effect on the spatial distribution of poverty-stricken districts.

The fourth poverty factor according to Booth (1998) is personal and physical factors, which are usually related to health factors. Health can also be an opportunity to reduce poverty levels, as Gupta and Mitra (2004) stated that per capita health expenditure clearly and positively affects health status and the results seem to show that poverty decreases in response to improving health status. This is in line with Bloom and Canning (2003) who argued that there is a large effect of health improvement on household income and economic growth and make it an important tool for poverty reduction. Similarly, Novignon et al. (2012) stated that health status affects vulnerability to poverty because the likelihood of future illness is reduced for households. Weziak-Bialowolska (2016) and Liu et al. (2020) also argued that health has a close relationship with poverty. However, this is different from what Asare and Barfi (2021) stated that health status has no effect on poverty reduction. In addition, according to Booth (1998), the poverty factor also comes from limited access.

Accessibility influences the spatial variation of poverty significantly, including economic accessibility, market accessibility, and traffic accessibility as the main driving factors (Liang et al., 2022). Furthermore, Acheampong et al. (2021) and Sugasawa (2019) argue that urban areas contribute to poverty significantly because

of accessibility. Interesting findings were also found by Ahlström et al. (2011) and Kwigizile et al. (2011) that households with high estimated accessibility to markets are poorer than households with high accessibility to cities. Accessibility to infrastructure services such as roads shows that the farther a person travels to use these services, the higher the poverty rate (Medeiros et al., 2021).

The problem in this study is how spatial dependence and factors affect poverty in the North Coast Region of East Java. Poverty is one of the main problems faced by various countries in the world, including Indonesia. According to data from the Central Statistics Agency (BPS, 2020) the percentage of poor people in Indonesia was 9.78%, or around 26.42 million people. Poverty not only affects individual well-being, but also social, economic, and environmental development (Rahayu et al., 2021). Therefore, eradicating poverty and hunger by 2030 is the main goal of the sustainable development agenda SDGs (Sustainable Development Goals) agreed by the United Nations. This research aims to analyze spatial dependence and factors that influence poverty in the Pantura Region of East Java Province.

The Pantura Region is a strategic and vulnerable area in East Java, because it has high potential for natural resources, industry, and trade, but also faces various problems such as natural disasters, environmental degradation, health, and accessibility (Handiani et al., 2022). This research hopes to provide a deeper and more comprehensive understanding of the patterns and causes of poverty in the Pantura Region, as well as appropriate and effective policy recommendations to solve this problem. In researching poverty, there are various factors that can influence it, both from internal and external aspects. Some factors that are often related to poverty are geographic and environmental factors, personal and physical factors, and accessibility factors.

Geographic and environmental factors relate to natural resources, climatic conditions, and environmental quality that influence productivity and the availability of food, employment, and income. Personal and physical factors relate to health, education, and skills that influence an individual's ability and opportunities to escape poverty. Accessibility factors relate to infrastructure, transportation, and markets that influence an individual's mobility and connectivity with needed resources and services. Various studies have been done to examine the influence of these factors on poverty, both separately and together, using various analytical methods, such as linear regression, logistic regression, multilevel analysis, and spatial analysis. However, there are still gaps in knowledge or understanding that need to be filled, especially about the spatial dependence between different regions in terms of poverty and the factors that influence it. Spatial dependence refers to the phenomenon in which the values of variables at one location are influenced by the values of variables at other locations that are near or far.

Geo spatial analysis is a process that uses data with location information to model, represent and predict phenomena that happen in Earth's space. Geo spatial analysis involves collecting, combining, and visualizing different types of geo spatial data, such as satellite image data, census data, survey data, GPS data, etc. Spatial dependence can be caused by internal interactions, which are interactions between dependent variables in different locations, or external interactions, which are interactions between independent variables in different locations. Spatial dependence

can cause bias and inefficiency in parameter estimates if it is not considered in the analysis model (Owusu et al., 2021). Therefore, this research uses spatial analysis methods, such as Moran's index analysis and spatial panel regression, to examine spatial dependence and the factors that affect poverty in the Pantura Region of East Java. This research also compares four spatial panel regression models, which are the spatial autoregressive model (SAR), spatial error model (SEM), spatial Durbin model (SDM), and combined spatial autoregressive model (SAC), to find the best model that fits the data and research goals. This research hopes to make a significant contribution to the development of theory, practice and policy on poverty and sustainable development. Theoretically, this research can enrich knowledge and understanding of spatial dependence and the factors that affect poverty, as well as offer a new and holistic perspective in analyzing this problem. Practically, this research can provide useful and accurate information for the government, institutions and society to design and implement suitable and effective programs and policies to reduce poverty and improve community welfare in the Pantura Region of East Java. Policy-wise, this research can provide relevant and strategic recommendations for policy makers to integrate spatial approaches in planning and evaluating sustainable development, especially in achieving SDGs goals. This research also recognizes some limitations and challenges that may be faced, such as the quality and availability of data, model assumptions and validity, and the complexity and dynamics of the poverty phenomenon.

2. Materials and methods

One theoretical perspective on the spatial concentration of poverty comes from economic agglomeration theory, the second from central place theory, and the third from selective out-migration theory. In this study, the economic agglomeration theory is used, which explains how the proximity or concentration of similar firms attracts supportive services and markets, which in turn attracts more firms. Conversely, where there is poverty and conditions of poverty it produces more poverty in the surrounding or adjacent areas.

Booth (1998) argues that there are five factors that cause poverty. The first is economic factors which consist of lack of capital and low technology. The second is socio-cultural factors which consist of low skills and education, limited employment opportunities and the existence of a bad culture. The third factor is geography and environment which consists of regional isolation, number of diseases and land sterility. The fourth factor is personal and physical, consisting of age, gender and individual health. The fifth factor is limited access to many things such as market products, public facilities and credit facilities.

2.1. Relationship between economic growth and poverty

One important aspect in a country's development is economic growth and poverty. Economic growth can be interpreted as increasing the long-term capacity of a country to produce and provide various kinds of economic goods for its population (Triatmanto et al., 2023). Poverty, on the other hand, can be defined as a condition in which a person or group does not have sufficient access to the economic goods

needed to meet their basic needs (Kuznets, 1955). To understand the relationship between economic growth and poverty, one theory that is often used is the Kuznets curve theory, which was put forward by Simon Kuznets in 1955. This theory states that the relationship between economic growth and poverty is non-linear and reverses direction, namely at stages at the beginning of economic growth, poverty tends to increase, but in the later stages of economic growth, poverty tends to decrease. This is caused by structural changes that occur along with economic growth, which includes changes in economic sectors, income distribution and institutions (Ahmad et al., 2021).

The early stages of economic growth, most of the population worked in the agricultural sector, which had low productivity and income. When economic growth increases, part of the population shifts to the industrial sector, which has higher productivity and income. However, this movement is not evenly distributed, giving rise to income inequality between groups working in the industrial sector and groups still working in the agricultural sector. As a result, poverty becomes more severe among disadvantaged groups. In the advanced stages of economic growth, most of the population works in the service sector, which has even higher productivity and income. This movement is also uneven, but there are several factors that help reduce income inequality, such as institutional improvements, increased education, and ideological adjustments. Better institutions, such as political, legal and administrative systems, can create an environment that is more conducive to economic growth and equal distribution of prosperity (Yaqoob et al., 2023).

