Murialti, Neng; Hadi, M. Fikry; Hidayat, Muhammad et al.

Periodical Part

The role of government spending, FDI, and infrastructure energy on poverty between regions in Riau province, spatial approach

International Journal of Energy Economics and Policy

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

Reference: In: International Journal of Energy Economics and Policy The role of government spending, FDI, and infrastructure energy on poverty between regions in Riau province, spatial approach 15 (2025).
https://www.econjournals.com/index.php/ijeep/article/download/18150/8645/42551.
doi:10.32479/ijeep.18150.

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2025, 15(2), 352-359.

The Role of Government Spending, FDI, and Infrastructure Energy on Poverty between Regions in Riau Province; Spatial Approach

Neng Murialti[1]*, M. Fikry Hadi[1], Muhammad Hidayat[1], Arie Frinola Minovia[2], Midespa Ramadona[1]

[1]Department of Economics, Faculty of Economics and Business, Universitas Muhammadiyah Riau, Indonesia, [2]Department of Accounting, Faculty of Economics and Business, Universitas Bung Hatta, Indonesia. *Email: neng.murialti@umri.ac.id

Received: 05 October 2024 **Accepted:** 18 January 2025 **DOI:** https://doi.org/10.32479/ijeep.18150

ABSTRACT

This study attempts to investigate poverty that occurs between regions in Riau Province in the form of trends that occur and the role of government spending, FDI, and energy infrastructure on poverty levels, as well as spatial dependence from neighboring areas. This study uses panel data from 12 districts/municipalities for the period 2011–2023 with a spatial econometric approach - spatial durbin model (SDM). The results found that the overall poverty trend has decreased, with the highest figure in Meranti district and the municipal area at 3%. The results of the spatial regression found that government spending, last year's FDI, and economic growth significantly increased poverty. In addition, the results of this study provide evidence that the influence of neighboring regional characteristics significantly affects the decline in poverty levels in key areas such as government spending on social aid, economic growth, education, and infrastructure energy.

Keywords: Poverty, Social Aid, Economic Growth, FDI, Infrastructure Energy
JEL Classifications: C23, H55, I32

1. INTRODUCTION

Poverty is part of the main problem of national development, especially in the regions within it; this is reflected in the primary goal of SDG 2030, which states "no poverty." Prolonged poverty will hurt national and regional development. It should be a significant concern in development priorities. National and regional development policies have been formulated in various time-period corridors. The 2005-2025 RPJPN's long-term planning policy states that regional development aims to realize more equitable and just development. The medium-term corridor for 2020-2024 has seven development agendas, including those in the economic sector, as follows: (1) Strengthening economic resilience for quality growth; (2) Developing regions to reduce inequality. The Indonesian government targets a poverty rate of 6.5-7%.

The economy of Riau Province, over the past ten years, has experienced fluctuating values with an average economic growth of 2.22%. The growth rate in 2013 of 2.48% continues to change until 2022 to 4.55%, although there was a contraction in 2015 to 0.22 and in 2020 to −1.13 caused by the COVID-19 pandemic in 2020. Meanwhile, the percentage of poor people has fluctuated and tends to decrease, with a slight decrease in 2013, which was 8.42%, and in 2022, it was 6.78%. This value does not follow the target of Riau Province in 2025 of 5%. The ideal condition for economic development is to produce high growth while increasing welfare. In this case, poverty alleviation should be one of the main priorities for regional development in Riau Province in the future.

In the concept of pro-poor economic growth, economic growth accompanied by fair income distribution can accelerate poverty alleviation (Permadi, 2018). Poverty alleviation requires a

renewal solution. Cross-country empirical results show that fiscal redistribution, monetary policy aimed at macro stability, and structural reforms to stimulate trade, reduce unemployment and increase productivity are determinants of inclusive growth (Aoyagi and Ganelli, 2015).

Recent research results show that poverty in Indonesia is influenced by various economic, social, and spatial factors, thus requiring a comprehensive spatial regression analysis to understand its dynamics better. Sunusi and Subarkah (2023) have shown that poverty alleviation programs often miss their targets due to a lack of attention to spatial aspects. There is a spatially varying relationship between poverty levels and influencing factors such as per capita expenditure, life expectancy, and GDP.

The multidimensional nature of poverty, encompassing economic, political, social, and cultural dimensions, is evident in South Sumatra by Mirrahma et al. (2023), where factors such as unemployment rate, average length of schooling, and human development index significantly influence poverty rates. In East Java by Syahzaqi et al. (2023), poverty remains prevalent, influenced by the unemployment rate, life expectancy, and population density despite high economic growth. Similarly, Darnius and Tambunan (2023) in North Sumatra proved that spatial regression models had identified the human development index and population density as significant predictors of poverty. Muttaqin et al. (2023) stated that the role of per capita household expenditure and ICT in reducing poverty has also been emphasized, with ICT development being important in less developed areas.

