THE IMPACT OF FISCAL DECENTRALIZATION ON ECONOMIC VARIABLES: EVIDENCE FROM INDONESIA'S PROVINCES

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ABSTRAK

The objective of this paper is to identify the effect of fiscal decentralization on economic growth in Indonesia's provinces. We try to build an empirical modeling method to figure out the desired objective. Since Indonesia had implemented the fiscal decentralization to boost the regional economy, Central Government required for cash transfer to local government to help their local economic growth more rapidly. In this paper, we want to find out the effect of the cash transfer, and the spillover effect between regions for particular years to the Regional GDP, Income Disparity, and Tax Revenue of Central Government. We use panel data set of 33 provinces for the period 2007-2016. The cash transfer is introduced into the regression as an independent variable to measure the effect of fiscal decentralization to the three variables on interest. We find that revenue sharing on tax has a positive effect on Regional GDP including spillover effect from neighbors and Tax Revenue of Central Government while revenue sharing on natural resources is found to be negative. Meanwhile, the insignificant contribution of fiscal decentralization is found to the Income Disparity.

Key Words: Fiscal Decentralization, Spillover Effect, Cash Transfer

1. INTRODUCTION

Indonesia is one of the unique countries in the world. Indonesia is a highly diverse country that comprises over 13,000 islands, 34 provinces, with more than 300 local tribes and 500 local languages. Meanwhile, according to the Ministry of Finance of Indonesia, Indonesia also has a relatively stable economic growth around 5%, annually. It also has a relatively speedy economic recovery after the crisis financial of 1998, from plummeted debt to GDP ratio at roughly 100% to around 30% today.

Since 1998, Indonesia has tried to mitigate bad effects of the centralized economy and switched its constitution to a decentralized economy. Since 1998, the TAP MPR Number 15/1998 and Law 33/2004 about Fiscal Decentralization bring a larger expectation to facilitate local governments has sufficient resources to promote economic growth in its regions. Through these regulations, Central Government provides intergovernmental transfer to local governments by allocating general purpose grant (DAU), specific purpose grant (DAK), natural resources revenue sharing, and tax revenue sharing. The purposes of fund transfer are to stimulate the local economic development and growth, and subsequently generates jobs and reduces local unemployment.

General Purpose Grant/Dana Alokasi Umum (DAU)

As the main part of the fiscal stimulus in the decentralized fiscal system, the objective of General Purpose Grant is to maintain an equal interregional fiscal capability. According to the Law 33/2004, the minimum allocation of this grant in the state revenue is 26% of the net state revenue of each fiscal period.

The total allocation of this grant to every province is based on the fiscal gap and base allocation. The regional fiscal gap is derived from the ratio of every region fiscal gap with the total amount of fiscal gap multiplied by the total amount of allocated grant. A region that has 0 fiscal gaps receives a base amount of allocation. A region that has a negative fiscal gap means that this grant is unnecessary to the corresponding region. The regional base allocation is derived from the total amount of regional government officer salaries in each region.

Specific Purpose Grant (DAK)

The objective of this grant is to provide an additional fund and increase the regional fiscal capacity of a specific region as a part of the nationwide economic priority. Every local government adds a set of technical criteria input as an adjustment in allocating the grant for each region. Technical criteria are settled by the infrastructure in each region and the level of service performed by each region.

Natural Resources Revenue Sharing

Every region has a different endowment of natural resources. This variety leads to an imbalance in fiscal capacity of each region. In establishing equality in fiscal capacity with a different endowment of natural resources among regions, the central government distributes the benefit of this endowment equally to all regions. The sharing portion is adjusted to the General Purpose Grant and Specific Purpose Grant.

However, the central government needs to appreciate regions that give more revenue from its natural resources endowment. This component becomes critical because there were some political moves from unsatisfied sides at several provinces that have abundant natural resources such as East Kalimantan, Nanggroe Aceh Darussalam, Papua, and Riau. With a wide range of natural resources of energy and mineral, these provinces believe that it is reasonable if they get more attention from the central government by receiving a part of the revenue from the exploited natural resources. This revenue sharing becomes more critical because these types of province usually are still considered as a poor province. Some of them argue that the central government only exploits their natural resources and give inappropriate attention to the source of the revenue. They also argue that the revenue from natural resources mostly is allocated to the infrastructure development in the Java island. According to the Law 25/1999, there are four types of natural resources that its revenues have to be shared between central government, provincial governments, and district/municipalities governments: oil and gas, mining products, forestry products, and fishery products. This set of natural resource will be distributed proportionally through the natural resources revenue sharing to the contributed regional.

Tax Revenue Sharing

There are several taxes those are collected by the central and local government. However, according to the Law 25/1999, property tax is the only tax revenue that has to be shared between the central government and local government. Some would

argue that the property tax should be pure local tax since the tax objects are immobile and no spill-over effects generated. However, the central government has strong arguments that the complexities of collecting and assessing this kind of tax cannot be matched by the local government tax apparatus capacity.

Under the tax revenue sharing, the central government redistributes the revenue to both of the central government itself, the regional government, and the surrounding regions. For the property tax revenue, 90% of it will be sent back to the respective local government, while the rest will be distributed evenly to all local governments in Indonesia. For another type of property tax, the right ownership fee, 80% will belong to the respective local government and the rest will be distributed evenly to all local governments.

Failure of Fiscal Decentralization Policy

Figure 1 Percentile Map of GDP per capita in 2007(left) and 2016(right)

However, the decentralization policy has not been effectively helped local governments to have a more balanced economic growth. Indonesia still struggles with the disparity in its economics. The Percentile Map of GDP per capita (picture 1) shows that the growth remains dispersed and not sustain. Jamzuri (2013) exposed that about 1% of Indonesia population has 49.3 % of Indonesia's $1.8 trillion wealth. Hewings, Suahasil, and Sonis found evidence that over the last three decades, Java is the dominant economy having almost 60% of national income (2005). Such a centralized growth became one of the critical issues that sparked a political shift and forced the New Order era stepped down in 1998. On another hand, some rebel group at regions with abundant natural resources has brought this issue politically to establish independence.

These findings intrigue us to conduct a deeper analysis and find out the effect of fiscal decentralization policy. We will look at the way of local governments spend their budget to the capital expenditure and its impact on the regional GDP per capita, income disparities, and Central Government revenue. We will also try to analyze the spill-over effect of local economic growth to its neighbors to capture if shocks at one region may be transmitted to other nearby regions. At the end of this research, we hope we can propose appropriate policies to enhance the fiscal decentralization policy in Indonesia.

