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The Impact of Government Spending Spillovers on Regional Economic Growth

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ABSTRACT

The purpose of this study is to analyze the spatial effects that occur on inter-provincial regional government expenditure on regional economic growth in Indonesia. Its analyzed data from 33 provinces in Indonesia for the 2007-2018 period. This study implements a spatial panel data model that can generate spillover effects on regional government expenditure models. The implementation of the spatial panel data model in this study uses the Spatial Durbin Model (SDM) which utilizes the Maximum Likelihood Estimation Approach. The results of this study indicate that regional internal effects of government expenditure, investment, and education variables on regional economic growth in Indonesia are positive and significant. Further analysis in the form of spatial effects on the model empirically reveals that the abundant effects of economic growth, government spending, investment, and education contribute positively to the economic growth of neighbouring regions. This result contributes to the interdependence of local government policies, which implies that every policy made by a local government correlates with other neighbouring local governments.

INTRODUCTION

The relationship between fiscal policy and economic growth is one of the crucial issues to study in various countries. Some of the objectives of implementing fiscal policy are to maintain the stability of macroeconomic conditions, to encourage long-term economic growth, (Tanzi and Zee, 1997) and to increase a country's economic development (Easterly and Rebelo, 1993). The implementation of government policies through fiscal policies is shown by the existence of various forms of policies on the side of government revenues and expenditures, which are oriented towards maintaining the stability and sustainability of the economic activity. Government strategies and policies in intervening in the economy can be done through tax collection and spending distribution (Glomm and Ravikumar, 1997). Various forms of government fiscal policy will have an impact on economic activity, thereby spurring the country's economic growth for the better.

Significant changes in the government system from centralization to decentralization in Indonesia in 1999 had a significant impact on the policies and management of local government budgets so that regions became the main actors in the process of regional development through local government expenditure policies. This has a significant impact on regional economic development and is one form of delegation of authority from the central to regional policy process (Brodjonegoro and Asanuma, 2000). Studies related to fiscal decentralization in Indonesia show that (Pepinsky and Wihardja, 2011) generally improves economic performance in Indonesia. The fiscal policy carried out by the government through state revenue and expenditure is not only carried out accumulatively through central government policy. Fiscal policies were undertaken by local governments also have an important role as a means of increasing economic activity that will have an impact on people's welfare.

The development of studies related to the issue of government spending is shown by several preliminary studies related to the effects of spending on the education sector (Al-Yousif, 2008), while the health sector (Wang, 2011). In addition, the social sector was analysed by (Bellettini and Ceroni, 2000; Lee and Chang, 2006), while military spending was explored by (Dritsakis, 2004; Chang, Huang and Yang, 2011; Alptekin and Levine, 2012). Other related studies on effectiveness and efficiency of government spending on economic growth (Chen *et al.*, 2017), optimal government investment and economic growth (Shen, Yang and Zanna, 2018), and the important role of government spending on economic growth in Low-Income Countries. The development of the study is shown by eliciting the effect of interaction between regions in the model of government spending shown by (Baicker, 2005) using state data in US, (Peltzman, 2016) using data on counties in the US, (Zheng *et al.*, 2013) and (Yu *et al.*, 2011) in China and (Ojede, Atems and Yamarik, 2018) in the United States.

Finally, the development of the application of spatial econometrics models in Indonesia was conducted by (Vidyattama, 2013) who explored the regional per capita income convergence in the era of decentralization in Indonesia, and (Aritenang, 2014) who addressed the convergence of economic growth between provinces in Indonesia before and after decentralization. However, initial studies conducted in Indonesia related to this matter have not specifically analyzed the effects of government expenditure overflows on economic growth. Therefore, based on a study conducted by (Ojede, Atems and Yamarik, 2018), this study aims to analyze the effects of fiscal policy represented through government spending by applying spatial modelling to observe the effects of neighbourly interactions modelled with the spatial econometrics approach so as to capture the effects of overflow of neighbouring regions in the model. This is implemented through an empirical study of spatial issues in regional expenditure policies in Indonesia that aims to become an initial empirical study on this issue using a spatial model.

1. LITERATURE REVIEW

In general, the correlation between government fiscal policies and the state of the country's economy are not only shown through the relation of aggregate state expenditure policies. Several studies related to the effects of fiscal policy on economic growth were carried out by analyzing fiscal structures (Easterly and Rebelo, 1993), fiscal decentralization and local economic growth (Zhang and Zou, 1998). In addition, some studies analyzed the structure of government expenditure and economic growth using the endogenous growth model (Park and Philippopoulos, 2003). The difference in fiscal structure is a form of government policy to choose the orientation of the largest and smallest expenditure that must be issued to fund various policies. Studies related to the effects of spending on the education sector were conducted by (Al-Yousif, 2008), while the health sector was addressed by (Wang, 2011). In addition, the social sector was analysed by

(Bellettini and Ceroni, 2000; Lee and Chang, 2006), while military spending was explored by (Chang, Huang and Yang, 2011; Alptekin and Levine, 2012). This shows that the analysis of the composition of government spending is an important determinant of economic growth.