Furthermore, Lestari et al. (2023) analyzed poverty patterns in Bali Province, revealing significant spatial dependence. In Central Java by Anwar (2022), poverty in neighbouring areas has a positive spatial effect. Meanwhile, research by Farhan et al. (2024) in Riau did not prove any spatial dependence using cross-section data. Research by Kurniasari and Oktavilia (2023) has highlighted the significant impact of life expectancy, average length of schooling, and health sector spending on poverty in Western and Eastern Indonesia. The empirical results of previous studies underline the need to incorporate spatial analysis in poverty modelling to develop targeted and effective poverty alleviation strategies in Indonesia.

Government expenditure plays a diverse role in poverty alleviation, with its effectiveness varying across regions and contexts. Yusoff et al. (2023) study in Malaysia showed that increased development expenditure was an insignificant determinant of poverty reduction, while reduced development expenditure significantly reduced poverty in the long run. In contrast, Anjande et al. (2022) found that government expenditure and foreign direct investment significantly reduced poverty in Sub-Saharan African countries. Khader and Salman (2022) for Iraq, despite increased public expenditure, poverty rates have fluctuated, highlighting inefficiencies and distortions in public expenditure policies. Furthermore, according to Omodero (2019), government expenditure on key sectors such as agriculture, education, and health did not significantly affect poverty alleviation in Nigeria, indicating insufficient funds.

In Indonesia, government spending has significant direct and indirect effects on poverty reduction through economic growth, as seen in provincial and regional studies (Miar and Yunani, 2020). The Special Autonomy Fund in Aceh Province effectively reduces poverty rates (Yusri, 2022). Furthermore, empirical results from Akhmad et al. (2022) and Pradana and Fitriyanti (2022) suggest that certain types of government spending, such as direct and indirect spending, positively affect poverty reduction. Overall, while government spending can be a powerful tool for poverty alleviation, its effectiveness depends mainly on the efficiency of fund allocation, targeted sectors, and the broader economic and policy environment.

Based on the background and empirical studies above, this study has several research questions, including: 1) How is the trend of poverty levels between regions in Riau Province, and evidence of inter-regional dependency? 2) How do government spending, FDI, education and energy infrastructure affect poverty between regions in Riau Province? Thus, this study's first objective is to analyze the conditions of poverty and evidence of inter-regional dependency. Second, to analyze the influence of government spending, FDI, education and energy infrastructure on poverty between regions in Riau Province in terms of spatiality.

2. REVIEW OF LITERATURE

Theoretically, the relationship between investment and poverty levels is known as The Vicious Cycle of Poverty, which is a self-reinforcing mechanism that leads to factors that perpetuate and worsen poverty, including price factors, economic growth and investment. Specifically, the low-level equilibrium trap theory explains more about investment in developing countries. There are recent studies that identify investment as a determinant variable of poverty, including for developing countries by Qifa et al. (2023) and Han et al. (2023), found that foreign investment has a significant effect on long-term poverty reduction in the short term it can increase poverty, but the results of Dhrifi et al. (2020) stated that it does not apply to countries in the African region. Agarwal et al. (2017) found that FDI inflows and outflows in India can reduce poverty. The results of this debate provide a gap for further research using different modelling. As a research gap with previous research, this study will use the time lag of investment with the logic that current investment does not necessarily have a role in the current year but has a delay effect in the following year.

The results of Garza-Rodriguez (2018) research using the vector error correction model (VECM) found that in the long term, a 1% increase in economic growth causes a 2.4% increase in per capita consumption (and indirectly poverty reduction), in addition, a two-way causal relationship was also found between poverty reduction and economic growth in Mexico. The paper from Niyimbanira (2017) found that in South Africa, especially in the province of Mpumalanga, economic growth reduces poverty but not income inequality. The results of research by Tsaurai (2021) state that economic growth and energy consumption significantly reduce poverty in BRICS countries.

Several studies state that government spending does not affect poverty, including Yusoff et al. (2023) and Anjande et al. (2022).

On the other hand, some are pro-poverty reduction by Khader and Salman (2022), Omodero (2019), and research in Indonesia that states that it has an effect, including Akhmad et al. (2022); Pradana and Fitriyanti (2022); Yusri (2022). Empirical findings from Shahzad and Yasmin (2016) show that fiscal decentralization increases poverty and income inequality in Pakistan. However, better institutional quality and fiscal decentralization can promise to reduce the negative consequences of fiscal decentralization on poverty. Furthermore, findings from Sepulveda and Martinez-Vazquez (2011) show that fiscal decentralization can lead to increased poverty rates but can reduce income inequality. The research gap with previous research is modelling, which uses spatial elements of panel data and comparisons with static panel data in the current research. While none of the previous research used this, we also make this one of the novelties.

Energy infrastructure has an impact on poverty, especially in rural areas. It is impossible to imagine industrialization and high living standards without an adequate, reliable, sustainable electricity supply, supported by the results of research by Osanyinlusi et al. (2017), who found that households in non-electrified communities are poorer than households in electrified communities. So that rural electrification can reduce poverty and improve living standards. The paper by Eseyin and Ogunjobi (2022) clearly states that electricity generation is important in reducing poverty in Nigeria, while electricity consumption does not guarantee poverty reduction.