2. RESEARCH METHODOLOGY & THEORETICAL FRAMEWORK

2.1. Data

Our panel dataset is on an annual basis, collected from Ministry of Finance and Central Bureau of Statistics of Indonesia. For the capital expenditure, we use its lagged values because infrastructure project usually needs more time before its effect becomes material. While recent development has increased the number of provinces to 34 during the period of observation, we decide to omit the youngest province in Indonesia that was established in 2012. As a result, we come up with the complete dataset of the 2007-2016 research period. It gives us mere 330 observations in total.

Table 1 Variables Description

Variables	Description	Source	Period
Regional GDP	Provincial GDP	Central Bureau of Statistic	2007-2016
regional capital expenditure	Annual capital expenditure	Ministry of Finance	2007-2016
Local tax revenue	Annual local government tax revenue		
Revenue sharing on tax	Annual Central Government's revenue sharing on tax revenue		
Revenue sharing on natural resource	Annual Central Government's revenue sharing on natural resources		
General Purpose Grant	Annual General Purposes Grant		
Special Purpose Grant	Annual Special Purposes Grant		
Central tax revenue	Annual Central Government tax revenue		2008-2016
Income Disparity		Estimation	2007-2016
Dummy Variables for Java Island		Estimation	2007-2016

2.2. Model

We employ multiple linear regression analysis to estimate the contribution of each variable to regional GDP. Initially, by utilizing log-transformed variables in OLS regression and fixed effect for provinces those are located in Java Island, we estimate the following basic model specification (equation 1) to find out the effect of Fiscal Decentralization policy and local government policy in Indonesia:

$$log\_RGDP_t = \beta_1 + \beta_2 * Capital_{Expenditure_t} + \sum_{i=1}^{m} \beta_{3,i} * Fiscal\ Decentralization_{i,t} + \beta_4 * Dummy\_Java + \varepsilon_t \ldots (1)$$

In this research, we found that Spatial Lag of X(SLX) (Equation 2) and Spatial Durbin Error Model (SDEM) (Equation 3) cater these objectives by generating strong explanatory results.

$$log\_RGDP_t = \beta_1 + \beta_2 * Capital_{Expenditure_t} + \sum_{i=1}^{m} \beta_{3,i} * Fiscal\ Decentralization_{i,t} + \sum_{i=1}^{m} \beta_{4,i} * Neighbor\_Effects_{i,t} + \varepsilon_t \ldots (2)$$

$$log\_RGDP_t = \beta_1 + \beta_2 * Capital_{Expenditure_t} + \sum_{i=1}^{m} \beta_{3,i} * Fiscal\ Decentralization_{i,t} + \sum_{i=1}^{m} \beta_{3,i} * Neighbor\_Effects_{i,t} + \lambda_t,$$
$$\text{where } \lambda_t = \delta_t + \rho * \varepsilon_t \quad \ldots(3)$$

Furthermore, in measuring the income disparity in Indonesia, this paper follows an adjusted version of Bonet (2006):

$$I_{i,t} = \frac{PCGDP_{i,t}}{PCGDP_{NAL,t}} - 1$$

As a result, we can distinguish regions that have a higher income than national level and the one who has a lower level.

Several regression assumption tests are conducted to ensure Best, Linear, and Unbiassed Estimator (BLUE) of the estimators. We use Jarque-Bera statistics to check if the residual is normally distributed, Breusch Pagan for heteroscedasticity, and Durbin-Watson statistics to check the autocorrelation of the residuals. To measure the spillover effect from a neighbor, we examine weight matrix based on Moran's I statistics to explain the spatial autocorrelation between provinces in Indonesia appropriately. To test the endogeneity problem, we employ the Hausman test to check the consistency of the model. If endogeneity problem exists, we replace a variable from the model with an Instrumental Variable (IV) and run Two-Stage-Least Square Regression (2SLS). The result and the IV in the 2SLS regression will be tested through Anderson Canonical Correlation LM Statistics from Under-Identification Test. We also ensure if the IVs is powerful by conducting the Weak-Identification test and examining the Cragg-Donald Wald F statistic. All tests are executed using R packages and STATA.

3. RESULT

3.1. Data Exploration

In this paper, we try to measure the role of fiscal decentralization policy to several key indicators in Indonesia. We also take into account the role of local government policy, such as spending on infrastructure from the previous period. Picture 2 shows the historical data of these set of policies, as well as annual tax revenue of central and local governments and income disparity. In general, cash transfer, capital spending, and tax revenue are showing a gradual increase. A higher slope of tax revenue compared to the cash transfer and capital spending makes the policy from local and Central Government has a critical role in promoting revenue. However, decreasing income disparity cannot be easily interpreted. The distribution of GDP per capita shown by Picture 1 reveals the persistence of imbalance economy in Indonesia.