The government expenditure studies are developed by dividing the composition of these expenditures into various forms, such as analysis (Gerking and Morgan, 1998) on the fiscal structure of the state to achieve state development policies. The composition of other fiscal structures is shown by (Dritsakis, 2004) analyzing military spending on growth. The structure of revenue and expenditure becomes an important aspect (Zagler and Durnecker, 2003), which will have an impact on long-term economic growth (Butkiewicz and Yanikkaya, 2011), effectiveness and efficiency of government spending on economic growth (Chen *et al.*, 2017), optimal government investment and economics growth (Shen, Yang and Zanna, 2018), and the important role of government spending on economic growth in Low-Income Countries. This identification shows the development of studies that are not focused on composition but rather emphasize the effectiveness and efficiency in management that affect economic growth.

Fiscal policy in developing countries is an important aspect because the government has a dominant role in driving the economy. The study by (Mundle, 1999) represents the issue of fiscal policy in developing countries in Asia, which indicates a policy transition that is not only focused on taxation policy but also related to the distribution of expenditures that are oriented towards economic growth. The political side is also an important factor in the distribution of government spending that drives the implementation of government democracy, which will have a positive impact on government spending on the healthy side (Laiprakobsup, 2019). Studies related to fiscal policy in Indonesia show (Vidyattama, 2010) that local government investment spending has an impact on regional economic growth. In this line, (Sriyana, 2016) analyzed the optimum size of government spending in Indonesia, while (Lewis, 2013) revealed that central government transfer funds to regions had an impact in stimulating local government capital expenditure.

The development of spatial models in economic analysis is an important aspect because interactions between regions cannot be excluded in the model. Some preliminary studies were conducted to analyze the determinants of economic growth by bringing up spatial aspects in the economic growth model as that conducted by (Rey, 2001) related to income distribution, (LeSage and Fischer, 2008) that analysed several models of economic growth by spurring spatial effects in the model, and a study by (Bai, Ma and Pan, 2012; Wenqing, 2013) using spatial models to analyze the factors that cause regional income growth. The study on the development of a determinant model of economic growth and its effects that specifically analyses the impact of government spending on neighbouring region was conducted by (Baicker, 2005) who analysed the effects of state spending that cause interstate spillovers and (Peltzman, 2016) who explored the effects of fiscal policy connectivity between states and localities. Some researches related to the development of spatial models were conducted by (Zheng *et al.*, 2013). Meanwhile, spatial effects of government infrastructure spending in China was conducted by (Yu *et al.*, 2011) that analyzed the main effects of public investment on growth with the model spatial, and (Ojede, Atems and Yamarik, 2018) explored the effects of an overflow of government spending on the state of economic growth in the United States. The follow-up study showed that the development of spatial models in the analysis of fiscal policy became something important to do.

1. RESEARCH METHOD

1.1 Data

This research is an empirical study that used secondary data as a basis for estimating models. The study used panel data of 33 provinces in Indonesia in the period of 2007-2018. All data used in this study were obtained from the Indonesia Central Statistics Agency (BPS). Specifically, the variables used in this study were:

Table 1. Definitions of Variables

Variable	*Symbol*	*Unit*	*Description*
Regional Gross Domestic Product	$\ln rgdp_{i,t}$	Billions	Real GRDP per province based on 2010 constant prices.
Government Expenditures	$\ln ge_{i,t}$	Billions	Total funds for the realization of expenditures to finance government activities in the span of one year.
Foreign Direct investment	$\ln fdi_{i,t}$	Billions	4 Investment activity to conduct business in the territory of the Republic of Indonesia which is carried out by foreign investors, both those who use foreign capital fully, and those who are affiliated with domestic investors.
Numbers of Literacy	$lit\_rate_{i,t}$	Percent	The proportion of the population aged 15 years and over who has the ability to read and write Latin letters and other letters compared to the population aged 15 years and over.
Population density	$pdens_{i,t}$	Person/km²	Comparison of the number of inhabitants with the area based on certain units of area

Sources: Indonesia Central Statistics Agency

1.2 Research Model

According to (Elhorst, 2014) the basic form of the spatial model may be divided into endogenous interaction effects, exogenous interaction effects, and interaction effects among error terms. On this basis, this study used the Spatial Autoregressive Model (SAR), Spatial Error Model (SEM) and Spatial Durbin Model (SDM) classification models.

Non-Spatial Panel Model

The formation of the basic model is shown by the relationship between the basic factors forming economic growth (ln_rgdp) as indicated by government spending (ln_ge), investment (ln_fdi), education (lit_rate) and population (pdens).

$$\ln rgdp_{i,t} = \alpha_t + \beta_1 \ln ge_{i,t} + \beta_2 \ln fdi_{i,t} + \beta_3\, lit\_rate_{i,t} + \beta_4\, pdens_{j,t} + \mu_i + v_{i,t} \quad (1)$$

SAR model

The Spatial Autoregressive model indicates the spatial aspects of the dependent value of the variable for the neighbouring area as shown in the following model:

$$\ln rgdp_{i,t} = \alpha_t + \rho \sum_{j=1}^{N} W_{ij} \ln rgdp_{j,t} + \beta_1 \ln ge_{i,t} + \beta_2 \ln fdi_{i,t} + \beta_3\, lit\_rate_{i,t} + \beta_4\, pdens_{i,t} + \mu_i + v_{i,t} \quad (2)$$

The value of $\sum_{j=1}^{N} W_{ij} \ln gdp_{j,t}$ is a neighbouring effect in the autoregressive model. Thus, the value of ρ is the estimated analysed value to capture the spillover effect of spatial conditions on the autoregressive model.