Furthermore, Hidayat et al. (2020) found that adequate electrification for each region can reduce economic disparities. Meanwhile, the results of Hidayat et al. (2022; 2023) state that energy infrastructure has a negative relationship with the convergence process in the Sumatra island region because urban areas already have the highest or adequate electrification ratio. In the research results of Leiwakabessy and Payapo (2022), no relationship was found between energy consumption and poverty in the short term. However, there was a relationship between poverty and economic growth. The results also stated that widespread poverty hurt achieving economic growth.

Based on the results of literature studies from various published scientific articles, it is known that poverty studies seen from the spatial aspect of panel data in Indonesia are still few, especially for Riau Province. Therefore, a more in-depth, comprehensive, and prospective study of poverty in Riau is needed.

3. METHODOLOGY

The quantitative approach in this study is descriptive, which explains what it is. It also uses correlation and causal approaches to reveal the facts of the relationship between the variables studied and obtain variables that affect the dependent variable. This study uses panel data by including spatial elements, which will be much more realistic than an analysis that does not include spatial elements. The areas that are the units of analysis are the regencies/municipalities in Riau Province, totalling 12 regions. The selection of this research area is not only because all autonomous regions have different socio-cultural characteristics, regional demographics, and economic structures but also because, of course, these will affect the level of development progress of each region. Furthermore, for time series data from 2011-2023, thus the total number of observations is 156. The selection of this time interval is not only to provide a large amount of data because of panel data but also to provide a picture of poverty between regions after the implementation of the decentralization policy.

Furthermore, the use of variables in this study and their definitions can be seen in Table 1. The dataset used in this study is secondary data such as the percentage of poor people, foreign investment, Gross Regional Domestic Product (GRDP) at constant prices, local government spending data from social assistance posts, the number of school-age population by education level, demographic data, and other relevant data. These data are sourced from various reports and data compilations and other forms of publication, such as from the Central Statistics Agency (BPS), the Investment Coordinating Board (BKPM), and the Directorate General of Fiscal Balance - Ministry of Finance. Meanwhile, the Riau map (.shp) is used with the district/municipality administrative boundaries category to support spatial data.

Linear regression model on panel data that has spatial specific effects without spatial interaction effects, according to Elhorst (2003), is stated in the following equation (Elhorst, 2003; 2010; 2014):

$$y_{it} = X_{it}\beta + \mu_i + \varepsilon_{it} \quad (1)$$

Explanation: i is the cross-sectional dimension (spatial units) with $i = 1,\ldots, K$ and t is the time dimension (time) with $t = 1,\ldots T$. y_{it} is the observation unit on the dependent variable unit i and time t, x_{it} shows the observation vector on the independent variable on the spatial unit i for the time t, β is the parameter vector and ε_{it} is the error that is independently and identically distributed for each i and t with mean 0 and variance σ^2. μ_i is the spatial-specific effect.

Linear regression models on panel data that have interactions between spatial units will have spatial lag or spatial process-dependent variables on errors, usually called spatial lag models and spatial error models (Elhorst, 2014). There are two types of spatial effects: spatial dependence and spatial heterogeneity. Spatial dependence can be measured by spatial autocorrelation with Moran's I-test. Spatial Heterogeneity testing is done with the Breusch Pagan test (Anselin et al., 2006).

3.1. Spasial Durbin Model (SDM)

The Spatial Durbin Model continues the spatial autoregressive or spatial lag case by adding a spatial weighting variable to the independent variable so that spatial lag is added to the model, and weighting is done on the independent and dependent variables. The spatial Durbin model equation is as follows:

$$Y = \rho W_1 Y + \beta_0 + X\beta_1 + W_1 X\beta_2 + \varepsilon,\ \varepsilon \sim N(0,\sigma^2 I) \quad (2)$$

SDM parameter estimation uses Maximum Likelihood Estimation with the following equation:

$$Y = \rho W_1 Y + \beta_0 + X\beta_1 + W_1 X\beta_2 + \varepsilon \quad (3)$$

Table 1: Research variable and operational definitions

No.	Variable	Operational Definition	Unit
1.	Poverty (*Pov*)	The percentage of poor population is the number of people below the poverty line divided by the total population in the same period.	Percent (%)
2.	Government spending (Bansos)	Government spending is a proxy for government spending items, namely social aid spending (bansos).	Billion Rupiah
3.	Foreign Direct Investment (FDI)	Foreign investment is proxied from the value of FDI investment entering each region, which is recorded and reported to the Ministry of Investment (BKPM).	Million USD
4.	Economic growth (LPE)	The proxy of the economic growth rate value issued by BPS is based on LPE calculations using constant price GRDP.	Percent (%)
5.	Education (APM)	Education is proxied by the Net Participation Rates (APM) at the high school/equivalent level. This APM shows how many people attend school on time according to the school-age group at the level of education being taken. $\text{APM} = \frac{\sum \text{High school students } 16-18 \text{ y}}{\sum \text{Population age } 16-18 \text{ y}} \times 100\%$ The high school education level is considered relatively the same as the secondary school used by Mankiw et al. (1992)	Percent (%)
6.	Infrastructure Energy (ER)	Infrastructure energy is proxied from each region's electrification ratio, households, and State Electricity Company (PLN) usage.	Rasio