Figure 2 Historical Data

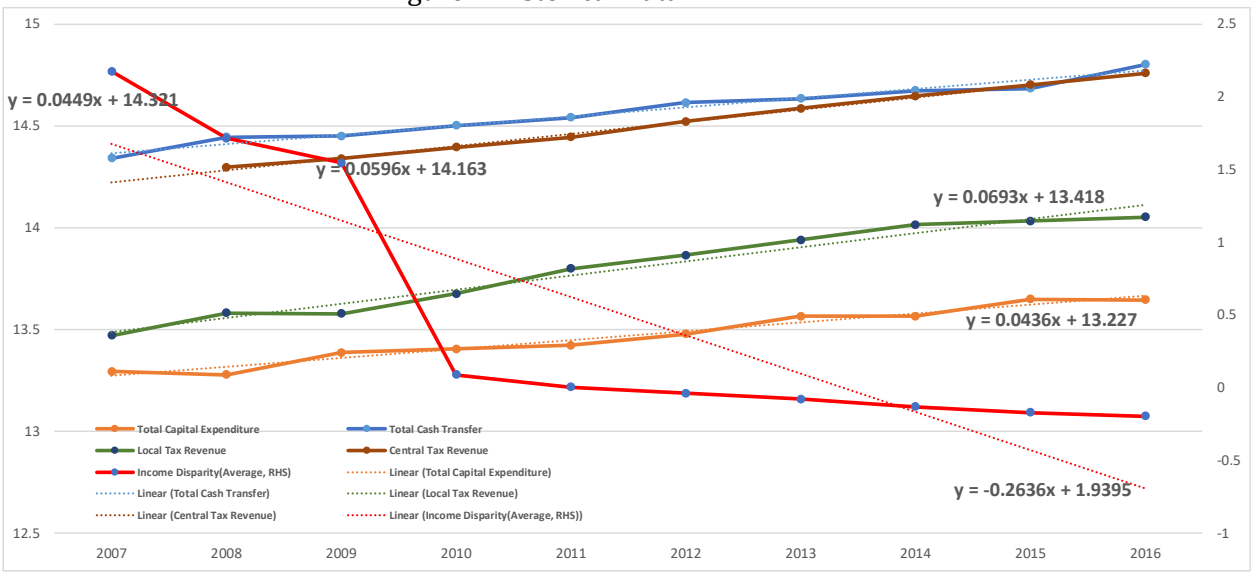

Figure 3 Distribution of Regional GDP

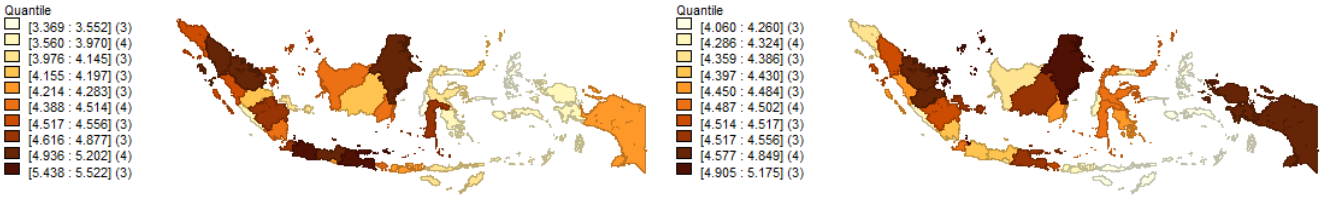

Figure 3 gives a clear distinction between the level of regional growth of GDP per capita between 2007 and 2016. In 2007, several provinces grew rapidly. Provinces in Java island and some others such as Riau, Sumatera Utara, and Kalimantan Timur were in this group. However, only few provinces that remained at higher consistently. These provinces such as Nanggroe Aceh Darussalam, Sumatera Utara, and Kalimantan Timur, they seem enjoyed a period of the boom of commodities prices between 2007-2009. Other provinces such as Kalimantan Barat, Nanggroe Aceh Darussalam, and Papua Barat got their percentile dropped drastically. There are also several provinces that remained at a lower percentile such as Nusa Tenggara Timur, Gorontalo, Sulawesi Tengah, and both Maluku provinces.

Figure 3 reveals the fact that several provinces highly depends on the commodities prices with a high level of sensitivity to commodities price. During 2007-2009 when the commodities prices were at a higher level as shown in Figure 5, those three provinces were at the top percentile. Consistently, Figure 6 and Figure 7 reveal that several provinces with abundant natural resources, energy, mineral, plantation, and fisheries also enjoy a higher level of growth in revenue sharing on tax, customs, and natural sharing. Meanwhile, during the period of declining commodities prices between 2012-2016, the provinces those mainly were benefited from energy and mineral sectors have a lower sharing of revenue while the group of provinces that

have a stronger sector in the horticulture and fisheries remains stable because prices in these sectors are stable.