SEM Model

The development of the Spatial Error Model shows the spatial relationship on the error as shown in the following model:

$$\ln rgdp_{i,t} = \alpha_t + \beta_1 \ln ge_{i,t} + \beta_2 \ln fdi_{i,t} + \beta_3\, lit\_rate_{i,t} + \beta_4\, pdens_{i,t} + \mu_i + v_{i,t} \quad (3)$$

Where

$$v_{i,t} = \lambda \sum_{j=1}^{N} W_{ij}\, \varepsilon_{jt} + \varepsilon_{i,t}$$

The value of $\sum_{j=1}^{N} W_{ij}\, \varepsilon_{j,t}$ is the neighbourly effect on the model error so that the value of λ is the estimated value analyzed to capture the spatial conditions in the error model.

SDM Model

The neighbourly effect represented by the abundance effect is shown in the SDM model. This model has an overflow effect on the independent variable which is indicated by the coefficient value of θ.

$$\ln rgdp_{i,t} = \alpha_t + \rho \sum_{j=1}^{N} W_{ij} \ln rgdp_{j,t} + \beta_1 \ln ge_{i,t} + \beta_2 \ln fdi_{i,t} + \beta_3\, lit\_rate_{i,t} + \beta_4\, pdens_{i,t} + \mu_i + v_{i,t} + \theta_1 \sum_{j=1}^{N} w_{ij} \ln ge_{j,t} + \theta_2 \sum_{j=1}^{N} w_{ij} \ln fdi_{j,t} + \theta_3 \sum_{j=1}^{N} w_{ij}\, lit\_rate_{j,t} + \theta_4 \sum_{j=1}^{N} w_{ij}\, pdens_{j,t} + \mu_i + v_{i,t} \quad (4)$$

1.3 Weight Matrix

The use of weight matrices in spatial analysis is one important aspect (Lesage, 2008) to quantify connections between regions formed into a matrix to project relations between regions. Theoretically (Getis, 2009) the nature of this W matrix must be exogenous and include the number of neighbours, the same side length, and the same perimeter proportion. This study used the simplest form is the spatial weight matrix where an area is valued as a 'neighbour' when they border part of one another (binary contiguity matrix). According to the proximity criteria, the spatial weight matrix (wij) element is one if location i is close to location j, and vice versa. To facilitate interpretation, the spatial weighting matrix is standardized so that the sum of the values for the elements in a row is one.

$$w_{ij} \begin{cases} w_{ij} = 0\,;\ if\ i = j \\ w_{ij} = 0\,;\ if\ i\ unshared\ border\ j \\ w_{ij} = 1\,;\ if\ i\ shared\ j \end{cases}$$

1.4 Testing Steps

Initial testing to show the spatial autocorrelation occurring in the data was conducted using Moran's I Statistics that indicate spatial autocorrelation in the data. Spatial model testing was done to choose the best spatial model using the specific to a general method, based on a specific estimation model which then performed restrictions on the parameter values to get the best model. This second method applied the Wald test or common factor test to perform the model restriction test. This study used the estimated specific model of the Spatial Durbin Model (SDM). Then, the value of the restriction parameter was analyzed to provide a more general model, the Spatial Autoregressive (SAR) or Spatial Error Model (SEM). Based on (Lesage and Pace, 2009) the specification of the model can be done by testing with the hypothesis of $H_0 : \theta = 0$ and $H_0 : \theta + \rho\beta = 0$. If the Wald Test on the hypothesis results in $H_0 : \theta = 0$ which conclude failing to reject H_0, the SDM model can be simplified into SAR, and if the testing result of $H_0 : \theta + \rho\beta = 0$ which conclude a failure to reject H_0, the SDM model can be simplified to SEM.

The implementation of the spatial model in this research was not only done by incorporating spatial elements in the economic growth model but also by using the panel data method to implement the SAR, SEM and SDM models with random effects and fixed effects (Elhorst, 2014). Spatial panel model estimation was done using maximum likelihood estimation which was theoretically developed by (Elhorst, 2003) and further modified by (Kapoor, Kelejian and Prucha, 2007). Empirically, the application of the maximum likelihood estimation model for the spatial panel model used in this study is to apply the "xsmle" module (Belotti, Hughes and Mortari, 2017).

2. RESULTS AND DISCUSSION

The initial conditions of the data shown by regional data for 33 provinces in Indonesia during the 2007-2018 period are shown in Table 2. The initial analysis is depicted from the data description indicating the average, standard deviation, minimum and maximum of each variable. The descriptive analysis reveals that the well-distributed conditions of the data. The variables of economic growth, government expenditure, investment, education and population density highlights that the average value, standard deviation, minimum and maximum indicate data that are well distributed and there are no data values with the outlier conditions. The next step of the analysis was the analysis of the regional distribution of the main variables for two periods between the beginning and the end. This step, which is an important requirement in spatial analysis, was carried out by testing spatial autocorrelation using Moran's I statistics.

The following step was to analyze the distribution condition of the main variables, namely government spending and economic growth, which was represented through the distribution map for the period of 2007 and 2018. This was done as a means to illustrate the gap and increase in the composition between government spending and economic growth. A comparison of regional government spending conditions in Indonesia for the period between 2007 and 2018 is shown in Figure 1. It is indicated that in 2007 the high level of regional government expenditure in Indonesia was dominated by regions of Java, where almost all regions have relatively high levels of government expenditure. Meanwhile, the regional government spending on the island of Sumatra was relatively at the middle to a low level.