Estimate is:

$$\hat{\beta} = \left(Z^T Z\right)^{-1} Z^T \left(I - \rho W_1\right) y$$

With Z = [I X W_1 X]

This study used a spatial weighting matrix with the Euclidean distance approach because land, rivers, and seas limit the districts and cities in the research area. In addition, distance-based methods support the influence of distance between the capital cities of the research unit area.

Furthermore, the spatial modelling that will be used in this research follows equation (3), as follows:

$$\begin{aligned} Pov_{it} &= \beta_0 + \beta_1 Bansos_{it} + \beta_2 FDI_{it-1} + \beta_3 LPE_{it} + \beta_4 Edu_{it} \\ &+ \beta_5 ER_{it} + \rho_1 \sum_{j=1}^{N} w_{ij} Bansos_{jt} + \rho_2 \sum_{j=1}^{N} w_{ij} FDI_{jt-1} \\ &+ \rho_3 \sum_{j=1}^{N} w_{ij} LPE_{jt} + \rho_4 \sum_{j=1}^{N} w_{ij} Edu_{jt} \\ &+ \rho_5 \sum_{j=1}^{N} w_{ij} ER_{jt} + \rho_6 \sum_{j=1}^{N} w_{ij} Pov_{jt} + \varepsilon_{it} \end{aligned} \quad (4)$$

Description: Pov is the poverty rate, Bansos is the social aid fund in the regional budget, FDI is the value of Foreign Investment, LPE is the rate of economic growth, Edu is the level of education of a region, and RE is infrastructure energy. w_{ij} is the element of the spatial weight matrix that shows spatial connectivity, ρ_1 is the coefficient of social assistance in neighbouring regions, ρ_2 is the coefficient of FDI in other regions, ρ_3 is the coefficient of LPE in other regions, ρ_4 is the coefficient of Edu in other regions, ρ_5 is the coefficient of infrastructure energy in neighbouring regions, ρ_6 is the coefficient of poverty in other regions and ε_{it} is a random shock.

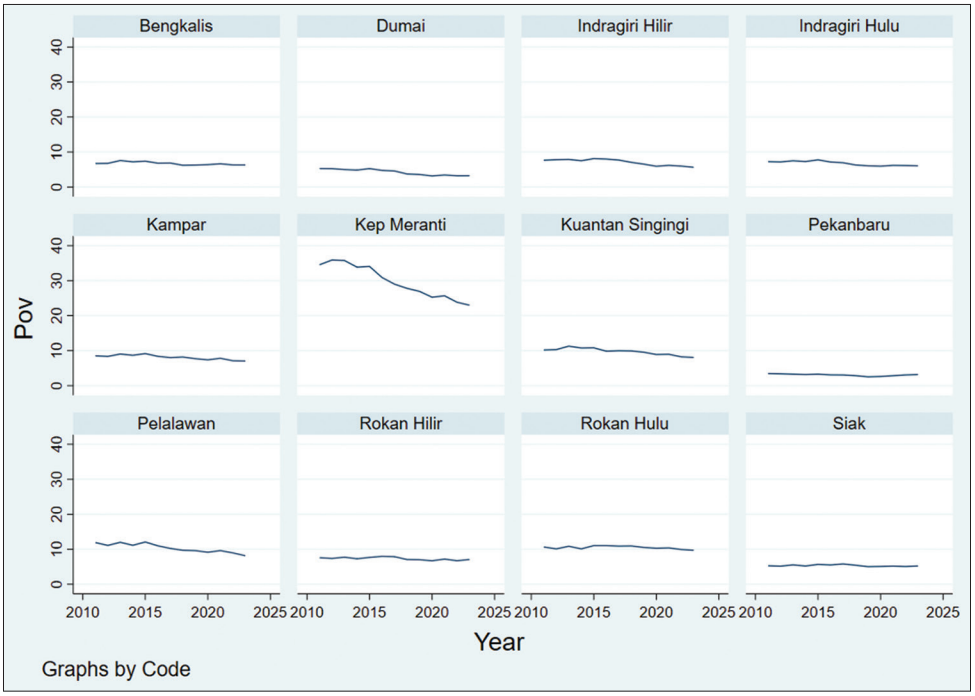
The spatial Durbin model in equation (4) illustrates that poverty in a region is influenced by the characteristics of the region itself, poverty in other regions, and characteristics of other regions. To show whether or not spatial dependence influences the poverty model, the author will first show the results of the regression of the poverty model without the spatial dependence aspect. Then, the author will compare the model with the poverty model, which involves the spatial dependence aspect. From both models, the impact of each determinant on poverty and its implications will be seen.