Higher education can improve skills and workforce mobility, thereby expanding opportunities for residents to get better jobs (Widarni and Bawono, 2023). More appropriate ideologies, such as democracy, human rights, and gender equality, can change society's values and attitudes, thereby reducing discrimination and marginalization of disadvantaged groups. As a result, poverty becomes lighter among disadvantaged groups (Mathias et al., 2020). Economic growth and poverty have a complex and dynamic relationship, which is influenced by various factors that change over time. Economic growth is determined by technological, institutional and ideological progress or adjustments to various demands of existing situations (Sasongko et al., 2021). Therefore, to achieve inclusive and sustainable economic growth, comprehensive and integrated efforts are needed from various parties, both government, private sector and society.

2.2. Relationship between education and poverty

Priyanto et al. (2022) suggest that education and health are fundamental development goals, which are essential for the formation of greater people skills that are at the core of what development means. Education is one of the factors that influence poverty. Nurkse (1971) states that education has an impact on the quality of resources. Low education will result in low quality resources. When the quality of existing resources is low, it will have an impact on declining productivity. Decreased productivity will affect low wages, leading to increased poverty.

2.3. Relationship between unemployment and poverty

Islamiah et al. (2021) argue that regional unemployment rates can have both direct and indirect effects on poverty. The first is a direct effect: higher aggregate unemployment increases the likelihood of individual unemployment. The second effect is an indirect effect through the negative impact of the unemployment rate on the wage bargaining power of jobs that are at higher risk (as they face higher competition) of being fired or receiving lower wages when the aggregate regional unemployment rate increases.

According to Dahliah and Nur (2021), the negative impact of unemployment is the reduction of people's income which in turn reduces the wealth that a person achieves. Of course, when people's wealth falls due to unemployment, it is likely that they are trapped in poverty because they do not have a high income. When unemployment is very high in a country, there will always be political and social unrest, which seriously affects people's welfare and economic development prospects.

2.4. The relationship between natural resources and poverty

In general, people explain that the decline of an economy or the opportunity to develop for a community can be seen from the availability of natural resources in the area. Even today there are still people who say that a country experiences poverty because it does not have enough natural resources. Natural resources are the engine that drives economic growth (Wright and Czelusta, 2004). This was also suggested by Auty and Mikesell (1998), who stated that a country's ability to remain sustainable in the long run can be attributed to its richness of natural resources, which will raise the standard of living per person, provided other factors remain constant. In other words, regions that are rich in natural resources have different economic advantages from regions that are poor in natural resources.

2.5. The relationship between health and poverty

Priyanto et al. (2022) argue that health and education are fundamental development goals. Health is essential for well-being and education is essential for a fulfilling and worthwhile life. Both are very important in relation to the broader idea of enhancing human capabilities as the essence of the true meaning of development.

People's responses vary when it comes to health, which is linked to poverty, as it was at the time due to the economic crisis. For example, those in poverty are more likely to forego outpatient care, postpone hospital care, avoid costly specialist care, cut down on hospital stays, buy half or even a third of prescribed drugs to avoid full treatment, and seek out local care, which can occasionally have negative effects. According to Massaquoi et al. (2021), mothers typically give birth at home with the assistance of traditional birth attendants, which raises the danger of childbirth and causes diseases to worsen because expensive care is avoided.

2.6. Relationship between accessibility and poverty

Accessibility is the ability of a person or group to reach and utilize the resources, services, and opportunities available in their environment. Accessibility

can be influenced by various factors, such as distance, cost, time, quality and availability of infrastructure, such as roads, transportation, electricity, water and sanitation. Accessibility is an important determinant in determining the poverty level of a person or group, because it is related to their opportunities for income, education, health and welfare.

Several studies have shown that there is a negative relationship between accessibility and poverty, that is, the better a person or group's accessibility, the lower their likelihood of experiencing poverty, and vice versa. For example, Medeiros et al. (2021) found that accessibility to infrastructure services, such as roads, shows that the farther a person accesses infrastructure services, the higher their poverty level. This shows that the better a person's accessibility to physical infrastructure, the easier it is for that person to escape poverty. This was also mentioned by Warr (2010), who claimed that increasing accessibility—especially on roads—is associated with reducing poverty.

The rationale behind this relationship is that accessibility affects a person's or group's productivity, efficiency, and economic diversification. Good accessibility can increase productivity, because it allows a person or group to obtain the input, output and information needed more quickly, cheaply and easily. Good accessibility can also increase efficiency, because it reduces transaction, transportation and communication costs incurred by a person or group. Good accessibility can also increase economic diversification, because it opens up opportunities for individuals or groups to develop new and more profitable businesses, jobs and markets.

Accessibility and poverty have a close relationship and influence each other. Good accessibility can be a strategy for reducing poverty, because it can increase the capacity and opportunities of a person or group to improve their income, education, health and welfare. However, poor accessibility can be one of the causes and consequences of poverty, because it can limit and hinder a person or group from achieving their potential and aspirations.

2.7. Method

This study uses a quantitative approach. Quantitative research is research that measures symptoms and observations using statistics. Forms of quantitative research can be experimental research and other non-experimental research is correlational design where researchers use correlational statistics to describe and measure the level or relationship between two or more variables (Mohajan, 2020).

The type of data in this research is secondary data, namely data sources that indirectly provide data to data collectors, namely through other people or through documents (Khoa et al., 2023). In this case, the secondary data needed is data on poverty percentage, contribution of the agricultural sector to GRDP, accessibility data, open unemployment rate, level of last completed education, morbidity rates, and GRDP. This research uses data from the Indonesian Central Bureau of Statistics from 2012 to 2022. This research uses Moran index analysis, and spatial panel regression by selecting the best model from four models, namely the spatial autoregressive model (SAR), the spatial error model (SEM), the spatial Durbin (SDM), and spatial autoregressive combined model (SAC). **Figure 2** shows the flow

chart of the applied method.

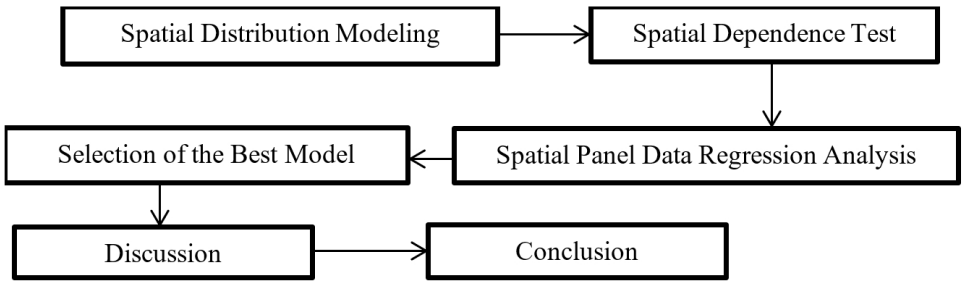

Figure 2. Flow chart of the applied method.

2.8. Data analysis methods and hypothesis testing

2.8.1. Moran index analysis

Moran's index (Moran's I) is the most widely used method to calculate spatial autocorrelation globally. This method can be used to detect the onset of spatial randomness. The Moran's index method can be done by Bhattacharyya et al. (2021):

$$I = \frac{n\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}\,(x_i - x)\left(x_j - x\right)^2}{\sum_{i\neq j}^{n} w_{ij}\sum_{i=1}^{n}(x_i - x)^2}$$

with: I: Moran index; n: number of event locations; x_i: value at location i; x_j: value at location; j: average of all objects; w_{ij}: element in the standardized weight between regions i and j.