Table 2. Descriptive Statistic of the Data

Variable	*Scope*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
ln_rgdp	overall	396	11.665	1.1831	9.421	14.367
	between			1.1823	9.770	14.041
	within			0.2023	11.185	12.126
ln_ge	overall	396	15.055	0.9754	12.805	18.081
	between			0.8381	13.786	17.281
	within			0.5182	13.306	16.156
ln_fdi	overall	396	4.842	2.3254	-1.715	9.203
	between			1.7940	1.400	8.447

	within			1.5096	-1.754	8.151
lit_rate	overall	396	94.204	5.7742	64.080	99.87
	between			5.6175	70.448	99.34
	within			1.6322	87.836	100.54
pdens	overall	396	710.340	2522.129	6.2654	15764.00
	between			2553.002	8.2087	14777.20
	within			157.548	-1536.875	1697.138

Sources: Indonesia Central Statistics Agency, Processed

The government spending on the island of Kalimantan shows that East Kalimantan has a relatively high level of government expenditure, while other areas in Kalimantan are in the low range of government expenditure. A significant different trend can be seen from the distribution in the eastern parts of Indonesia which tends to have a relatively low level of local government expenditure. There have been slight changes and shifts in the distribution of government spending for 2018. This is indicated by the fact that the level of local government spending was still concentrated in Java. Another condition was shown by the concentration of government spending on the island of Sumatra, which was dominated by the western regions. Meanwhile, the middle area tends to be relatively fixed with a distribution in the middle range. Different results were shown by some regions in eastern Indonesia that tended to experience an increase in state spending.

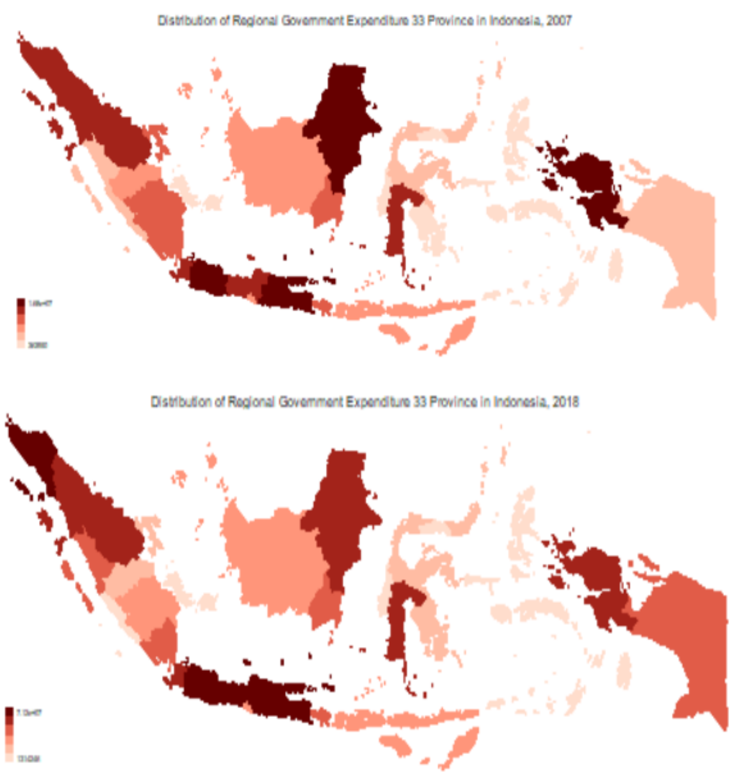
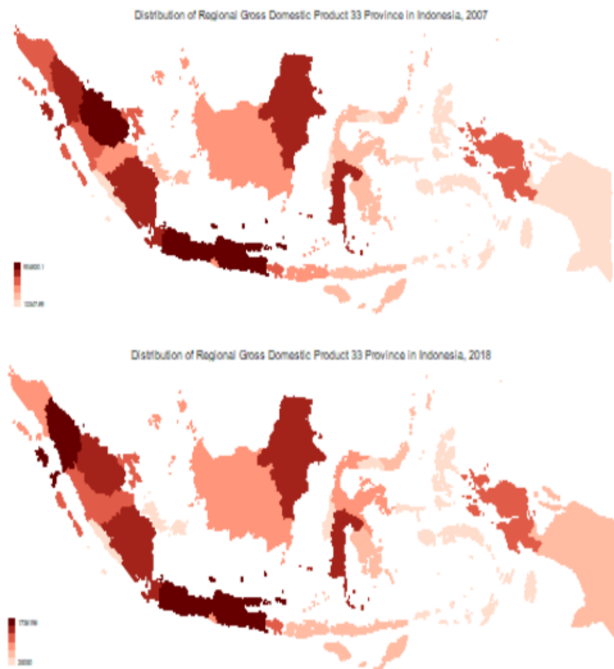


Figure 1. Distribution of Regional Government Spending in 33 Provinces of Indonesia

Sources: Indonesia Central Statistics Agency, Processed

The distribution of regional economic growth in Indonesia for the period between 2007 and 2018 is shown in figure 2. In 2007, the distribution of regional economic growth was not much different as compared to government spending. This was indicated by the high value of economic growth in almost all regions in Java and East Kalimantan islands. This condition shows that regions that have a relatively large tendency of government spending also have a large level of economic growth. In 2007, it was shown that most of the islands of Java showed high economic growth. Meanwhile, the central region on the island of Sumatra became the centre of growth. On the other hand, the growth centre in the eastern regions of Indonesia was shown by the South Sulawesi region. Similar conditions were highlighted in 2018, which showed a similar distribution as in 2007. The dominance of high growth rates was still dominated by Java and much of Sumatra, while eastern Indonesia relatively had low economic growth rates. This confirms (Hill, Resosudarmo and Vidyattama, 2008) which concluded that the Indonesian economic growth tends to be clustered and concentrated in Java.