4. RESULTS AND DISCUSSION

The initial analysis conducted was to identify the level of poverty that occurred in each region. Based on Figure 1, fluctuations with a downward trend can be seen for each region for Kep. Meranti Regency has the highest poverty rate, with a value in 2023 of 22.98%. In real terms, this area has just been released from the group of disadvantaged areas, and this figure's achievement has also been significantly reduced compared to a decade ago when the poverty rate was 34.53%. In addition, the area's geography as an archipelago requires it to open itself up by improving the flow of sea transportation.

Furthermore, municipal areas have low poverty rates, such as Pekanbaru City, with a poverty rate of 3.16% in 2023 and 3.45% in 2021. This achievement is due to the income obtained by the community, in general, being able to meet the needs of life so that it has a consumption value above the standard. In addition, adequate facilities make it easy for people to earn income. The same thing happened in Dumai City. This city is one of the Industrialized cities in Riau Province, so, naturally, the population has an income above the standard.

Figure 1: Trend of district/municipality poverty rates (%)



In terms of the average value of the period, outside of Kep Meranti Regency, there are Rokan Hulu and Pelalawan Regencies with values ranging from 10%. At the same time, this area is a producer of oil palm plantations, CPO factories, and large industries such as the pulp and paper industry. The existence of industry in this area does not have a significant impact on the poverty that occurs, especially since the wages of workers on plantations are still low, the absorption of workers on plantations does not require higher education, and for hi-tech industries, highly qualified workers are needed, and this is obtained from outside the area.

Next, the proof of spatial dependence and factors influencing poverty are presented in Table 2. The initial stage begins with static panel data or without spatial effects, the selection of the best static panel data model using the Hausman test, based on Table 2 column (1) Hausman test probability is obtained at 0.000 <0.05, meaning that the best model is the fixed effect (FE) model. Furthermore, two significant variables are obtained from the FE model: FDI and Electrification Ratio. In contrast, the government expenditure variable on social assistance posts is insignificant, and the economic growth and net participation rates are also insignificant. FDI has a positive relationship to poverty with a coefficient value of 0.4418, which means that a 1% increase in FDI will increase the poverty rate by 0.44%. The factor that reduces the poverty rate is the electrification ratio with a coefficient value of -0.06, which means that if there is an increase in the electrification ratio or energy infrastructure by one child feeding unit, the poverty rate will be reduced by 0.06%. Therefore, the distribution of energy infrastructure, especially electricity, needs to get attention from policymakers, especially in today's era where electricity use is a priority.

The next stage of analysis is panel data, which includes spatial elements. The spatial Durbin model (SDM) aims to identify regional dependence on neighbours from the dependent variable aspect and the fluctuations in independent variables in neighbouring areas. The use of SDM also answers the main research questions. Based on Table 2 column (2), the results of the SDM fixed effect found three significant variables on poverty, including FDI, LPE, and Education. From the coefficient values, FDI and LPE have positive values of 0.4418 and 0.0925, which means that if there were a 1% increase in FDI last year, poverty would increase by 0.4%. An economic growth increase of 1% would increase poverty by 0.09%, assuming other variables are considered constant - cateris paribus. The results of the economic growth variable it is not in line with the research findings of Garza-Rodriguez (2018), Niyimbanira (2017), and Tsaurai (2021), which state that economic growth can reduce poverty. Meanwhile, the education coefficient has a negative value of -0.041, which means that an increase in education proxied by the net participation rate of 1% will reduce poverty by 0.04% (cateris paribus). This finding provides evidence that timely education can reduce poverty.

There is a difference in results with the random effect model (REM) in column (3), that government spending on social aid has a positive value of 0.0034 and is significant, which means that if there is an increase in social aid funds, it will increase the number of poor people by 0.0034%. This study's results align with Anjande et al. (2022) and Yusoff et al. (2023), stating that government spending does not affect Social assistance funds that are on target, and timely disbursement and distribution should reduce the poverty rate, but this does not happen for district/municipal areas. On the contrary, in actual conditions, these social aid funds are often not on target, and the duration of disbursement to distribution takes a long time. The highlight is the amount of social aid, which always increases during political years.