According to Anselin and Hudak (1992), Moran scatterplot is a tool used to see the relationship between the standardized value of an observation and the standardized average value of its neighbors. When combined with a regression line, it can be used to determine the degree of fit and identify outliers. Moran Scatterplot can be used to identify spatial balance or influence.

2.8.2. Specification of spatial panel regression model

The general spatial regression model is expressed using the following equation (Elhorst, 2014).

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

where:

i = index on the cross-section dimension (spatial units), i = 1, ..., N.

t = index on the time dimension (time period), t = 1, ..., T.

y_it= dependent variable at the i-th unit and t-th time.

x_{it} = vector (1 × K) for the independent variable at the i-th unit and the t-th time.

β = (K × 1) vector for the parameters of the independent variable.

μ_i = spatial specific effect at the i-th unit.

ε_{it} = error/residual at the i-th unit and t-th time.

T = the number of time periods.

In the specification of the interaction between spatial units, the model can contain dependent variables with spatial lags or contain spatial error processes known as spatial lag models and spatial error models.

Based on the research concept with empirical studies conducted. The research model used in the study is used as an answer to the above problems described as

follows:

$$POV1_{it} = \rho WPOV1_{it} + \beta_1 GROWTH1_{it} + \beta_2 EDUC1_{it} + \beta_3 UNEM1_{it} + \beta_4 NATU1_{it} + \beta_5 HEALTH1_{it} + \beta_6 ACCESS1_{it} + \varepsilon_{it}$$

where:

i: One of the regions.

t: one of the years between 2012–2022.

W: spatial weight matrix element that shows the spatial relationship between region *i* and region *j*.

ε_{it}: white noise with zero mean and finite variance.

*POV*1: poor population of north coast region in year *t*.

*GROWTH*1: economic growth of the north coast region in year *t*.

*EDUC*1: education in the north coast region in year *t*.

*UNEM*1: unemployment in the north coast region in year *t*.

*NAT*1: natural resources of the north coast region in year *t*.

*HEALTH*1: health of the north coast region in year *t*.

*ACCES*1: accessibility of the north coast region in year *t*.

2.8.3. Spatial Durbin model (SDM)

The spatial Durbin model, which resembles a spatial autoregressive model (SAR) in shape and has a spatial variable lag, is a spatial regression model that also has a spatial lag on the explanatory variables in addition to the response variable. The SDM model is expressed in the following equation:

$$y_{it} = \rho \sum_{j=1}^{N} w_{ij} y_{jt} + x_{it}\beta + \theta \sum_{j=1}^{N} w_{ij} x_{jt} + \mu_i + \varepsilon_{it}$$

where:

y = response variable vector of size $n \times 1$.

$X = n \times (\rho + 1)$ predictor variables.

β = vector of regression parameter coefficients of size $(\rho + 1) \times 1$.

$W = n \times n$ spatial weight matrix.

ρ = spatial lag coefficient of response variable (y).

α = constant parameter vector of size $n \times 1$.

θ = predictor variable spatial lag parameter vector of size $(\rho + 1) \times 1$.

ε = error vector of size $n \times 1$.

$$\begin{aligned} POV1_{it} = \rho \sum_{j=1}^{10} w_{ij}\, POV1_{jt} &+ GROWTH1_{it}\beta_1 + EDUC1_{it}\beta_2 + UNEM1_{it}\beta_3 \\ &+ NATU1_{it}\beta_4 + HEALTH1_{it}\beta_5 + ACCESS1_{it}\beta_5 \\ &+ \theta_1 \sum_{j=1}^{10} w_{ij}\, GROWTH1_{jt} + \theta_2 \sum_{j=1}^{10} w_{ij}\, EDUC1_{jt} \\ &+ \theta_3 \sum_{j=1}^{10} w_{ij}\, UNEM1_{jt} + \theta_4 \sum_{j=1}^{10} w_{ij}\, NATU1_{jt} \\ &+ \theta_5 \sum_{j=1}^{10} w_{ij}\, HEALTH1_{jt} + \theta_6 \sum_{j=1}^{10} w_{ij}\, ACCESS1_{jt} + \mu_i + \varepsilon_i \end{aligned}$$

2.8.4. Model goodness of fit criteria

In spatial models, panel data can be a criterion for model quality in relation to the coefficient of determination (R^2) and the correlation coefficient determination (R^2) is the ratio of the amount of data variation given or explained by the model (Elhorst, 2014). R^2 panel data model can be calculated using the following equation:

$$R^2(\mathrm{e}, \Omega) = 1 - \frac{e,\Omega e}{(Y-\bar{Y})'(Y-\bar{Y})} \text{ atau } R^2(\tilde{e}) = 1 - \frac{\tilde{e}'\tilde{e}}{(Y-\bar{Y})'(Y-\bar{Y})}$$

The best model selection in the feasibility test of model estimation can use Akaike's information criterion (*AIC*). The selection of the best model is based on the smallest expected error that forms new observation data (error) that is equally distributed from the data used, further *AIC* is able to measure the suitability of the model from estimation using maximum likelihood estimation of the same data, defined:

$$AIC = -2\log(L) + 2p$$

where p is the number of model parameters and L is the result of the maximum likelihood value of the model estimation results.

3. Results and discussion

Based on **Figure 3** below, it can be seen that the spatial distribution of poverty in the Coastal Area of East Java Province in 2012 is spread across several regions. The percentage of poverty in the coastal region with a value of < 10% in 2012 was located in Pasuruan City, Surabaya City, and Sidoarjo Regency. The percentage of poverty in the coastal region between 10%–15% in 2012 was located in Gresik Regency, Probolinggo City, Pasuruan Regency, and Situbondo Regency. Meanwhile, poverty percentages > 15% were located in Lamongan, Probolinggo and Tuban districts.

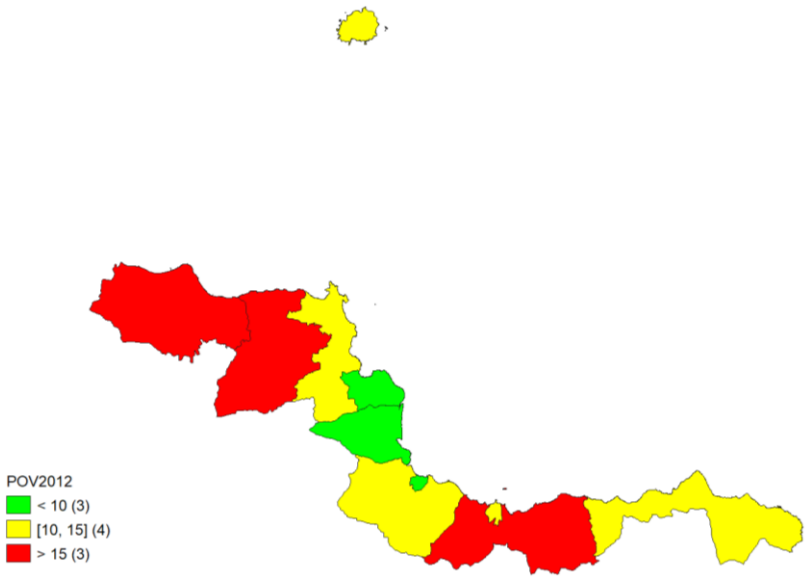

Figure 3. Spatial Distribution of Poverty in the Coastal Region of East Java Province in 2012.
(source: BPS processed with Geoda).