Figure 4 Boxplot of the Growth Regional GDP 2007-2016

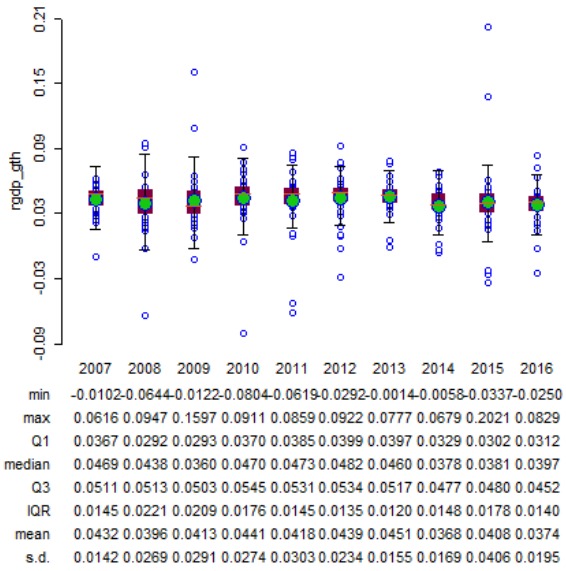

Figure 5 Commodities Prices 2007-2016

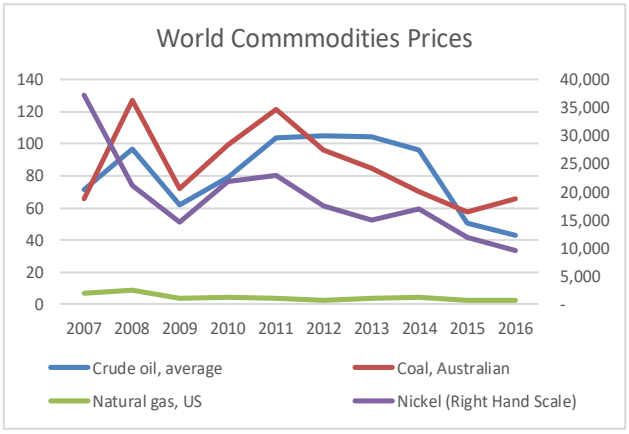

Figure 6 Boxplot of the Growth of Revenue Sharing on Natural Resources 2007-2016

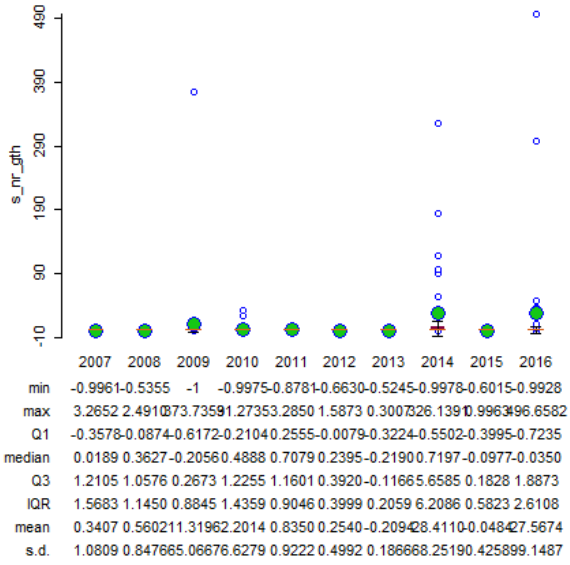

Figure 7 Boxplot of the Growth of Revenue Sharing on Tax and Customs 2007-2016

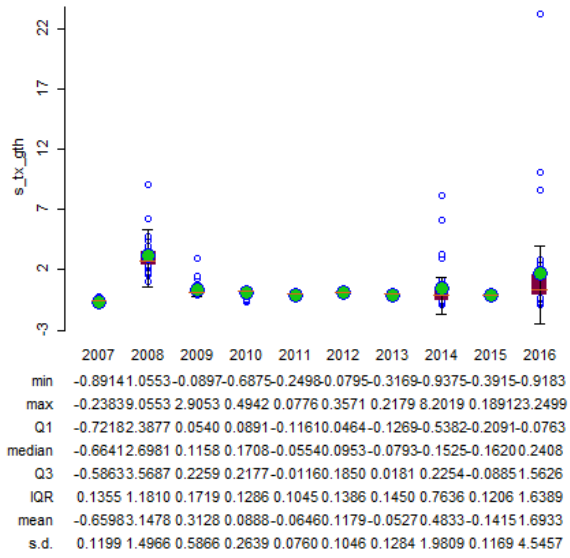

Figure 8 Boxplot of the Growth of Special purpose Grant 2007-2016

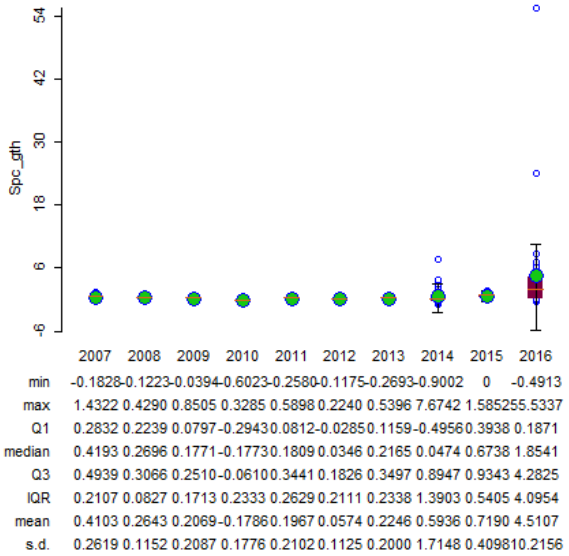

Figure 9 Boxplot of the Growth of General Purpose Grant 2007-2016

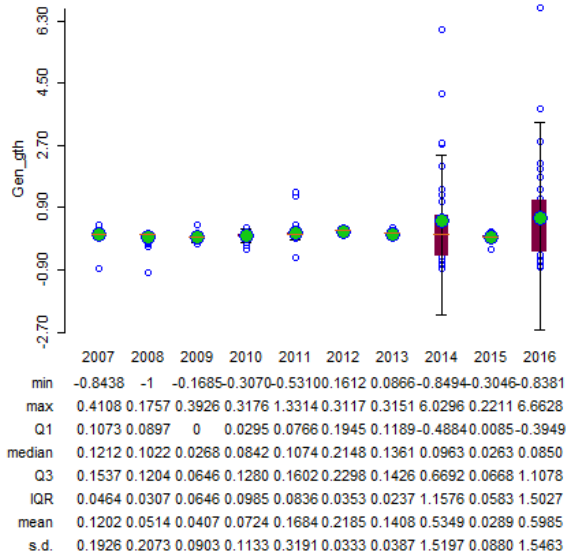

Figure 8 reveals percentage change of Special Purpose Grant and Figure 9 reveals percentage change of General Purpose Grant. At Figure 8, the capital city of Indonesia is shown that it almost never receives this Grant because the capital city is already self-sufficient. In addition, at Figure 8 also tells us that several there are several outliers with respect to the growth of General Purpose grant. Since 2014, the new government has imposed additional funding to the region that has villages. While in Figure 9, there is no big difference among every province where outliers are several provinces that has unique such as Yogyakarta and Papua Barat those have a special history and receive different treatment compared to other provinces.

3.2. Effect of Fiscal Decentralization Policy to Regional Gross Domestic Production

3.2.1. Basic Model

As shown in column 1 Table 2, we utilize OLS regression to reveal the effect of Fiscal Decentralization on Regional GDP. In the basic OLS regression, we add dummy variable of Java and non-Java island. We found that with p-values of Jarque Bera test on the normality of error, Breusch Pagan on Homoscedasticity, and Durbin Watson in error autocorrelation in a sequence 3.183e-07, 3.789e-16, and 6.592e-07, it appears that there are problems of heteroscedasticity and autocorrelation of error in this model. Then, we generate robust standard errors as appears in column 2 Table 2. This process results in a lower significance level of a dummy variable. Consequently, we omit the dummy variable in the reduced model.

Table 2 OLS regression result

	Basic	Robust	Reduced
	(1)	(2)	(3)
jawa_flag	0.086*	0.086	
	(0.051)	(0.110)	
Capital Expenditure (t-1, Log)	0.338***	0.338***	0.345***
	(0.057)	(0.085)	(0.057)
FD on Tax Revenue (Log)	0.192***	0.192**	0.231***
	(0.050)	(0.076)	(0.044)
FD on Natural Resources (Log)	0.018	0.018	0.006
	(0.017)	(0.019)	(0.016)
FD on General Grant (Log)	-0.018	-0.018	-0.014
	(0.014)	(0.013)	(0.014)
FD on Special Grant (Log)	-0.012	-0.012	-0.013
	(0.010)	(0.009)	(0.010)
Constant	1.359**	1.359	0.949
	(0.635)	(0.988)	(0.589)
Observations	330		330
R2	0.458		0.453
Adjusted R2	0.448		0.445
Residual Std. Error	0.275		0.276
F Statistic	45.481***		53.695***

Note: *p<0.1; **p<0.05; ***p<0.01

Column 3 Table 2 shows several independent variables that influence changes in regional GDP. The role of the policy of local government through capital expenditure and fiscal decentralization on tax revenue sharing are statistically significant. Every percentage of change in capital expenditure contribute to 0.345 percent change in regional GDP, while one percent change in Fiscal Decentralization, contribute to 0.23 percent of improvement in regional GDP. However, with the value of adjusted R^2 at 0.445 explains that there is a possibility that this model could be improved by adding other variables or change the structure of the model.

3.2.2. Spatial Autocorrelation

From the Figure 3, we found an imbalance of growth in Indonesia. Nazara (2010) support this idea and believes that the spatial distribution of economic resources in Indonesia follows the distribution of demographic and economic activities. To gain deeper supporting facts of the spatial distribution on our observation, we analyzed the spatial autocorrelation by generating Moran's I statistics with various weight matrices of K-nearest neighbors for 5, 10, and 15 neighbors and Great Circle Distance with 2432, 4000, and 6000 kilometers of distance between provinces.