Further analysis, which is an important step in spatial analysis, was to analyze the occurrence of spatial autocorrelation for the main variables used in the model because this is a prerequisite before spatial regression analysis was done in the model. The analytical tool used to see the relationship between variables in the spatial analysis was done by looking at the results of Moran's I statistics. The results of Moran 'I statistics for the two main variables in the study namely economic growth and government spending are shown in Table 3. The results show that in terms of economic growth variables, there is a positive and significant relationship for the whole year from 2007 to 2018. In other words, there is a tendency for regional groupings to have a high and low value in an area. Meanwhile, the same results were shown for government expenditure variables for 2007 to 2018 in that almost all years also showed positive and significant results of a positive spatial relationship in this variable. Based on this, the initial requirement of the data to have a spatial autocorrelation is fulfilled, and thus making it possible to do further analysis to prove the spatial influence in the government expenditure model on economic growth.

Table 3. Moran's I Statistic

Year	*Variables*			
	Regional Growth		*Government Expenditure*	
	I	*p-values*	*I*	*p-values*
2007	0.443	0.003	0.474	0.001
2008	0.444	0.003	0.105	0.212
2009	0.452	0.002	0.382	0.007
2010	0.443	0.003	0.38	0.007
2011	0.441	0.003	0.41	0.005
2012	0.442	0.003	0.397	0.006
2013	0.447	0.002	0.374	0.008
2014	0.448	0.002	0.495	0.001
2015	0.453	0.002	0.506	0.001
2016	0.46	0.002	0.53	0.000
2017	0.461	0.002	0.498	0.001
2018	0.467	0.002	0.515	0.001

Sources: Indonesia Central Statistics Agency, Processed

2.1 Non-Spatial Model of Government Spending on Economic Growth

Further analysis was done by modelling the effect of government spending on economic growth with a model without spatial interaction. It was followed by analyzing the existence of spatial relationships in the model. The results of the non-spatial model are shown in Table 4, which uses the non-spatial panel model approach for three models, namely common effect, random effect and fixed effect. The model specification was done by conducting initial testing on non-spatial models of LM tests to examine the common and random effects models that show significant results with a probability of 0.000. On this basis, the random effect model was chosen. Then, it was followed by an F-test to analyze the choice between the models of common and fixed effects that show significant results with a probability of 0.000, on which basis the fixed effect model was chosen. The further test to choose between random effects and fixed effects was done by performing a hausman test which showed significant results because it had a probability value of 0.0014. This indicated that the best model for non-spatial models was the fixed effect model. Based on the initial analysis, the best model that can be interpreted in the non-spatial model was the fixed effect model.

Table 4. Result of Non-Spatial Model

VARIABLES	Dependent Variable: ln_rgdp		
	Common	Random	Fixed
ln_ge	0.775***	0.236***	0.217***
	(0.0467)	(0.0157)	(0.0145)
ln_fdi	0.127***	0.0300***	0.0289***
	(0.0188)	(0.00398)	(0.00354)

lit_rate	-0.00761	0.0227***	0.0288***
	(0.00567)	(0.00451)	(0.00422)
pdens	2.93e-05**	0.000116***	0.000102***
	(1.40e-05)	(2.31e-05)	(2.76e-05)
Constant	0.0759	5.752***	5.467***
	(0.901)	(0.324)	(0.286)
Chow Test			
F-test		668.68	
Prob>F		0.0000	
LM-Test			
Chibar	852.46		
Prob	0.0000		
Hausman			
Chi2			17.76
Prob>chi2			0.0014
Observations	396	396	396
R-squared	0.734	0.5092	0.844
Number of ID_Prov	33	33	33

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Sources: Indonesia Central Statistics Agency, Processed

The specifications of the non-spatial model highlight that the fixed effects model is the best model to be interpreted. The results of the fixed effect model show that all variables, namely government spending, investment, education and population have a positive and significant value at the level of 1 percent. The coefficient value of government expenditure that is equal to 0.217 indicates the value of the magnitude of the effect if an increase in government spending has implications for regional economic growth in Indonesia. These results are in line with the research by (Zagler and Durnecker, 2003) and (Shen, Yang and Zanna, 2018) related to cases in developing countries but not in line with (Vidyattama, 2010) which concluded the negative effects of government spending on economic growth. This insinuates that the local government is one of the actors who has a central role in spurring economic growth by making the right expenditure according to its appropriate portion.

A positive coefficient value of 0.0289 is indicated by investment variables with a slighter degree of implications as compared to the effects of government spending. These results are in line with studies of (Li and Liu, 2005) and (Anwar and Nguyen, 2014). The investment effect empirically shows that the regional economic growth in Indonesia is also supported by foreign factors in terms of investment from outside parties. The effects of the control variables of education and population density with coefficients of 0.0288 and 0.000102, respectively, indicate that the positive contribution of the two variables to economic growth is relatively smaller than the value of government spending.