Based on **Figure 4** below, it can be seen that the spatial distribution of poverty in the Coastal Region of East Java Province in 2022 is spread across several regions. The percentage of poverty in the coastal region with a value of < 10% in 2022 is located in Pasuruan City, Probolinggo City, Surabaya City, Pasuruan Regency, and Situbondo Regency. The percentage of poverty in the coastal region between 10%–15% in 2022 is located in Gresik Regency, Lamongan Regency, and Situbondo Regency. Meanwhile, the poverty percentage of > 15% is located in Probolinggo Regency, and Tuban Regency.

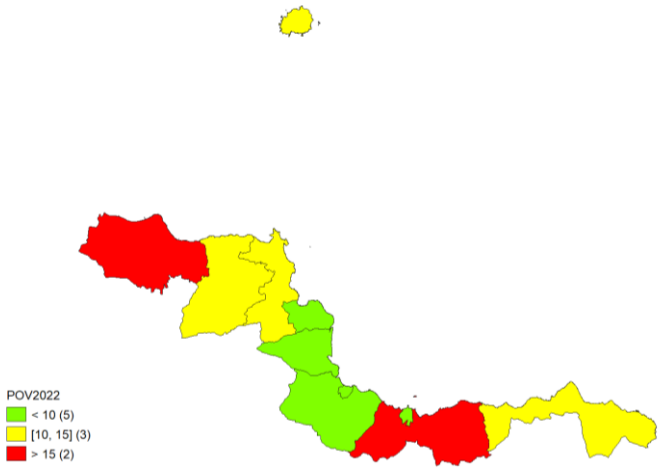

Figure 4. Spatial distribution of poverty in the Coastal Region of East Java Province in 2022.
(source: BPS processed with Geoda Software).

3.1. Spatial dependence test for the Coastal Region of East Java Province

To see each region in the coastal region has spatial dependence, it can be seen by looking at the Moran index value where the value of $0 < I \leq 1$ indicates the presence of positive spatial autocorrelation. The following are the results of the spatial dependency test using the Global Moran Index:

Table 1 demonstrates that the *I*-value of poverty in the coastal region for the years 2012–2022 is $0 < I \leq 1$ year. This indicates that the coastal region's poverty value has positive spatial autocorrelation, indicating that there is positive autocorrelation throughout the entire year and that a region's poverty value tends to be clustered and in line with its neighboring regions. Likewise, it can also be seen from the value of $E(I)$ which is negative, namely the value of the Moran index $(I) > E(I)$, meaning that there is a cluster pattern, indicating that adjacent points have the same characteristics. The Z test is conducted to determine whether there is a statistically significant spatial relationship. If the value of $Z(I) > Z\alpha/2$ or smaller than $-Z\alpha/2$, it can be concluded that there is a significant regional linkage at the alpha significance level. The critical value of alpha in this study is 5%, or $Z0.95 = 1.654$. So, it can be concluded that all Z values on poverty data in the Panturan Region > $Z0.95 = 1.654$, so there are significant regional linkages between regions in the Pantura.

Table 1. Global Moran index value of poverty statistic for Pantura Region (Geoda Processed, 2023).

Variable	*I* value	*Z* value	*P* value	*E*(*I*)	Description
POV (2012)	0.2213	1.0380	0.1710	−0.111	Positive spatial autocorrelation
POV (2013)	0.1095	0.6841	0.2660	−0.111	Positive spatial autocorrelation
POV (2014)	0.1209	0.7189	0.2550	−0.111	Positive spatial autocorrelation
POV (2015)	0.1099	0.6857	0.2570	−0.111	Positive spatial autocorrelation
POV (2016)	0.0885	0.6243	0.2700	−0.111	Positive spatial autocorrelation
POV (2017)	0.0925	0.6378	0.2700	−0.111	Positive spatial autocorrelation
POV (2018)	0.10555	0.6731	0.26000	−0.111	Positive spatial autocorrelation
POV (2019)	0.1212	0.7190	0.24600	−0.111	Positive spatial autocorrelation
POV (2020)	0.1358	0.7580	0.24100	−0.111	Positive spatial autocorrelation
POV (2021)	0.1244	0.7269	0.24900	−0.111	Positive spatial autocorrelation
POV (2022)	0.1404	0.7781	0.232000	−0.111	Positive spatial autocorrelation

3.2. Spatial panel data regression analysis

Before knowing the spatial panel data regression, Hausman test calculation is required. The Hausman test is conducted to compare or choose which model is better between the fixed effect and random effect models. The decision-making process by looking at the *p* value of the chi-square statistic or the cross-section random probability (*p*).

Table 2. Hausman test results.

chi2(6)	=	$(\boldsymbol{b}-\mathbf{B})'[(\vee\_\boldsymbol{b}-\vee\_\mathbf{B})\text{^}(-\mathbf{1})](\boldsymbol{b}-\mathbf{B})$
	=	0.39
Prob > chi2	=	0.9989

(source: Stata 17).

According to **Table 2** Hausman test above, Ha is rejected and H0 is approved because the chi-square probability value is 0.9989, which is higher than alpha 0.05 (0.9989 > 0.05). Then the right model to use is the random effect model. Thus, based on the Hausman test, the right model used to analyze the coastal area is to use the random effect model.

3.3. Selection of the best model

The best model selection can be done using several evaluation indicators. There are three evaluation indicators commonly used in selecting the best model, namely *R* square, log-likelihood and *AIC* (Akaike information criteria) value.

Based on **Table 3**, the estimation results of the three indicators, namely *R*-sq, Log-likelihood and *AIC* in the coastal region, it can be seen that the smallest *AIC* value is the HR model of 177.0683. The largest *R*-sq value is the SDM model of 0.6712 and the largest log-likelihood value is the SDM model of −72.5342. Therefore, the model chosen in the coastal region is the SDM model. The regression estimation results in the coastal region can be seen in **Table 4** below:

Table 3. Best model selection.

Indicator	*AIC*	Log-likelihood	*R*-square
SAR	189.1501	−84.5750	0.5000
SEM	182.9849	−81.4924	0.6295
SDM	177.0683	−72.5342	0.6712

(source: Stata 17).

Table 4. Spatial regression results of SDM model.

Variable	Coefficient	*z*	Sig.	Description
GROWTH	−1.93549	−2.25	0.025	Negative effect
EDUC	−0.07120	−2.78	0.005	Negative effect
UNEM	0.005274	0.15	0.878	No effect
NAT	0.22564	7.58	0.000	Positive effect
HEALTH	−0.540984	1.66	0.097	No effect
ACCES	−0.57187	−2.32	0.020	Negative effect
R^2	0.6712			
Loglikelihood	−72.5342			
AIC	177.0683			

* Significant at α = 5%.
(source: Stata 17).