By figuring out the Moran's I statistics to measure the spatial distribution of every variable in the model, we tried to identify weight matrices those give the best

explanation of spatial distribution for every variable at 2007 as the base year. As we can see at Table 3, we obtain various result for every weight matrix. For the regional GDP, there is no clear distinction between K5, K10, K15 which give significant results. However, we choose K5 for the Regional GDP because it gives the highest magnitude among others. For the Capital Expenditure, we obtained K5 weight matrix. For Fiscal Decentralization Policies, we also found mixed results. For the Tax Revenue Sharing and Special Purpose Grant, we found K5 weight matrix, while for Revenue Sharing on Natural Resources and General Purposes Grant, we found K15 and K10 sequentially. This outcome leads to a conclusion that we may use various weight matrices in the spatial model.

Table 3 Moran's I statistics for Regional GDP model

W-Matrices	Regional GDP 2007	Capital Expenditure 2007	Revenue Sharing on Tax and Custom Revenue 2007	Sharing on Natural Resources Revenue 2007	General Purpose Grant 2007	Special Purpose Grant 2007	Sum of Moran's I Statistics
K5	**0.11257**	**0.113788**	**0.144116**	0.0910803	-0.11799	**-0.0699231**	0.1598532
	0.069*	**0.073***	**0.041****	0.104	0.142	**0.047****	
K10	**0.0971946**	0.0124274	**0.0530931**	-0.0560865	**0.054609**	0.0199012	0.1687114
	0.026**	0.198	**0.093***	0.372	**0.0083*****	0.241	
K15	**0.0285518**	**0.0295514**	**0.0264218**	**-0.0736042**	**-0.068003**	-0.0348972	-0.1215308
	0.092*	**0.084***	**0.09402***	**0.067***	**0.138***	0.442	
W2432	-0.0811829	-0.136639	-0.0650156	-0.0399784	0.0721771	-0.0198678	-0.1338676
	0.4	0.218	0.385	0.485	0.212	0.389	
W4000	-0.0614044	**0.0774893**	-0.0932823	0.0390724	-0.149172	**-0.0547151**	-0.3195014
	0.372	**0.09****	0.216	0.163	0.033**	**0.079***	
W6000	-0.0550391	0.0164826	-0.0254032	0.0164106	-0.049533	-0.0313505	-0.1449152
	0.305	0.134	0.412	0.141	0.38502	0.481	

Another important analysis is to find the correlation between a region and its surrounding regions. According to Table 3, with the value of Moran's I statistics for the regional GDP of 0.11257, we find that there is a global positive correlation between a region and its surrounding area. Positive correlation reveals that a province with a low regional GDP is surrounded by provinces those have low regional GDP. This result implies that the assumption of global homogeneity does hold.

Table 4 Lagrange Multiplier Test

	full		reduced	
	statistics	p-value	statistics	p-value
LMLag	0.4147	0.5196	0.33685	0.5617
LMErr	1.1914	0.275	0.28865	0.5911
LMLag Robust	0.10463	0.7463	0.06599	0.7973
LMErr Robust	0.88135	0.3478	0.017782	0.8939
SARMA	1.296	0.5231	0.35464	0.8375

Furthermore, to assess the global spillover effect, we measure the Moran's I statistics for the dependent variable and other covariates. The result from Table 4 utilizes K5 weight matrix as the most appropriate weight matrix in this model as a result of our analysis on Table 3. Lagrange Multiplier Test (Table 4) reveals the insignificance of spatial lag and spatial error parameter. Conclusively, there is no clear global spillover obtained from the regional GDP. As a result, we use Spatial Lag on X

(SLX) and Spatial Durbin Error Model as models to conduct analysis on the local spillover.

3.2.3.Spatial Lag on X Regression

Table 5 SLX Regression Result

	SLX Full		SLX Reduced	
	OLS	Robust	OLS	Robust
	(1)	(2)	(3)	(4)
Capital Expenditure (t-1, Log)	0.352***	0.352***	0.354***	0.354***
	(0.061)	(0.085)	(0.060)	(0.083)
FD on Tax Revenue (Log)	0.251***	0.251***	0.251***	0.251***
	(0.049)	(0.084)	(0.049)	(0.082)
FD on Natural Resources (Log)	0.002	0.002	0.002	0.002
	(0.016)	(0.018)	(0.015)	(0.018)
FD on General Grant (Log)	-0.013	-0.013	-0.013	-0.013
	(0.013)	(0.012)	(0.013)	(0.012)
FD on Special Grant (Log)	-0.015	-0.015*	-0.015	-0.015*
	(0.010)	(0.008)	(0.010)	(0.008)
Neighbor(5) Capital Expenditure (t-1, Log)	0.189**	0.189	0.207**	0.207*
	(0.096)	(0.128)	(0.091)	(0.114)
Neighbor(5) FD on Tax Revenue (Log)	-0.138*	-0.138	-0.140*	-0.140
	(0.078)	(0.138)	(0.078)	(0.128)
Neighbor(15) FD on Natural Resources (Log)	-0.187***	-0.187***	-0.204***	-0.204***
	(0.051)	(0.064)	(0.047)	(0.063)
Neighbor(10) FD on General Grant (Log)	-0.031	-0.031		
	(0.037)	(0.041)		
Neighbor(5) FD on Special Grant (Log)	-0.0005	-0.0005		
	(0.018)	(0.019)		
Constant	2.596**	2.596	2.157**	2.157
	(1.062)	(2.181)	(0.915)	(1.632)
Observations	330		330	
R2	0.488		0.487	
Adjusted R2	0.472		0.474	
Residual Std. Error	0.269 (df = 319)		0.269 (df = 321)	
F Statistic	30.454*** (df = 10; 319)		38.117*** (df = 8; 321)	

Note: *p<0.1; **p<0.05; ***p<0.01

In SLX model, we measure the effect of changes in independent variables at neighbors. As shown by Table 5, in the full model of SLX (column (1) and (2)), we add all effect of changes in every covariate from neighbors. Meanwhile, in the reduced model (column (3) and (4)), insignificant neighbor's covariates are omitted. To test the robustness of these results, we conduct Breusch Pagan Test. P-values of the test of 0.03298 for the full model and 0.0314 for the reduced model show the existence of heteroscedasticity problem. As a treatment, we generate the robust standard error as

shown in column (2) and (4) at Table 5. To test if spatial autocorrelation problem still exposed in SLX model, we conduct Moran's test for spatial autocorrelation. With p-values for the full model is 0.663 and 0.663 for the reduced model, the SLX model in this paper has an ability to manage the spatial autocorrelation. Furthermore, the p-values of 0.928 and 0.95 for the full and reduced model, tell us that the spatial heterogeneity is not statistically significant. The increasing adjusted R2 in SLX model supports the fact that reduced SLX model can explain changes in Regional GDP better than OLS.