Furthermore, to prove whether or not spatial dependence occurs in the district/municipality on the fluctuations in the characteristics

Table 2: Result model data panel static and spatial

Variable	FE (1)	SDM – FE (2)	SDM – REM (3)
Bansos	0.0018	0.0034	0.0034 **
	(0.0045)	(0.0017)	(0.0014)
$logFDI_{t-1}$	0.4418 ***	0.4418 ***	0.4373 ***
	(0.0823)	(0.0668)	(0.0473)
LPE	0.0597	0.0925 ***	0.0186 ***
	(0.0489)	(0.0327)	(0.0051)
Edu	−0.0371	−0.0411***	−0.0406 ***
	(0.0224)	(0.0068)	(0.0097)
ER	−0.0617 ***	−0.0094	−0.0097
	(0.0076)	(0.0080)	(0.0060)
Spatial effect			
Wx Pov	-	0.0183	0.0133
		(0.0596)	(0.0582)
Wx Bansos	-	−0.0097**	−0.0095 **
		(0.0049)	(0.0044)
Wx $logFDI_{t-1}$	-	0.1325 ***	0.1386 **
		(0469)	(.0553)
Wx LPE	-	−0.1315**	−0.1324**
		(0.0587)	(0.0657)
Wx Edu	-	−0.0235**	−0.0239***
		(0.0123)	(0.0101)
Wx RE	-	−0.0786***	0.5886***
		(0.0060)	(0.0448)
Hausman (Prob)	0.0000	0.0000	0.0000
AIC	503.25	450.95	540.08
Log-likelihood	−245.62	−213.47	−258.04
R^2	0.3577	0.5740	0.5741
N	156	156	156

Notes: The spatial model is based on the Euclidean distance matrix. AIC: Akaike information criterion. Heteroskedasticity robust standard errors are shown in parentheses. **P<0.05; ***P<0.01

of neighbouring areas, we can see in Table 2 in the spatial effect section. The two SDM models produce almost the same value and significance regarding neighbouring areas' characteristics. First, regarding government expenditure, social aid has a negative coefficient of -0.009 and is significant. This finding states that if there is an increase in social aid expenditure in neighbouring areas, it will significantly reduce poverty in the central area by 0.009%. This is inseparable from the object of poverty, namely, the poor residents can move to neighbouring areas, and with persuasion, they will get a share in the distribution of social aid. Another option from what happened is that the increase in social assistance expenditure in neighbouring areas provides a multiplier effect to the main area in the form of increased public consumption.

Next, the second characteristic variable is FDI. From the results of the SDM model, the coefficient value of Wx FDI is positive at 0.13 and significant at the 1% level for SDM-FE and the 5% level for SDM-RE, stating that every increase in foreign investment in neighbouring areas will have a positive impact on the main area by 0.13% and statistically significant. As is known, the use of foreign investment can increase regional development so that it becomes a region that continues to grow (Rusiadi et al., 2024), and conversely, if the region lacks capital, especially investment, it results in slow growth, which has an impact on the sustainability of the population, thereby increasing the poverty rate. According to Hidayat et al. (2018a; 2018b), the concentration of investment in a region will cause an imbalance in the distribution of investment, which is considered one of the main factors causing inequality in development or economic growth. The low value of investment in a region will reduce the rate of economic growth and the level of per capita income due to the absence of productive economic activities.

Moreover, the third variable is economic growth with a coefficient value of Wx LPE of −0.13, which is significant at the 5% level for both models. These results show that increasing neighbouring economic growth can significantly reduce poverty rates by 0.13%. Economic growth that occurs in neighbouring areas provides spillover to the main area, and there is a multiplier effect from community consumption, also supporting other areas to be productive in producing the needs of neighbouring areas. The fourth variable is education, represented by the net participation rate (APM), which has a coefficient value of Wx-Edu of -0.023 and is significant for both models. This finding indicates that an increase in APM in neighbouring areas by 1% will significantly reduce poverty by 0.023%. Education is the principal capital in increasing human capital, as found by Mankiw et al. (1992), which states that school enrollment can increase economic growth, and Romer (2019) states that education is the most important part in increasing human capital as well as a person's standard of living.

Fifth, the coefficient of the energy infrastructure variable is -0.07 for the SDM-FE model, and SDM-RE is -0.5886 and is significant for both models. These results provide evidence that if there is an increase in the quality of energy infrastructure in neighboring areas by 1%, it will reduce poverty in the area of origin. Energy infrastructure is considered necessary for the sustainability of development, and the relationship between shopping must still be in accordance with basic needs. It is known that the electrification ratio has a maximum value of 100%. Therefore, urban areas benefit from public facilities that are superior to district areas. Considering again that poor people can move to neighboring areas that have primary facilities that make them attractive, the number of poor people in the area of origin automatically decreases with the movement of the poor.

Finally, the coefficient value of Wx Pov is 0.018 for the SDM-FE model, and SDM-RE is 0.013 and is not significant for both. This indicates that there is no influence from the rise and fall of the poverty rate in neighboring areas on the area of origin. This finding is in line with the research results of Farhan et al. (2024). Our findings provide the enlightenment that to overcome or overcome poverty, each regional government as a policy maker creates its programs because no dependence on poverty occurs in neighboring areas, and synergy is needed at the provincial level.