Regression using SDM model can be described as follows:

$$\begin{aligned} POV1_{it} = {} & 0.510\sum_{j=1}^{10} w_{ij}\, POV1_{jt} - 1.935 GROWTH1_{it} - 0.0712 EDUC1_{it} \\ & + 0.0052 UNEM1_{it} + 0.225 NAT_{it} + 0.013 HEALTH1_{it} \\ & - 0.540 ACCESS1_{it} - 0.482\sum_{j=1}^{10} w_{ij}\, GROWTH1_{jt} \\ & - 0.029\sum_{j=1}^{10} w_{ij}\, EDUC1_{jt} + 0.130\sum_{j=1}^{10} w_{ij}\, UNEM1_{jt} \\ & - 0.149\sum_{j=1}^{10} w_{ij}\, NATU1_{jt} + 0.008\sum_{j=1}^{10} w_{ij}\, HEALTH1_{jt} \\ & + 0.167\sum_{j=1}^{10} w_{ij}\, ACCESS1_{jt} + \boldsymbol{\mu_i} + \boldsymbol{\varepsilon_i} \end{aligned}$$

The *GROWTH* variable has a negative and significant direct effect on the dependent variable, with a coefficient of −1.93549, a *z* value of −2.25, and a significance value of 0.025. This means that every one unit increase in the *GROWTH* value will reduce the value of the dependent variable by 1.93549 units, with a confidence level of 95%. The *EDUC* variable has a negative and significant direct effect on the dependent variable, with a coefficient of −0.07120, a *z* value of −2.78, and a significance value of 0.005. This means that every one unit increase in the *EDUC* value will reduce the value of the dependent variable by 0.07120 units, with a confidence level of 99.5%.

The *NAT* variable has a positive and significant direct effect on the dependent variable, with a coefficient of 0.22564, a *z* value of 7.58, and a significance value of 0.000. This means that every one unit increase in the *NAT* value will increase the value of the dependent variable by 0.22564 units, with a confidence level of almost 100%. The *ACCES* variable has a negative and significant direct effect on the dependent variable, with a coefficient of −0.57187, a *z* value of −2.32, and a significance value of 0.020. This means that every one unit increase in the *ACCES* value will reduce the value of the dependent variable by 0.57187 units, with a confidence level of 98%.

The *UNEM* variable does not have a significant direct effect on the dependent variable, with a coefficient of 0.005274, a *z* value of 0.15, and a significance value of 0.878. This means that the *UNEM* value has no effect on the value of the dependent variable, with a confidence level of only 12.2%. The *HEALTH* variable does not have a significant direct effect on the dependent variable, with a coefficient of −0.540984, a *z* value of 1.66, and a significance value of 0.097. This means that the *HEALTH* value has no effect on the value of the dependent variable, with a confidence level of only 90.3%.

The R^2 value of the model is 0.6712, which indicates that the model can explain 67.12% of the variation in the dependent variable. The loglikelihood value of the model is −72.5342, which indicates the likelihood of the model to produce the observed data. The *AIC* value of the model is 177.0683, which indicates the quality of the model considering the number of parameters. To compare this model with other models, we need to look at the R^2, loglikelihood, and *AIC* values of the other models.

4. Discussion

4.1. Spatial aspect influence

The estimated model results show that there is spatial interaction among regions in the Pantura Region through both endogenous and exogenous factors. This means that poverty in one region affects the poverty in nearby regions. If one region is poor, it will make the neighboring regions poorer, and vice versa. This is consistent with Tobler's law of geography (1970), which states that everything is related, but things that are closer have more influence than things that are farther away. In spatial analysis, proximity matters more than distance.

Keynes (1936) proposed a grand theory that poverty is caused by economic structures and limited access to resources. This is similar to Alfred Marshall's theory of Agglomeration Economies (1920), which describes how proximity or clustering of similar firms attracts services and markets, and encourages more firms to join. On the other hand, where poverty exists, it creates more poverty in nearby areas. Myrdal also discussed the spread effect theory of regional development. This theory says that economic growth in one region leads to income growth, which attracts tourists to the surrounding areas. This happens because of more jobs, investments, wages, and production in the region. This also encourages people from nearby regions to move there for better incomes. In addition, local communities can start new businesses or industries in the area, which boosts economic growth and reduces poverty in the

vicinity.

On the other hand, poverty in one area can cause poverty in its surrounding regions. This is because poverty in an area means low economic activity and development there. This limits trade, labor movement, and interaction among regions, which makes it difficult for people to find markets and jobs in nearby places. Therefore, more workers have to leave the region for work. This weakens the interregional relationships. As a result, poverty in one area spreads to the neighboring areas. The regional economies are interlinked and affect each other. For example, if one area has high unemployment, it will reduce the buying power of the people, including the businesses in nearby areas. Factors like poor healthcare, low education, can also spread from one area to nearby regions; for example, low education in one area can affect the workforce quality in neighboring areas. Likewise, poor infrastructure or lack of public services in one area can affect the mobility and well-being of the people in nearby regions. Infrastructure inequality can create gaps that affect poverty rates.

4.2. The influence of economic growth on poverty in the Pantura Region

The SDM model analysis results show that economic growth lowers poverty in the Pantura Region. This supports the research hypothesis that economic growth negatively affects poverty. The research findings agree with Kuznet's theory, which shows a negative link between poverty and economic growth. Kuznet's theory says that poverty and growth are strongly related, as poverty rises in the early stages of development, but falls in the later stages (Kuznets, 1955). High economic growth is thought to create jobs, giving people better work opportunities, and reducing poverty levels.

Stable economic growth often means higher average income for the population. This can help individuals and families meet their basic needs such as food, housing, healthcare, and education, and lower the poverty rate. Countries with strong economic growth can often spend more resources on infrastructure and social programs. For example, investing in education, healthcare services, affordable housing, and effective social assistance programs can ease poverty by giving wider access to those who need it.

This study matches several research works by Jr Adams (2004), Adeleye et al. (2020), Fosu (2017), Perera and Lee (2013), which claim that economic growth can reduce poverty. However, the findings of this study disagree with the research by Dollar et al. (2016) and Chen et al. (2015), which say that economic growth cannot fix the problem of poverty.

4.3. The influence of education on poverty in the Pantura Region

The SDM model analysis results show that the education variable lowers poverty in the Pantura Region. This agrees with Nurkse's (1971) theory, which says that education affects the quality of resources. Low education levels lead to low resource quality. When the resource quality is low, it lowers productivity. Lower productivity results in lower wages, which increases poverty.

The research findings also match several studies. Hofmarcher (2021) show that

education affects poverty, similar to Chen and Wang (2015), who say that education is a key factor in reducing poverty by improving human resources (human capital). Other studies by Garza-Rodriguez et al. (2021), Tilak (2007), Mohanty and Swain (2019), Peng et al. (2019), Bloom et al. (2006), also highlight education levels as one of the main causes of poverty.

However, this study differs from other research studies, such as Zhang (2014), Barham et al. (1995), which say that education levels have no impact on poverty. The effect of education on poverty in the Pantura Region is due to the rising number of graduates, especially bachelor's degree holders, every year. Quality education gives more access to better job opportunities, which leads to higher incomes. Higher income levels help people escape poverty by providing access to basic needs such as food, housing, healthcare, and quality education.

4.4. The influence of unemployment on poverty in the Pantura Region

The SDM model analysis results show that unemployment has no effect on poverty in the Pantura Region. This goes against Quy's (2016) research, which says that unemployment has a negative effect on poverty. It also opposes Keynes' theory, which says that unemployment comes from low demand. Therefore, the obstacle to economic growth is not low production but low consumption. Keynes says that this is due to free market mechanisms. When the labor force grows, wages fall, leading to losses. The lower wages reduce the people's buying power for goods or services, making producers lose money, unable to hire workers, and eventually causing poverty.

Islamiah et al. (2021) agree that regional unemployment rates can affect poverty in two ways. The direct effect is that more unemployment in a region makes it more likely for individuals to be unemployed. The indirect effect is that the unemployment rate lowers the wage bargaining power for riskier jobs (because of more competition) that leads to layoffs or lower wages when the regional unemployment rate goes up.