3.2.4. Spatial Durbin Error Model

Table 6 SDEM Regression Result

	Full (1)	Reduced (2)
Capital Expenditure (t-1, Log)	0.351*** (0.060)	0.351*** (0.059)
FD on Tax Revenue (Log)	0.252*** (0.048)	0.252*** (0.048)
FD on Natural Resources (Log)	0.003 (0.015)	0.003 (0.015)
FD on General Grant (Log)	-0.013 (0.013)	-0.013 (0.013)
FD on Special Grant (Log)	-0.016 (0.010)	-0.015 −0.01
Neighbor(5) Capital Expenditure (t-1, Log)	0.186** (0.092)	0.206** (0.088)
Neighbor(5) FD on Tax Revenue (Log)	-0.147* (0.075)	-0.147* (0.075)
Neighbor(15) FD on Natural Resources (Log)	-0.187*** (0.048)	-0.203*** (0.044)
Neighbor(10) FD on General Grant (Log)	-0.029 (0.035)	
Neighbor(5) FD on Special Grant (Log)	-0.003 (0.017)	
Constant	2.720*** (0.997)	2.267*** (0.869)
Observations	330	330
Log Likelihood	-29.526	-29.941
sigma2	0.070	0.070
Akaike Inf. Crit.	85.051	81.881
Wald Test (df = 1)	0.367	0.311
LR Test (df = 1)	0.312	0.279

Note:*p<0.1; **p<0.05; ***p<0.01

Due to a relatively low adjusted R2 in SLX models, we decided to test the role of spatial error component in the model by generating Spatial Durbin Error Model. As shown in Table 6, we omit insignificant variables, which are Fiscal Decentralization policy on General Grant to 10 nearest neighbors and Fiscal Decentralization on Special Grant to 5 nearest neighbors. With a lower statistic for the Akaike Information Criterion between these models, we can justify that the reduced model is better.

If we compare between the full model and the reduced model, there is no clear distinction among them. While the Wald test give similarity in the significance among these models, the Likelihood Ratio test indicates that the Full Model explains our observations better. However, the Akaike Information Criterion statistics describes the Reduced Model is more efficient than the Full Model.

Furthermore, there is no substantial difference between SDEM model and SLX model. In the SDEM model, only the intercept of the models is different while other variables are mostly similar.

3.2.5. Model Selection

There is no substantial difference between the R2 of regular model of OLS and spatial model of SLX. Since SDEM model is generated from Generalized Method of Moments, while SLX and OLS is a linear model, scrutinizing the adjusted R2 is not relevant. We compare Log Likelihood test, Akaike Information Criterion, and Bayesian Information Criterion to get the most relevant model. As shown in Table 7, the full model of SDEM seems the best. However, since the lambda as the coefficient for error is not significant, SDEM model turns to irrelevant. Consequently, a full model of SLX becomes the selected model.

Table 7 Model Comparison

	OLS		SLX		SDEM	
	full	reduced	full	reduced	full	reduced
	1	2	3	4	5	6
Log Likelihood	-39.22164	-40.67902	**-39.2216**	-40.67902	-29.5256	-29.9406
AIC	94.44327	95.35803	**94.44327**	95.35803	85.05124	81.88128
BIC	124.836	121.9517	**124.836**	121.9517	134.4394	123.6713
Lambda (statistics)	NA				**-0.0573**	-0.06239
Lambda (p-values)	NA				0.57634	-0.21396

3.2.6. Results

Table 5 shows a consistent result between the non-spatial OLS and the SDEM model result. The role of Capital Expenditure from previous period is significant with the value of 0.354. This result identical with Mankiw, Romer, and Weil (1992) say that human and physical capital have strong explanation power to economic activities. Meanwhile, the Revenue Sharing from Tax Revenue is also significant at the value of 0.251. This result provides evidence that a high revenue sharing of tax results from a

high tax revenue from previous period. On another hand, tax revenue explains economic activities in the region. As a result, a rich region will receive a higher revenue sharing on tax from the central government. Another interesting finding, the coefficient of Fiscal Decentralization on Special Grant is slightly higher in SLX model compared to the similar covariate obtained from non-spatial OLS model, it becomes significant in the SLX model. It seems that the objective of Fiscal Decentralization policy on Special Grant to provide additional funds and increase fiscal capacity in specific regions has negative effect to the development in the region itself. This policy seems like a double edge sword that is not only improving the fiscal capacity of a region, but also reducing the incentive of regions to spend efficiently and to focus their budget to stimulate development.

There are two significant covariates of spatial components in the SLX model. First, the lagged values of Capital Expenditure from the 5 nearest neighbors. With the value of 0.207, it justifies that an infrastructure spending at a close neighbor has a positive spillover effect. Second, the Fiscal Decentralization policy on Natural Resources from 15 nearest neighbors. The coefficient of -0.204 for this covariate illustrates that an increase of the activity related with natural resources in a province can give a strong negative effect to many provinces even though a large distance lies among them. There is a probability that provinces with abundant natural resources can absorb economic resources from provinces those are surrounding them.

The SLX model in this paper proves the existence of spillover effect of Fiscal Decentralization policy to surrounding regions. However, a relatively low adjusted R2 (0.474), there is a possibility of covariates with higher explanatory power. While development of physical capital in a region could contribute positively to surrounding neighbors, on another hand, a substantial economic activity in another region could give negative effect to neighboring regions.

3.3. Effect of Fiscal Decentralization Policy on Income Disparity

3.3.1. Basic Model

As shown in column 1 Table 8, we utilize OLS regression to reveal the effect of Fiscal Decentralization on Income Disparity. We add a dummy variable to distinguish provinces those are located in the Java and outside of Java island. We found that with p-values of Jarque Bera test on the normality of error, Breusch Pagan on Homoscedasticity, and Durbin Watson in error autocorrelation in a sequence 2.2e-16, 4.855e-14, and 8.295e-15, it appears that there is a problem in this model. Then to solve problems of heteroscedasticity and autocorrelation of error, we generate robust standard errors as appears in column 2 Table 8. This process results in a lower significance level of dummy variable and local tax revenue. We find that the role of the policy of local government through capital expenditure, fiscal decentralization policy through revenue sharing from tax, and distinguishing the location of provinces are statistically significant. However, with low adjusted R2, it seems that this model

has weak explanatory power in explaining the variation in income disparity. Furthermore, we exploit the spatial model for this research question.