2.2 Spatial Model of Government Expenditure on Economic Growth

The next analysis step of the model was done by taking into account the external conditions of the region or the effects of interactions between regions namely the spatial autoregressive effects or spatial effects on other variables. This is indicated from the regional interaction factor as one form of development in the spatial model. The results of this relationship are shown in table 4 which illustrates the spatial models in several forms, namely the spatial autoregressive model (SAR), spatial error model (SEM) and spatial durbin model (SDM). The spatial relations concept was simply applied by the concept of neighbourliness as a condition where regions share the same boundary area. On this basis, this model used the weight matrix contiguity.

Model specifications were performed to find out the best model to be interpreted in a spatial model. The first model specification was carried out to specify the appropriate spatial model using the general to a specific approach. This test uses a wald test as a means to restrict general models. The test was based on the Spatial Durbin Model (SDM) in accordance with the steps indicated by (Lesage and Pace, 2009) with a hypothesis if the wald test rejects the null hypothesis that $\theta + \rho\beta = 0$, the SEM model is used and if the Wald test rejects the null hypothesis that $\theta = 0$, the model chosen is the SAR model. Based on the results of the Wald test in table 4 for the hypothesis of $\theta + \rho\beta = 0$, the p-value is 0.000, which rejects the null hypothesis. In other words, the model selected is SDM. Based on the Wald test for the hypothesis of $\theta = 0$, the p-value is 0,000, thus rejecting the null hypothesis, so the best model is the SDM model. The next step was to conduct a test to choose the random effect and fixed-effect models using the Hausman Test based on the SDM model. The results of the Hausman test for the SDM model obtained a p-value of 0,000 which rejects the null hypothesis. Therefore, the best model that can be interpreted is the SDM model with fixed effects.

Table 5. Results of Spatial Model

VARIABLES	*Dependent Variable: ln_rgdp*					
	SAR RE	*SAR FE*	*SEM RE*	*SEM FE*	*SDM RE*	*SDM FE*
ln_ge	0.165*** (0.0137)	0.147*** (0.0126)	0.189*** (0.0158)	0.183*** (0.0152)	0.163*** (0.0142)	0.151*** (0.0132)
ln_fdi	0.0227*** (0.00306)	0.0207*** (0.00285)	0.0258*** (0.00344)	0.0253*** (0.00329)	0.0196*** (0.00325)	0.0195*** (0.00302)
lit_rate	0.0261*** (0.00352)	0.0260*** (0.00332)	0.0238*** (0.00393)	0.0250*** (0.00378)	0.0270*** (0.00365)	0.0252*** (0.00343)
pdens	7.45e-05*** (2.26e-05)	6.71e-05*** (2.18e-05)	0.000103*** (2.30e-05)	9.60e-05*** (2.34e-05)	7.76e-05*** (2.28e-05)	7.23e-05*** (2.21e-05)
Constant	4.044*** (0.368)		6.382*** (0.353)		4.564*** (0.397)	
rho	0.267*** (0.0305)	0.348*** (0.0267)			0.218*** (0.0475)	0.341*** (0.0455)
lambda			0.428*** (0.0611)	0.442*** (0.0582)		
Wln_ge					0.0110 (0.0182)	-0.0111 (0.0173)
Wln_pma					0.0128*** (0.00481)	0.00481 (0.00451)
Wlit_rate					-0.00367 (0.00463)	0.00230 (0.00443)
Wpdens					-9.28e-06 (3.36e-05)	-2.72e-05 (3.21e-05)
Hausman						
Chi2	22.07		0.13		16.50	
Prob>chi2	0.0003		0.9980		0.0002	
Wald Test						
$\rho = 0$	76.73 0.0000	169.94 0.0000			21.00 0.0000	56.20 0.0000
$\lambda = 0$			49.07 0.0000	57.57 0.0000		
$\theta + \rho\beta = 0$					9.10 0.0026	7.90 0.0049
Observations	396	396	396	396	396	396

R-squared	0.287	0.324	0.477	0.473	0.319	0.310
Number of Cross ID	33	33	33	33	33	33

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Sources: Indonesia Central Statistics Agency, Processed

The estimation results shown in Table 5 for the fixed effect SDM model column indicate a spatial autoregressive effect that represents an abundance of economic growth. The empirical results show that the estimated coefficient value for the economic growth of the neighbouring region (ρ) shows positive and significant results of 0.341. This is an indication that when the neighbouring region experiences an increase in economic growth, it will increase the economic growth of the neighbouring region. These results confirm the results of the study by (LeSage and Fischer, 2008) which showed the existence of autoregressive spatial effects in the model. This has an impact on the role of the government in creating regional economic growth centres that are expected to support economic growth in the neighbouring regions.

2.3 Interprovincial Spatial Effect in All-Region

Based on the results of the model specifications, the SDM model with fixed effects is the appropriate basis for interpreting the results of spatial model analysis. Spatial regression results for the SDM FE model show two main results, namely the direct effect representing the internal effects of the area and the indirect effect that shows the effect of spatial interaction with neighbouring regions. Based on (Elhorst and Vega, 2013) the results of spatial effects of abundance between regions referring to the fact that the value of regional internal effects and neighbourly abundance effects on the SDM model is not shown by the parameter coefficient values (β and θ) on the SDM model, but are indicated by the continued estimated value which produces the value of direct effect. This is the value of the effect arising from the internal variables of the area, while the indirect effect is an external effect or abundance of neighbourliness and the total effect is the accumulated value of direct and indirect effects. The estimation results of non-spatial effects caused by regional internal factors are in line with the results shown in Table 4. The results of regional internal effects highlight that government spending, investment, education and population density are positive and statistically significant. In general, the results of spatial effects represented through the presence of external effects from neighbouring regions are determined by the positive and significant value of the variable of government expenditure, investment, and education, while population density has no external impact.