Jachimowicz et al. (2020) says that the negative impact of unemployment is lower income for the community, which reduces individual wealth. However, this does not happen in the Pantura Region, where unemployment does not affect poverty. These findings disagree with studies by Liu et al. (2022), Ucha (2010), Xue and Zhong (2003), which say that unemployment raises the risk of poverty.

Even though unemployment is thought to cause poverty, this is not true in the Pantura Region. East Java, one of Indonesia's biggest provinces with a strong economy and diverse sectors, has good diversification in its Pantura Region. It has various strong sectors that offer many job opportunities, reducing the direct effect of unemployment on poverty because of more job options.

This is an important finding in this research. Also, government programs like the pre-employment card and other social programs provide a safety net to reduce the direct effects on poverty, keeping people above the poverty line.

4.5. The influence of natural resources on poverty in the Pantura Region

The SDM model analysis results show that natural resources increase poverty in the Pantura Region. This means that more natural resources will make poverty

worse. However, this goes against Suparmoko's (2016) theory, which says that low output levels in low-income countries are partly due to limited natural resources, in quantity and type. Without enough natural resources in a country, there may be little chance for economic development.

This also disagrees with the theory by Wright and Czelusta (2004), which says that natural resources drive economic growth. Auty and Mikesell (1998) also say that natural resources boost per capita welfare, enabling long-term development in a country. In other words, regions with natural resources have economic benefits over those without them. Several studies back this idea, such as research by Schleicher et al. (2018), Gray and Moseley (2005), and Malerba (2020), which show a link between natural resources and poverty.

Moreover, this research matches studies by Zhou and Xiong (2018), Gao et al. (2020), Chen et al. (2015), and Kassa et al. (2021), which say that natural resources, especially in agriculture, help lower poverty.

Despite the rich natural resources in the Pantura Region, such as fertile farming, mineral mining, marine products, and forest products, they do not reduce poverty. This fits the theory of the resource curse, which says that countries with natural resources tend to face economic and social problems like poverty more than those with fewer resources. This is a new finding in this research, where abundant natural resources do not ensure an area's escape from poverty. The Pantura Region, with its strong farming and fishing sectors, still cannot ease poverty, even though a large part of its workforce depends on agriculture, forestry, mining, and fishing sectors.

4.6. The influence of health on poverty in the Pantura Region

The SDM model analysis results show that health does not affect poverty in the Pantura Region. This agrees with some studies, such as Asare and Barfi (2021), which say that health status does not reduce poverty. However, this disagrees with the theory by Widarni and Bawono (2021), which says that health is a key development goal and the main part of real development, which is ending poverty. Some other studies also oppose this research, such as Gupta and Mitra (2004), Bloom and Canning (2003), Novignon et al. (2012), Weziak-Bialowolska (2016), which show that poor health conditions raise the poverty rate. Health does not influence poverty in the East Java Pantura Region. This is because health is not the only factor that causes poverty. For example, lack of job opportunities, low education and poor infrastructure also matter. Also, some people might have good healthcare services but still face poverty because of other reasons such as social, economic, or political conditions that they cannot control and keep them poor. Another reason health does not affect poverty is that not all health effects are seen in poverty statistics. The effect of poor health may not always be clear in poverty statistics, even though it can be a cause of poverty. The effects of poor health might not always be easy to measure in poverty statistics.

4.7. The influence of accessibility on poverty in the Pantura Region

The SDM model analysis results show that the accessibility variable lowers poverty in the Pantura Region. This supports the theory by Medeiros et al. (2021),

which says that accessibility to infrastructure services like roads means that the farther someone has to travel to reach them, the higher the poverty level. This suggests that better accessibility to physical infrastructure helps people get out of poverty. The research findings also agree with Warr's (2010) claim that poverty reduction is linked to improved accessibility, especially road accessibility. Some other studies also say that accessibility affects poverty in a region, such as research by Liang et al. (2022), Sugasawa (2019), Ahlström et al. (2011) and Kwigizile et al. (2011).

The regional accessibility has a big impact on poverty in the Pantura Region of East Java. This is a new finding in this research, because regions with good accessibility tend to have easier access to basic services like healthcare, education, clean water, and other essential infrastructure. This helps communities improve their living standards and education, and escape poverty.

Areas with easy access also have better economic connectivity, which makes trade and exchange of goods and services easier, and opens up business opportunities, market access, and income for local entrepreneurs. Moreover, good accessibility can boost regional economic growth by attracting new investments, infrastructure development, and tourism expansion, which can create economic opportunities that reduce poverty. Also, good accessibility increases population mobility; people can easily look for work, education, and healthcare services in other places, giving opportunities for people in areas with limited access to meet their needs.

5. Conclusion

There is spatial interaction among regions in the Pantura area through both internal and external factors. This means that more poverty in one region will make the neighboring regions poorer, and vice versa. If one region has low poverty rates, nearby regions will likely have low poverty rates too.

Economic growth lowers poverty in the Pantura Region. Economic growth and poverty are strongly related, as economic growth is a first goal of the development process that eventually reduces poverty.

Education lowers poverty in the Pantura Region because it affects the quality of resources. Low education leads to low resource quality. When the resource quality is low, it lowers productivity, which results in lower wages and more poverty.

Unemployment does not affect poverty in the Pantura Region. This research found that poor people lack access to education, healthcare, and information, which prevents them from getting job opportunities. Therefore, the poor people who have access to these job opportunities control economic activities.

Natural resources increase poverty in the Pantura Region. Despite the rich natural resources in the Pantura Region, such as fertile farming, mineral mining, marine resources, and forest products, they do not reduce poverty. This agrees with the theory of the resource curse, which says that countries with natural resources tend to face economic and social problems like poverty more than those with fewer resources.

Health does not influence poverty in the Pantura Region. Health, a key goal of

development and the main part of ending poverty, surprisingly does not improve the quality of human resources in this area through health programs.

Accessibility lowers poverty in the Pantura Region. Accessibility to infrastructure services like roads means that the farther someone has to travel to reach them, the higher the poverty level. Better physical infrastructure accessibility helps people get out of poverty.

Author contributions: Conceptualization, KI and SV; methodology, KI and SV; software, ES; validation, KI and SV; formal analysis, KI; investigation, KI and SV; resources, KI and SV; data curation, ES and THP; writing—original draft preparation, ES and THP; writing—review and editing, ES; visualization, KI and SV; supervision, KI; project administration, THP; funding acquisition, KI. All authors have read and agreed to the published version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

References

Acheampong, A. O., Erdiaw-Kwasie, M. O., & Abunyewah, M. (2021). Does energy accessibility improve human development? Evidence from energy-poor regions. Energy Economics, 96, 105165. https://doi.org/10.1016/j.eneco.2021.105165

Adeleye, B. N., Gershon, O., Ogundipe, A., et al. (2020). Comparative investigation of the growth-poverty-inequality trilemma in Sub-Saharan Africa and Latin American and Caribbean Countries. Heliyon, 6(12), e05631. https://doi.org/10.1016/j.heliyon.2020.e05631

Ahlström, A., Pilesjö, P., & Lindberg, J. (2011). Improved accessibility modeling and its relation to poverty—A case study in Southern Sri Lanka. Habitat International, 35(2), 316–326. https://doi.org/10.1016/j.habitatint.2010.11.002

Ahmad, M., Muslija, A., & Satrovic, E. (2021). Does economic prosperity lead to environmental sustainability in developing economies? Environmental Kuznets curve theory. Environmental Science and Pollution Research, 28(18), 22588–22601. https://doi.org/10.1007/s11356-020-12276-9

Akinyemi, F., & Bigirimana, F. (2012). A Spatial Analysis of Poverty in Kigali, Rwanda using indicators of household living standard. Rwanda Journal, 26(1). https://doi.org/10.4314/rj.v26i1.1

Anselin, L., & Hudak, S. (1992). Spatial econometrics in practice: A review of software options. Regional science and urban economics, 22(3), 509–536.