5. CONCLUSION

Based on the results above, it was found that the trend of poverty rates in almost all municipalities experienced a decline. The highest poverty rate was in Kep. Meranti Regency, and for municipalities, it was at the level of 3%. Furthermore, from the results of poverty determination, there are education variables that can reduce poverty; conversely, there are those that have an impact on increasing poverty rates, namely FDI last year, Economic growth, and government spending - social aid The results with

the Durbin model spatial method provide findings that the characteristics of neighboring areas influence poverty in the central area, while the characteristics of neighboring areas that affect poverty reduction are as follows: government spending - social aid, economic growth, education, energy infrastructure. Conversely, what increases poverty is the time lag of FDI investment. Thus, the results of the influence of the characteristics of neighboring areas are novelties in this article.

These findings provide input for policymakers at the municipality level to take strategic steps related to poverty alleviation in their respective areas, one of which is by improving education, such as timely education and compulsory education up to the high school level. In addition, incoming investment is intended to absorb labour, indirectly increasing people's income and meeting basic needs.

6. ACKNOWLEDGEMENT

In this study, we, as the authors, would like to thank the Universitas Muhammadiyah Riau for providing the funding. In addition, we thank the parties who have helped facilitate this research and produce this article.

REFERENCES

Agarwal, M., Atri, P., Kundu, S. (2017), Foreign direct investment and poverty reduction. South Asia Economic Journal, 18(2), 135-157.

Akhmad, A., Amir, A., Saleh, S., Abidin, Z. (2022), Effectiveness of regional government expenditure in reducing unemployment and poverty rate. European Journal of Development Studies, 2(4), 90-99.

Anjande, G., Asom, S.T., Ayila, N., Mile, B.N., Ijirshar, V.U. (2022), Government Spending and Money Supply Roles in Alleviating Poverty in Africa. Papers 2209.14443. Availabkle from: https://arxiv.org/abs/2209.14443v1

Anselin, L., Syabri, I., Kho, Y. (2006), GeoDa: An introduction to spatial data analysis. Geographical Analysis, 38(1), 5-22.

Anwar, A. (2022), Spatial analysis of regional poverty in central Java Indonesia. Jurnal Dinamika Ekonomi Pembangunan, 5(1), 36-55.

Aoyagi, C., Ganelli, G. (2015), Asia's Quest for Inclusive Growth Revisited. IMF Working Paper No. 15/42. International Monetary Fund.

Darnius, O., Tambunan, Y. (2023), Spatial regression model of poverty in the province of North Sumatera on 2017. Journal of Physics: Conference Series, 2421(1), 012003.

Dhrifi, A., Jaziri, R., Alnahdi, S. (2020), Does foreign direct investment and environmental degradation matter for poverty? Evidence from developing countries. Structural Change and Economic Dynamics, 52, 13-21.

Elhorst, J.P. (2003), Specification and estimation of spatial panel data models. International Regional Science Review, 26(3), 244-268.

Elhorst, J.P. (2010), Spatial panel data models. In: Handbook of Applied Spatial Analysis. Berlin: Springer Berlin Heidelberg. p377-407.

Elhorst, J.P. (2014), Spatial Econometrics: From Cross-Sectional Data to Spatial Panels. Berlin: Springer Berlin Heidelberg.

Eseyin, O., Ogunjobi, J.O. (2022), Sustainable electricity supply and poverty reduction in Nigeria. International Journal of Energy Economics and Policy, 12(1), 54-61.

Farhan, M., Hadi, M.F., Hidayat, M. (2024), Poverty analysis in Riau Province: Spatial econometric approach. Comserva: Jurnal Penelitian dan Pengabdian Masyarakat, 3(11), 4576-4586.

Garza-Rodriguez, J. (2018), Poverty and economic growth in Mexico. Social Sciences, 7(10), 0183.

Han, Q., Jin, L., Khan, M.A.S., Vitenu-Sackey, P.A., Obrenovic, B. (2023), Poverty alleviation in developing and underdeveloped countries. Do foreign capital and economic freedom matter? Technological and Economic Development of Economy, 29(1), 45-73-45-73.

Hidayat, M., Bachtiar, N., Sjafrizal, S., Primayesa, E. (2022), Does Investment and Energy Infrastructure Influence Convergence in Sumatra Island, Indonesia? International Journal of Energy Economics and Policy, 12(4), 274-281.

Hidayat, M., Bachtiar, N., Sjafrizal, S., Primayesa, E. (2023), The influence of investment, energy infrastructure, and human capital towards convergence of regional disparities in Sumatra Island, Indonesia; Using oil and gas data and without oil and gas. International Journal of Energy Economics and Policy, 13(4), 139-149.

Hidayat, M., Darwin, R., Hadi, M.F. (2018a), Analisis pertumbuhan ekonomi antarwilayah di Provinsi Riau; Pendekatan regresi data panel. Jurnal Akuntansi dan Ekonomika, 8(1), 41-48.

Hidayat, M., Darwin, R., Hadi, M.F. (2018b), Inequality of interregional development in Riau Indonesia; Panel data regression approach. International Journal of Economics and Financial Issues, 8(5), 184-189.