Table 6. The Spatial Effect

VARIABLES	*Direct Effect*	*Indirect Effect*	*Total Effect*
ln_ge	0.1571***	0.0431***	0.2001***
	(0.0128)	(0.0149)	(0.0201)
ln_fdi	0.0211***	0.0120***	0.0330***
	(0.00305)	(0.00413)	(0.00520)
lit_rate	0.0269***	0.0116***	0.0385***
	(0.00328)	(0.00408)	(0.00562)
ln_pdens	7.09e-05***	-4.89e-06	6.61e-05
	(2.32e-05)	(3.40e-05)	(4.73e-05)

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Sources: Indonesia Central Statistics Agency, Processed

Table 6 reveals the direct, indirect, and total effects of the SDM model estimation indicating that the influence of government spending variables on economic growth has a direct effect of a positive and significant result of 0.1570, while the indirect effect also indicates the positive and significant value of 0.0431. This shows the tendency that the influence of government spending on regional economic growth is dominated by internal effects caused by the region amounting to 78.5% of the total effects and external effects or abundance of government spending that is equal to 21.5% of the total effects. In other words, it is conclusive that the expenditure of neighbouring regional governments has a positive contribution to the economic growth of other regions so that the increasing economic growth in a region is also determined by the fiscal policies of other regions. The results of this study are in line with and confirm the results of the study by (Baicker, 2005) and (Ojede, Atems and Yamarik, 2018), which specifically show indirect effects for productive government spending on neighbouring regions.

The effect of investment variables on economic growth shows that there is a positive and significant direct effect with a value of 0.0211, while the indirect effect value indicates a value that is also positive and significant at 0.0120. This highlights that the internal effect of the investment area contributed to 63.93%, and the effect of the abundance originating from the investment in the neighbouring region contributed to 36.37%. These results confirm the results of the previous research conducted by (Ouyang and Fu, 2012), which revealed the existence of interstate spill over for FDI. This condition shows the important role of investment, which not only can increase the internal economic growth of the region but also can encourage the economic growth of the neighbouring regions.

The effect of the education variable on economic growth indicates that there is a positive and significant direct effect with a value of 0.0269, while the indirect effect also indicates a positive and significant value at 0.0116. This shows that the internal effects of the education area contributed 69.87% and the effect of the abundance of education derived from the neighbouring regions contributed to 30.13%. These results confirm the study conducted by (Ramos, Suriñach and Artís, 2010) related to the effects of abundant human capital on regional economic growth. This condition insinuates that urban areas tend to have residents with higher levels of education that will spur the migration process to neighbouring regions. As a result, this will increase the productivity of neighbouring regions. A different result is shown by population density variables that lead to statistically insignificant results. On this basis, it is conclusive that population density does not have an internal and external impact on regional economic growth.

2.4 Interprovincial Spatial Effect Within Region

There is a tendency that spatial interactions will occur between regions with geographical proximity. Therefore, to have a more in-depth analysis of the spatial effects between provinces in a particular region, 33 provinces in Indonesia will be divided into 5 large regions based on the areas of islands surrounding these regions. Estimates in the 5 island areas are based on the previous model specifications indicating that the best model to use is the SDM model with fixed effects. Hence, the estimation results in the 5 regions are based on the results of spatial effects, namely direct, indirect and total effect. The estimation results are shown in Table 7, which shows a comparison of results between provinces in terms of a national scale and between provinces in each region for the 5 major regions in Indonesia.

Table 7. Comparation of Spatial Effect for All Regions and 5 Regions in Indonesia