Table 8 OLS Regression on Income Disparity

	OLS	OLS robust
Dependent variable	(1)	(2)
jawa_flag	0.803***	0.803**
	(0.233)	(0.387)
Local Tax Revenue	-1.421***	-1.421***
	(0.216)	(0.455)
Capital Expenditure (t-1)	-0.435*	-0.435**
	(0.249)	(0.221)
Total Fiscal Decentralization	(0.428	(0.428
	(0.308)	(0.377)
Constant	27.934***	27.934***
	(3.163)	(8.151)
Observations	330	
R2	0.349	
Adjusted R2	0.341	
Residual Std. Error	1.261 (df = 325)	
F Statistic	43.537***(df=4; 325)	
Note:	*p<0.1; **p<0.05; ***p<0.01	

3.3.2. Spatial Autocorrelation

Table 9 Moran's I statistics for Income Disparity Model

W-Matrices	Income Disparity 2007	Fiscal Decentralization 2007	Capital Expenditure 2006	Local Tax Revenue 2007	Sum of Moran's I Statistics
K5	**0.318421**	-0.0026827	**0.113788**	**0.19164**	**0.6211663**
	0.004* **	0.345	**0.073***	**0.012****	
K10	**0.258732**	0.052218	0.0124274	**0.102697**	0.4260744
	0.002* **	0.1	0.198	**0.009*** **	
K15	**0.177454**	-0.026844	**0.0295514**	**0.0612017**	0.2413631
	0.001* **	0.359	**0.084***	**0.029****	
W4000	0.66877	-0.0121955	-0.136639	-0.040128	0.4798075
	0.223	0.423	0.218	0.464	
W6000	-0.0659265	**-0.13818**	**0.0774893**	-0.0263314	-0.1529486
	0.35	**0.06***	**0.09*** **	0.429	
W9600	-0.0559959	-0.645578	0.0164826	-0.0399411	-0.7250324
	0.306	0.217	0.134	0.465	

By figuring out the Moran's I statistics to measure the spatial distribution of every variable in the model, we tried to identify weight matrices those give the best explanation of spatial distribution for every variable at 2007 as the base year. As we can see at Table 9, we obtain various result for every weight matrix. For the regional

GDP we choose K5 means that nearest 5 closest provinces have spillover effect to the corresponding province if any changes in Regional GDP occurs in surrounding provinces. For the Fiscal Decentralization Policy, we obtain W6000 means that within the distance of 6000 kilometers from the corresponding province, there is spillover effect if there exist any changes to the Fiscal Decentralization policy at surrounding provinces. For Lagged Capital Expenditure and Local Tax Revenue, we find mixed results. However, since the dependent variable has a significant and appropriate magnitude, we decide to use Spatial Auto Regressive model (SAR) as our spatial model.

As shown at the column (3) Table 10, the spatial lag value of income disparity is incorporated in the Spatial Autoregressive Lag (SAL) model. To test the robustness of SAL model, we conduct the Breusch-Pagan Test for Heteroscedasticity and Moran's test for spatial autocorrelation. With the p-value of BP Test and Moran's test in a row are 9.003e-10 and 0.551, a problem of heteroscedasticity exists, while null hypothesis of error autocorrelation is accepted. Thus, to handle the heteroscedasticity problem, we follow a strategy in Ertur and Koch (2007) by running multi-step GM/IV estimation of a linear Cliff and Ord-type to generate robust standard error regression for SAL model (shown by column (4) Table 10).

Table 10 Model Comparison for Income Disparity

	OLS	OLS robust	SAL	SAL robust
Dependent variable	(1)	(2)	(3)	(4)
jawa_flag	0.803***	0.803**	0.804***	0.795343***
	(0.233)	(0.387)	(0.231)	(0.218488)
Local Tax Revenue	-1.421***	-1.421***	-1.421***	-1.420566***
	(0.216)	(0.455)	(0.215)	(0.255516)
Capital Expenditure (t-1)	-0.435*	-0.435**	-0.434*	-0.441174*
	(0.249)	(0.221)	(0.247)	(0.173377)
Total Fiscal Decentralization	(0.428	(0.428	(0.428	-0.414038
	(0.308)	(0.377)	(0.307)	(0.296754)
Constant	27.934***	27.934***	27.918***	27.821713***
	(3.163)	(8.151)	(3.197)	(4.723608)
Observations	330		330	330
R2	0.349			
Adjusted R2	0.341			
Log Likelihood	-542.3816		-542.3809	-542.2984
sigma2			1.567	1.2511
Rho				0.038446
Akaike Inf. Crit.	1096.763		1,098.76	1096.8
Residual Std. Error	1.261 (df = 325)			0.1681
F Statistic	43.537***(df=4; 325)			
Note:	*p<0.1; **p<0.05; ***p<0.01			

Furthermore, we analyze the result of SAL model estimation. Since the SAL model is not a linear model, it cannot be interpreted directly. According to LeSage(2014), a scalar products of the coefficient is necessary. Thus, we generate the direct and indirect effect of every variables as shown by the Table 11. Table 11 reveals that the

Fiscal Decentralization policies does not contribute significantly to reduce the income disparity within provinces in Indonesia. We also find that province in Java Island is roughly 80% richer than national average. On another hand, a higher capital expenditure on previous period and local tax revenue significantly help to reduce the income disparity.

Table 11Direct and Indirect Effect of SAL Model

Variable	Direct	Indirect	Total
Jawa_flag	0.8035***	0.0026	0.8061***
Local Tax Revenue	-1.4207***	-0.0046	-1.4252***
Capital Expenditure (t-1)	-0.4341*	-0.0014	-0.4355*
Total Fiscal Decentralization	-0.4279	-0.0014	-0.4293

3.4. Effect of Fiscal Decentralization Policy on Tax Revenue of the Central Government

Table 12OLS Regression on Tax Revenue

	OLS (1)	Cochrane Orcutt (2)
Capital Expenditure (t-1, Log)	0.390***	0.393***
	(0.044)	(0.039)
Local Tax Revenue (log)	0.544***	0.500***
	(0.032)	(0.027)
FD on Tax Revenue (Log)	0.214***	0.228***
	(0.043)	(0.040)
FD on Natural Resources (Log)	-0.031***	-0.038***
	(0.012)	(0.011)
FD on General Grant (Log)	0.004	0.006
	(0.009)	(0.008)
FD on Special Grant (Log)	0.002	0.002
	(0.007)	(0.007)
jawa_flag	0.185***	0.213***
	(0.039)	(0.034)
Year	0.003	0.007*
	(0.005)	(0.004)
Constant	-6.361	-13.625*
	(9.702)	(7.881)
Observations	297	297
R^2	0.907	0.9321
Adjusted R^2	0.905	0.9302
Residual Std. Error	0.175 (df = 288)	0.1694(df = 287)
F Statistic	352.683*** (df = 8; 288)	492.7*** (df = 8; 287)