Anselin, L., & Rey, S. J. (2010). Perspectives on spatial data analysis. Cham: Springer.

Asare, P., & Barfi, R. (2021). The Impact of Covid-19 Pandemic on the Global Economy: Emphasis on Poverty Alleviation and Economic Growth. The Economics and Finance Letters, 8(1), 32–43. https://doi.org/10.18488/journal.29.2021.81.32.43

Auty, R. M., & Mikesell, R. F. (1998). Sustainable development in mineral economies. Clarendon Press.

Barham, V., Boadway, R., Marchand, M., & Pestieau, P. (1995). Education and the poverty trap. European Economic Review, 39(7), 1257–1275.

Bhattacharyya, A., Haldar, S. K., & Banerjee, S. (2021). Determinants of crime against women in India: A spatial panel data regression analysis. Millennial Asia, 1(1), 1–10.

Bloom, D. E., Canning, D., & Chan, K. (2006). Higher education and economic development in Africa (Vol. 102). Washington, DC: World Bank.

Bloom, D., & Canning, D. (2003). The Health and Poverty of Nations: From theory to practice. Journal of Human Development, 4(1), 47–71. https://doi.org/10.1080/1464988032000051487

Booth, A. (1998). The Indonesian economy in the nineteenth and twentieth centuries: A history of missed opportunities. Cham: Springer.

Bourguignon, F., & Chakravarty, S. R. (2003). The measurement of multidimensional poverty. The Journal of Economic Inequality, 1(1), 25–49.

Central Bureau of Statistics (BPS). (2021). East Java Province Statistic.

Chen, X., Pei, Z., Chen, A. L., et al. (2015). Spatial Distribution Patterns and Influencing Factors of Poverty—A Case Study on

Key Country From National Contiguous Special Poverty-stricken Areas in China. Procedia Environmental Sciences, 26, 82–90. https://doi.org/10.1016/j.proenv.2015.05.005

Dahliah, D., & Nirwana Nur, A. (2021). The Influence of Unemployment, Human Development Index and Gross Domestic Product on Poverty level. Golden Ratio of Social Science and Education, 1(2), 95–108. https://doi.org/10.52970/grsse.v1i2.84

Dollar, D., Kleineberg, T., & Kraay, A. (2016). Growth still is good for the poor. European Economic Review, 81, 68–85. https://doi.org/10.1016/j.euroecorev.2015.05.008

Ehrlich, M. v., & Overman, H. G. (2020). Place-Based Policies and Spatial Disparities across European Cities. Journal of Economic Perspectives, 34(3), 128–149. https://doi.org/10.1257/jep.34.3.128

Elhorst, J. P. (2014). Spatial econometrics from cross-sectional data to spatial panels. Cham: Springer.

Fitrianto, A. R., & Samsuri, A. (2021). A Rural Community's Livelihood Dynamic in the maintenance of a Mangrove Area as a Tourist Destination. (2021). ASEAN Journal of Community Engagement, 5(1). https://doi.org/10.7454/ajce.v5i1.1090

Fosu, A. K. (2017). Growth, inequality, and poverty reduction in developing countries: Recent global evidence. Research in Economics, 71(2), 306–336. https://doi.org/10.1016/j.rie.2016.05.005

Gao, P., Liu, S., Qi, W., et al. (2020). The Nexus between Poverty and the Environment: A Case Study of Lijiang, China. Sustainability, 12(3), 1066. https://doi.org/10.3390/su12031066

Garza-Rodriguez, J., Ayala-Diaz, G. A., Coronado-Saucedo, G. G., et al. (2021). Determinants of Poverty in Mexico: A Quantile Regression Analysis. Economies, 9(2), 60. https://doi.org/10.3390/economies9020060

Gray, L. C., & Moseley, W. G. (2005). A geographical perspective on poverty–environment interactions. The Geographical Journal, 171(1), 9–23. Portico. https://doi.org/10.1111/j.1475-4959.2005.00146.x

Gupta, I., & Mitra, A. (2004). Economic Growth, Health and Poverty: An Exploratory Study for India. Development Policy Review, 22(2), 193–206. Portico. https://doi.org/10.1111/j.1467-7679.2004.00245.x

Handiani, D. N., Heriati, A., & Gunawan, W. A. (2022). Comparison of coastal vulnerability assessment for Subang Regency in North Coast West Java-Indonesia. Geomatics, Natural Hazards and Risk, 13(1), 1178–1206. https://doi.org/10.1080/19475705.2022.2066573

Hofmarcher, T. (2021). The effect of education on poverty: A European perspective. Economics of Education Review, 83, 102124. https://doi.org/10.1016/j.econedurev.2021.102124

Islamiah, N., Rahmatia, R., Paddu, H., et al. (2021). Direct and Indirect Effect of Macro Economic Factors in the West of Indonesia. Golden Ratio of Social Science and Education, 1(1), 13–24. https://doi.org/10.52970/grsse.v1i1.107

Jachimowicz, J. M., Szaszi, B., Lukas, M., et al. (2020). Higher economic inequality intensifies the financial hardship of people living in poverty by fraying the community buffer. Nature Human Behaviour, 4(7), 702–712. https://doi.org/10.1038/s41562-020-0849-2

Jr Adams, R. H. (2004). Economic Growth, Inequality and Poverty: Estimating the Growth Elasticity of Poverty. World Development, 32(12), 1989–2014. https://doi.org/10.1016/j.worlddev.2004.08.006

Kassa, G., Teferi, B., & Delelegn, N. (2018). The Poverty—Environment Nexus in Developing Countries: Evidence from Ethiopia: A Systematic Review. Asian Journal of Agricultural Extension, Economics & Sociology, 24(3), 1–13. https://doi.org/10.9734/ajaees/2018/39310

Khoa, B. T., Hung, B. P., & Brahmi, M. H. (2023). Qualitative research in social sciences: data collection, data analysis and report writing. International Journal of Public Sector Performance Management, 12(1/2), 187–209. https://doi.org/10.1504/ijpspm.2023.132247

Kuznets, S. (1955). American Economic Association. The American Economic Review, 45(1), 1–28.

Kwigizile, E., Chilongola, J., & Msuya, J. (2011). The impact of road accessibility of rural villages on recognition of poverty reduction opportunities. African Journal of Marketing Management, 3(2), 22–31.