VARIABLES	Indonesia			Sumatera			Jawa and Bali		
	Direct Effect	*Indirect Effect*	*Total Effect*	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Direct Effect*	*Indirect Effect*	*Total Effect*
ln_ge	0.1571***	0.0431***	0.2001***	0.0717***	-0.0231	0.0486*	0.217***	0.119***	0.337***
	(0.0128)	(0.0149)	(0.0201)	(0.0207)	(0.0215)	(0.0294)	(0.0222)	(0.0319)	(0.0345)
ln_fdi	0.0211***	0.0120***	0.0330***	0.0250***	0.00624	0.0312***	-0.0270***	-0.0231**	-0.0501***
	(0.00305)	(0.00413)	(0.00520)	(0.00626)	(0.00867)	(0.0105)	(0.00553)	(0.0106)	(0.0141)
lit_rate	0.0269***	0.0116***	0.0385***	0.0889***	0.0288***	0.118***	0.0384***	-0.0250***	0.0134
	(0.00328)	(0.00408)	(0.00562)	(0.0100)	(0.0111)	(0.0107)	(0.00502)	(0.00903)	(0.00976)
pdens	7.09e-05***	-4.89e-06	6.61e-05	1.90e-07	-0.000116**	-0.000115	5.97e-05***	6.81e-06	6.65e-05*
	(2.32e-05)	(3.40e-05)	(4.73e-05)	(5.92e-05)	(4.82e-05)	(8.05e-05)	(1.42e-05)	(2.74e-05)	(3.85e-05)
Observation	396	396	396	120	120	120	84	84	84
Group	33	33	33	10	10	10	7	7	7
VARIABLES	Kalimantan			Sulawesi			NT, Maluku and Papua		
	Direct Effect	*Indirect Effect*	*Total Effect*	*Direct Effect*	*Indirect Effect*	*Total Effect*	*Direct Effect*	*Indirect Effect*	*Total Effect*
ln_ge	0.167***	-0.0686*	0.0982***	0.0722***	0.189***	0.261***	0.240***	0.0295	0.270***
	(0.0314)	(0.0390)	(0.0339)	(0.0220)	(0.0481)	(0.0621)	(0.0365)	(0.0382)	(0.0464)
ln_fdi	0.00580	0.0153**	0.0211***	0.0105***	0.0285***	0.0390***	0.0262***	0.000964	0.0272***
	(0.00590)	(0.00774)	(0.00594)	(0.00349)	(0.00777)	(0.00960)	(0.00680)	(0.00470)	(0.00641)
lit_rate	-0.0223	0.0595**	0.0372**	0.00547	0.0265**	0.0319***	0.00931	0.000799	0.0101**
	(0.0216)	(0.0263)	(0.0181)	(0.00524)	(0.0111)	(0.0124)	(0.00574)	(0.00274)	(0.00499)
pdens	0.00344	0.0193***	0.0227***	0.00128	0.00391	0.00519	-0.00213	-0.0102	-0.0123
	(0.00282)	(0.00420)	(0.00394)	(0.00192)	(0.00374)	(0.00527)	(0.00692)	(0.00303)	(0.0271)
Observation	48	48	48	72	72	72	72	72	72
Group	4	4	4	6	6	6	6	6	6

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Sources: Indonesia Central Statistics Agency, Processed

Table 7 reveals that not every region shows the effect of an overflow of regional government expenditure that has an impact on regional economic growth. Significant results that have had the effect of an overflow of regional government spending on regional economic growth are shown in the regions of Java and Bali, Kalimantan, and Sulawesi. This contribution indicates that the greater level of distribution of government spending in some of these regions will encourage better economic growth in the neighbouring regions. This effect denotes that identification of the centre of economic activity for a particular region in a limited area is something that is important to do. This will have an impact on all aspects of the regional economy and that will consequently have a continuous implication on neighbouring regions.

The overflow effect on other variables is shown by investment variables, which tend to have implications for regions outside the economic centre in Indonesia, namely the island of Java. Significant results and positive implications for the effects of this investment overflow are shown in Kalimantan and Sulawesi islands, which empirically indicate that these areas are regions that have a dominant level of natural resources. As a result, these investments tend to have an impact on the mining sector. The island of Java shows significant results but have a negative effect, which means that the grouping of regions that have a relatively small value of investment tends to have a significant impact, while regions that have large investment values tend not to have a significant impact in the grouping of a particular region.

Another variable that indicates the effects of abundance between regions within a region in Indonesia is the educational variable. The effects of educational abundance show that four out of five regions in Indonesia experiencing an abundant effect of education on economic growth. This confirms that mobilization of the population and the attractiveness of certain regions in terms of economic conditions are key factors that contribute to interregional development. Other overflow effects that show significant value on regional economic growth are shown by the results of significant population density for Sumatra and Kalimantan. A significantly different result compared to other regions is shown by the eastern regions of Indonesia which does not show any abundant effects that have implications on the neighbouring regions.

CONCLUSION

The analysis of non-spatial effects and spatial effects on economic growth models that focus on the effects of an overflow of government spending on regional economic growth in Indonesia empirically proves the role of government spending on regional economic growth in Indonesia both non-spatially and spatially. The analysis on the non-spatial model indicates that the contribution of government policies through government spending has a significant effect on increasing regional economic growth in Indonesia. In addition, the effects of investment and education also have a significant role to encourage regional economic growth. The contribution of population density is not empirically proven to affect regional economic growth in Indonesia.

Empirical results from the spatial analysis indicate that there are interdependencies between regions, which actually occur due to interactions between them. The results of the analysis highlight that the effects of neighbourliness shown from the effects of an abundance of economic growth, government spending, investment, education, and population contributed significantly to regional economic growth in Indonesia. This shows that when a region carries out regional policies related to government spending, it will have a significant impact on its neighbouring regions. In addition, an investment from the external parties will also spur the internal growth of the related region and the economic growth of its neighbouring regions. The effect of education is shown by the classification of the quality and quantity of the region inhabitants who have an increasingly good level of education. Therefore, certain areas such as urban areas will experience a more significant increase in the economic growth since it is closely related to the education level of its population that will certainly contribute to the economic growth of the neighbouring regions.

Inter-provincial effects of policy and economic growth in a particular region become one form of analysis to show intra-regional effects of policy and economic growth that are empirically important because the effects of regional interactions tend to cluster at the nearest boundary. Empirical results show that the effects of overflowing government spending on regional economic growth occur only in a few regions, namely Java and Bali, Kalimantan and Sulawesi. This pinpoints that a region that has a high level of distribution of government spending will have an impact on a high level of regional economic growth. It is no wonder that there are few regions that tend to have a higher level of economic growth that dominates the interaction that will have an impact on the overflow of other regions.

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