*Note:*p<0.1; **p<0.05; ***p<0.01*

As shown in column 1 Table 12, we utilize OLS regression to reveal the effect of Fiscal Decentralization policy to tax revenue of Central Government. We add a dummy variable to distinguish provinces those are located in the Java and outside of Java island. We found that with p-values of Jarque Bera test on the normality of error, Breusch Pagan on Homoscedasticity, and Durbin Watson in error autocorrelation in

a sequence 0.2972, 0.004683, and 3.636e-14, it appears that this model has heteroscedasticity and error autocorrelation. Then to solve problems of heteroscedasticity and autocorrelation of error, we run Cochrane-Orcutt procedure to generate a model that its error is not autocorrelated as shown in column 2 Table 12. With a similar significance level of every variable and a high adjusted R2 at the level of 0.9302, this model proves it has strong explanatory power in explaining the variation in Central Government tax revenue.

Table 12 shows that a combination of local government policy and fiscal decentralization policies have strong explanatory power to tax revenue obtained from the corresponding region. With coefficient of Capital Expenditure from the previous period at the value of 0.393, it reveals that the importance of investment of the local government on physical capital to support the economic activities. Furthermore, the Local Tax Revenue also plays important role. With a coefficient at magnitude of 0.500, Local Tax Revenue explains the economic activities in the region has a strong explanation power to the central government tax revenue. This fact proves that the local tax revenue and central government revenue do not have any reciprocal effect. On another hand, Fiscal Decentralization policies have mixed effects. One percent change of revenue sharing on tax revenue contributes to 0.228 percent change in central government tax revenue. While the revenue sharing on natural resources contributes negatively to the tax revenue of central government at a small magnitude of -0.038. This result explains that a province with abundant natural resources may rely their economic on the natural resources related activities. Interestingly, when we put dummy variable to distinct provinces located in the Java island and outside of Java island, we obtain that in general provinces in Java Island have higher contribution to the tax revenue of central government.

4. Discussion

This research tries to investigate the effect of fiscal decentralization on Regional GDP per capita and spillover from its neighbor through basic OLS, SLX, and SDEM Regressions, while Income Disparity and tax revenue of Central Government is analyzed through basic OLS. The log transformation form leads to the interpretation that every 1% change in covariates will result as much as the coefficient for corresponding covariates.

The first research question is about the effect of fiscal decentralization to the regional GDP in 33 provinces in Indonesia. Capital expenditure and spillover from neighbors is 99% statistically significant. This result shows a possibility that for 1% change in the previous period of capital expenditure at the region and its neighbors will result in a change of regional GDP at the value of 0.354% and 0.207% at the corresponding regions. On another hand, 1% increase in cash transfer related to fiscal decentralization leads to a 0.251% increase in regional GDP. This is obvious because the cash transfer on tax revenue sharing depends on the taxable regional economic activities. Furthermore, the fiscal decentralization policy in natural resources revenue sharing has a negative relationship with the regional GDP with a -0.204% of magnitude. However, with the low adjusted R2, there is a possibility that the model can have better explanatory power if it also includes local government spending on other sectors such as health and education.

Secondly, we analyze the effect of fiscal decentralization policy on income disparity in Indonesia. By adjusting formula of income disparity in Bonet (2006), we can distinguish between provinces with higher annual GDP and the lower ones. The significant and negative effect of local tax revenue at the value of -1.157 shows us that tax policy in most regions in Indonesia contributes to a lower regional income. Meanwhile, the negative effect on capital expenditure describes that capital spending across the country by the local government has failed to collaborate with other production factors in generating higher income. We also find that provinces located in Java Island tend to have a higher income than other provinces. However, the insignificant effect of fiscal decentralization policy proves that the Central Government needs to evaluate this policy to support the development in provinces as the primary objective. Meanwhile, with a low adjusted R2, it seems that adding human development covariates will result in a deeper analysis.

Lastly, we measure the impact of cash transfer through fiscal decentralization policy to the income tax and value-added tax revenue of the Central Government. As the main result, we found that fiscal decentralization policy at tax revenue sharing has a significant and positive effect on the tax revenue at a magnitude of 0.228. On another hand, cash transfer of revenue sharing from natural resources revenue has a negative and significant correlation at -0.038. Another significant and positive effect from capital expenditure shows that infrastructure spending has a critical role in the regional economy and contribute to a higher tax revenue at the level of 0.393. Similar with our findings in two research questions, we found that provinces at Java island on average, contribute to a 21.3% higher of tax revenue of Central Government. As a conclusion, with a high adjusted R2, at the level 93.02, it seems that this model has strong explanatory power in explaining the variation of regional tax revenue in Indonesia.

5. Conclusion

In this research, we measure the impact of fiscal decentralization policy to Regional GDP, income disparity and tax revenue of Central Government. First, Fiscal Decentralization has various effects on the variable in the interest of our research. We find that the sharing on tax revenue of Central Government gives positive and significant effect to Regional GDP and tax revenue of Central Government. Furthermore, the positive spillover effect from neighbor to Regional GDP implies that an increase in revenue at neighbors contributes to Regional GDP. The next is the effect of revenue sharing on natural resources. This policy has a negative effect on tax revenue the Central Government. This policy also has negative spillover effect from neighbors. This result implies that there is a possibility that natural resources sector has a negative effect on other sectors of the economy. On another side, the special grant has a negative effect to Regional GDP which implies that this grant is fluctuating and depends on the Regional GDP with an objective to cover a lower level of Regional GDP. Furthermore, a total cash transfer to local government remains insignificant to the variation of income disparity. With these various results on the effects of fiscal decentralization policy, we believe that it is necessary to improve this policy in promoting local economic growth and reducing the imbalance of economy.

Secondly, we find that the role of capital expenditure is significant. In Regional GDP and Tax Revenue of Central Government, we find the positive effect of this policy on local governments. We also find this positive spillover effect from neighbors. This result reveals that capital spending helps to boost economic locally as well as to neighbors. While in estimating the income disparity we find another direction. There is a possibility that this negative effect comes from imprecise infrastructure development strategy. The local government also may prioritize human development sector, because based on Human Development Report 2016, Indonesia was ranked at 113, while the number of population is around 261 million at the corresponding year. We also find that provinces in Java Island have a higher economic level. This is because Java island is well known as the center of economic activities.

In this research, we only emphasize the policy of the government in infrastructure. For future research, we suggest putting other policies, especially sectors in human development, such as education or health sector. We believe that these additional policies will give a deeper and more comprehensive analysis.

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