Liang, Y., Li, S., Zeng, J., et al. (2022). Examining the impact of multidimensional accessibility on regional poverty in Laos. Applied Geography, 148, 102789. https://doi.org/10.1016/j.apgeog.2022.102789

Liu, M., Ge, Y., Hu, S., et al. (2022). The spatial–temporal variation of poverty determinants. Spatial Statistics, 50, 100631. https://doi.org/10.1016/j.spasta.2022.100631

Liu, W., Li, J., & Zhao, R. (2020). Rural Public Expenditure and Poverty Alleviation in China: A Spatial Econometric Analysis. Journal of Agricultural Science, 12(6), 46. https://doi.org/10.5539/jas.v12n6p46

Malerba, D. (2020). Poverty alleviation and local environmental degradation: An empirical analysis in Colombia. World

Development, 127, 104776. https://doi.org/10.1016/j.worlddev.2019.104776

Massaquoi, H., Atuhaire, C., Chinkonono, G. S., et al. (2021). Exploring health-seeking behavior among adolescent mothers during the Ebola epidemic in Western rural district of Freetown, Sierra Leone. BMC Pregnancy and Childbirth, 21(1). https://doi.org/10.1186/s12884-020-03521-7

Mathias, K., Rawat, M., Philip, S., et al. (2020). "We've got through hard times before": acute mental distress and coping among disadvantaged groups during COVID-19 lockdown in North India—A qualitative study. International Journal for Equity in Health, 19(1). https://doi.org/10.1186/s12939-020-01345-7

Medeiros, V., Ribeiro, R. S. M., & Amaral, P. V. M. do. (2021). Infrastructure and household poverty in Brazil: A regional approach using multilevel models. World Development, 137, 105118. https://doi.org/10.1016/j.worlddev.2020.105118

Mohajan, H. K. (2020). Quantitative Research: A Successful Investigation in Natural and Social Sciences. Journal of Economic Development, Environment and People, 9(4). https://doi.org/10.26458/jedep.v9i4.679

Novignon, J., Nonvignon, J., Mussa, R., et al. (2012). Health and vulnerability to poverty in Ghana: evidence from the Ghana Living Standards Survey Round 5. Health Economics Review, 2(1). https://doi.org/10.1186/2191-1991-2-11

Nurkse, R. (1971). The theory of development and the idea of balanced growth Developing the underdeveloped countries. Cham: Springer. pp. 115–128.

Owusu, M., Kuffer, M., Belgiu, M., et al. (2021). Towards user-driven earth observation-based slum mapping. Computers, Environment and Urban Systems, 89, 101681. https://doi.org/10.1016/j.compenvurbsys.2021.101681

Perera, L. D. H., & Lee, G. H. Y. (2013). Have economic growth and institutional quality contributed to poverty and inequality reduction in Asia? Journal of Asian Economics, 27, 71–86. https://doi.org/10.1016/j.asieco.2013.06.002

Priyanto, E., Widarni, E. L., & Bawono, S. (2022). The Effect of Internet Inclusion on Financial Inclusion in P2P Lending in Indonesia Based on Human Capital Point of View. Modeling Economic Growth in Contemporary Indonesia, 107–121. https://doi.org/10.1108/978-1-80262-431-120221008

Quy, N. H. (2016). Relationship between Economic Growth, Unemployment and Poverty: Analysis at Provincial Level in Vietnam. International Journal of Economics and Finance, 8(12), 113. https://doi.org/10.5539/ijef.v8n12p113

Rahayu, A. S., Nur Hasanah, L. A., & Pratiwi, L. S. (2021). The Role of Financial Literacy in Reducing Poverty: Experience from Indonesia. Dinamika Ekonomi, 12(2), 133–141. https://doi.org/10.29313/de.v12i2.7796

Sasongko, B., Bawono, S., & Prabowo, B. H. (2021). The Economic Performance of China in Trade War: The Case Study of Three Global Economic Crises in 1997–2020. International Symposia in Economic Theory and Econometrics, 1–11. https://doi.org/10.1108/s1571-03862021000029b022

Schleicher, J., Schaafsma, M., Burgess, N. D., et al. (2018). Poorer without It? The Neglected Role of the Natural Environment in Poverty and Wellbeing. Sustainable Development, 26(1), 83–98. Portico. https://doi.org/10.1002/sd.1692

Sugasawa, T. (2019). Accessibility to the nearest urban metropolitan area and rural poverty in Japan. DSSR Discussion Papers, 94(1), 1–30.

Tilak, J. B. G. (2007). Post-elementary education, poverty and development in India. International Journal of Educational Development, 27(4), 435–445. https://doi.org/10.1016/j.ijedudev.2006.09.018

Triatmanto, B., Bawono, S., & Wahyuni, N. (2023). The contribution and influence of total external debt, FDI, and HCI on economic growth in Indonesia, Thailand, Vietnam, and Philippines. Research in Globalization, 7, 100163. https://doi.org/10.1016/j.resglo.2023.100163

Ucha, C. (2010). Poverty in Nigeria: Some dimensions and contributing factors. Global Majority E-Journal, 1(1), 46–56.

Wang, C., Wang, Y., Fang, H., et al. (2020). Determinants of Rural Poverty in Remote Mountains of Southeast China from the Household Perspective. Social Indicators Research, 150(3), 793–810. https://doi.org/10.1007/s11205-020-02348-1

Warr, P. (2010). Roads and poverty in rural Laos: an econometric analysis. Pacific Economic Review, 15(1), 152–169. https://doi.org/10.1111/j.1468-0106.2009.00494.x

Weziak-Bialowolska, D. (2016). Spatial Variation in EU Poverty with Respect to Health, Education and Living Standards. Social Indicators Research, 125(2), 451–479. https://doi.org/10.1007/s11205-014-0848-7

Widarni, E. L., & Bawono, S. (2021). The Comparation of Foreign Financial Investment and Human Investment Effect on Economic in Indonesia Base on Macro Economic Point of View. Studies of Applied Economics, 39(12). https://doi.org/10.25115/eea.v39i12.6006

Widarni, E. L., & Bawono, S. (2023). Investigating the Role of Education in Stability of Work Participation in Economic Shocks from the Asian Financial Crisis to the Covid 19 Pandemic in Indonesia. International Journal of Professional Business

Review, 8(1), e0811. https://doi.org/10.26668/businessreview/2023.v8i1.811

Wright, G., & Czelusta, J. (2004). Why Economies Slow: The Myth of the Resource Curse. Challenge, 47(2), 6–38. https://doi.org/10.1080/05775132.2004.11034243

Xue, J., & Zhong, W. (2003). Unemployment, Poverty and Income Disparity in Urban China. Asian Economic Journal, 17(4), 383–405. https://doi.org/10.1111/j.1467-8381.2003.00192.x

Yaqoob, N., Ali, S. A., Kannaiah, D., et al. (2022). The effects of Agriculture Productivity, Land Intensification, on Sustainable Economic Growth: A panel analysis from Bangladesh, India, and Pakistan Economies. Environmental Science and Pollution Research, 30(55), 116440–116448. https://doi.org/10.1007/s11356-021-18471-6

Zhang, H. (2014). The poverty trap of education: Education–poverty connections in Western China. International Journal of Educational Development, 38, 47–58. https://doi.org/10.1016/j.ijedudev.2014.05.003

Zhao, P., & Xu, J. (2024). Analysis of Residents' Livelihoods in Transformed Shantytowns: A Case Study of a Resource-Based City in China. Sustainability, 16(4), 1587. https://doi.org/10.3390/su16041587

Zhou, L., & Xiong, L. Y. (2018). Natural topographic controls on the spatial distribution of poverty-stricken counties in China. Applied Geography, 90, 282–292. https://doi.org/10.1016/j.apgeog.2017.10.006

Zhou, Y., & Liu, Y. (2022). The geography of poverty: Review and research prospects. Journal of Rural Studies, 93, 408–416. https://doi.org/10.1016/j.jrurstud.2019.01.008