Hidayat, M., Darwin, R., Hadi, M.F. (2020), Does energy infrastructure reduce inequality inter-regional in Riau Province, Indonesia? International Journal of Energy Economics and Policy, 10(1), 160-164.

Khader, H.A.R., Salman, A.A. (2022), Analysis and measurement of the impact of government spending on Iraq's poverty indicators for 2004-2018. International Journal of Health Sciences, 6(S4), 12135-12153.

Kurniasari, A., Oktavilia, S. (2023), Determinants of poverty in Western Indonesia and Eastern Indonesia. Economics Development Analysis Journal, 12(1), 84-99.

Leiwakabessy, E., Payapo, R.W. (2022), The dynamic link of energy consumption, economic growth and poverty in Eastern Indonesia: Panel VECM and FMOLS approach. International Journal of Energy Economics and Policy, 12(2), 83-90.

Lestari, W., Brata, A.S., Anhar, A., Rahmawati, S. (2023), Analisis autokorelasi spasial global dan lokal pada data kemiskinan Provinsi Bali. Jambura Journal of Mathematics, 5(1), 218-229.

Mankiw, N.G., Romer, D., Weil, D.N. (1992), A contribution to the empirics of economic growth. Quarterly Journal of Economics, 107(2), 407-437.

Miar, M., Yunani, A. (2020), The analysis of influence of the government expenditure on poverty in Indonesia. Jurnal Ekonomi Pembangunan, 18(1), 91-102.

Mirrahma, A.A., Septiani, M.A., Panorama, M. (2023), Poverty level determination analysis: Case study of South Sumatra Province. JESI (Jurnal Ekonomi Syariah Indonesia), 13(1), 144-156.

Muttaqin, T.F., Masbar, R., Jamal, A. (2023), Poverty in Indonesia: An application of Error Correction Model (ECM) Approach. International Journal of Advances in Social Sciences and Humanities, 2(1), 73-83.

Niyimbanira, F. (2017), Analysis of the impact of economic growth on income inequality and poverty in South Africa: The case of Mpumalanga province. International Journal of Economics and Financial Issues, 7(4), 254-261.

Omodero, C.O. (2019), Government sectoral expenditure and poverty alleviation in Nigeria. Research in World Economy, 10(1), 80-90.

Osanyinlusi, O.I., Awotide, B.A., Awoyemi, T.T., Ogunniyi, A.I., Ogundipe, A.A. (2017), An evaluation of rural electrification and households' poverty in Ikole local government Area, Ekiti State, Nigeria: An FGT Approach. International Journal of Energy Economics and Policy, 7(3), 24-30.

Permadi, Y.A. (2018), Growth, inequality, and poverty: An analysis of

pro-poor growth in Indonesia. Jurnal Ekonomi Kuantitatif Terapan, 11(2), 216-233.

Pradana, H., Fitriyanti, S. (2022), Causal relationship between government expenditure, economic growth, and poverty in South Kalimantan. Jurnal Kebijakan Pembangunan, 17(2), 275-288.

Qifa, H., Oppong, S., Borah, P.S., Addai-Dansoh, S. (2023), Investigating the role of foreign capital inflows and economic freedom in poverty alleviation. The Economics and Finance Letters, 10(1), 22-43.

Romer, D. (2019), Advanced Macroeconomics. 5th ed. United States: McGraw Hill.

Rusiadi, R., Hidayat, M., Rangkuty, D.M., Ferine, K.F., Saputra, J. (2024), The influence of natural resources, energy consumption, and renewable energy on economic growth in ASEAN region countries. International Journal of Energy Economics and Policy, 14(3), 332-338.

Sepulveda, C.F., Martinez-Vazquez, J. (2011), The consequences of fiscal decentralization on poverty and income equality. Environment and Planning C: Government and Policy, 29, 321-343.

Shahzad, S., Yasmin, B. (2016), Does fiscal decentralisation matter for poverty and income inequality in Pakistan? The Pakistan Development Review, 55(4I-II), 781-802.

Sunusi, N., Subarkah, A. (2023), Geographically weighted regression with different kernels: Application to model poverty. Indonesian Journal of Applied Research, 4(1), 27-41.

Syahzaqi, I., Alfarizi, P.A.S., Fithriasari, K. (2023), Modelling of poverty percentage in East Java Province with semiparametric regression approach. Barekeng: Jurnal Ilmu Matematika Dan Terapan, 17(2), 0727-0734.

Tsaurai, K. (2021), Energy consumption-poverty reduction nexus in Brics nations. International Journal of Energy Economics and Policy, 11(3), 555-562.

Yusoff, S., Law, S.H., Mohamed Nor, N., Ismail, N.W. (2023), Effects of government expenditure on the poverty level: A nonlinear ARDL approach. Malaysian Journal of Economic Studies, 60(1), 45-67.

Yusri, A. (2022), Does government expenditure affect poverty, health, and education? Evidence from Aceh, Indonesia. Jurnal Perencanaan Pembangunan: The Indonesian Journal of Development Planning, 6(1), 1-20.