The Impact of the flypaper effect on the Province of Bangka Belitung in the Context of Spatial Relationships

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Abstract: *Local governments must ensure proper financial management by carefully planning the allocation of regional funds (such as DAU/DAK/DBH) and expenditures (BELANJA), as well as maximizing effective and efficient income (PAD). However, the funds received by the regions from the central government are being used in an uneven manner, referred to as the flypaper effect. Despite this, the local government's expenditures have failed to close the fiscal gap and the amount of regional funds being used is greater than the amount of regional income. This study trains to examine the presence of the flypaper effect in Bangka Belitung and the impact of spatial elements on it. Utilizing data from 2006 to 2020 and employing a modified row normalized queen contiguity modified matrix with direct transportation connection, the research objectives were deployed. The study utilized the Spatial Durbin Model (SDM) to analyze the data. The findings indicated the presence of the flypaper effect in the Bangka Belitung Islands with spatial dependencies between 2006 and 2020. And only the Decentralized Allocation of Funds (DAU) was affected by the flypaper effect when there was spatial interdependence in Bangka Belitung. The influence of DAU on regional expenditure (BELANJA) was stronger than its effect on regional income (PAD). Increasing BELANJA in one jurisdiction would lead to an increase of 37 percent in other regions. The spillover effect of the decomposed lump-sum grants was related only to DAU in the context of spatial relationship. Local expenditure in Bangka Belitung was dependent on other locals.*

Keywords: Bangka Belitung; Panel Spatial, SDM; Spillover; The flypaper effect.

JEL: H71, H72, H76

1. INTRODUCTION

The central government provides funds to the local government to support regional development initiatives, in the form of expenditures. However, the allocations obtained by the regions from the central are responded by the local asymmetrically (Armawaddin et al., 2017; Deller & Maher, 2006). This indicates that either local governments are unable to make up the difference between their fiscal needs and capacity, or the expenditures that have been used have not been able to close the fiscal gap. In general, it can be said that the impact of regional funds on regional expenditure is stronger than its effect on regional income. This phenomenon is referred to as the flypaper effect. It leads to a promotion of inefficient budget usage. On the other hand, local governments are required to practice sound financial management, which includes organizing regional funds and expenditure while optimizing effective and efficient regional revenue.

Local government expenditures respond to funds and their own income (such as taxes) in many ways. When regional expenditure comes from funds, the stimulation for spending is different from the stimulation that comes from regional income (especially local taxes). The concept of the flypaper effect refers to the idea that money appears to remain in the location where it is initially allocated, much like a fly trapped on flypaper. This idea was first put forward by Arthur Okun and is widely cited (Inman, 2008). Two main theories have emerged from the many studies that have attempted to explain the Flypaper effect. The first theory contends that fiscal illusion is the root cause of the flypaper effect, while the second holds that bureaucrats are to blame (Sagbas & Saruc, 2007).

2. LITERATURE REVIEW

The discussion of the flypaper effect has yielded contrary conclusions in every

administrative area. The flypaper effect exists at municipal/city level in Indonesia (Inayati & Setiawan, 2018; Purbarini & Masdjojo, 2015), but it was uncertain at provincial level (Utami & Iskandar, 2021). Even after a significant adjustment was implemented by the 2004 decentralization law package, the over-dependence phenomenon has persisted (Munawar Chalil, 2018). One of the significant findings was that although a region had high regionally original income, they were experiencing the flypaper effect (Kusumadewi & Rahman, 2007). This research has also been followed, and the flypaper effect still occurred in several provinces on the same main island or in several regions close by (Ansori & Muthmainah, 2018; Armawaddin et al., 2017), and there was uncertainty at the provincial level (Anam et al., 2022; Andriani, 2021).

The amount of money spent in one area influences and is influenced by the amount of money spent in other areas. According to Tobler's Law I, things that are closer together have a bigger impact than those that are farther apart (Anselin & Lozano-Gracia, 2008). Spatial correlation in public expenditure can be explained by several ideas (Acosta, 2010). The first theory is that the judiciary tends to mimic their neighbor's expenditure behavior (Besley & Case, 1995). The second theory holds that nearby residents can benefit from public spending from one jurisdiction. Welfare competition as a result will result in lower benefits (Elhorst & Feret, 2007; Figlio et al., 1999; Saavedra, 2000). Likewise, the theory of spillover and contagion effects postulates that labor mobility factors allow shocks to a local government economy to quickly spread to nearby jurisdictions (Acosta, 2010).

In general, studies on the flypaper effect have been carried out at all provincial levels in Indonesia, from the initial variables to the segregation of research variables, and it was found that the results of both the national and provincial levels showed different hints. In the same area in different years, the findings were inconsistent. Panel data regression has been the most prominent model to use. All assume that government spending is only affected individually by region and time.

This paper examines the flypaper effect by using a spatial perspective, which has been less explored in previous research in Indonesia. Therefore, some questions set in this paper are: Does the flypaper effect occur in Bangka Belitung and vice versa by including spatial elements? And which funds are more related? Are there spatial and spillover effects on the decomposed lump-sum grand? And does local expenditure weigh on other locals?. A spatial correlation in public expenditure is offered in this paper due to the welfare competition to decrease benefits. And several argued that the phenomenon of the flypaper effect was found in municipal Bangka Belitung from 2011 until 2015 (Subangka, 2017), but another study conducted from 2016 until 2019 (Andriani, 2021) did not find the effect. Moreover, bias may arise in the estimation of the flypaper effect due to issues with spillover, population mobility, and inter-regional relationships, especially in island provinces such as Bangka Belitung.

3. METHOD

Secondary data, such as Local Government Expenditure/BELANJA), General Allocation Funds/ Dana Alokasi Umum (DAU), Special Allocation Funds/Dana Alokasi Khusus (DAK), Other Share Funds/Dana bagi Hasil (DBH), and Government Regional Income/Pendapatan Asli Daerah (PAD), were gathered from Statistics-Indonesia's publication, Financial Statistics of Regency and Municipality Governments. This study was carried out in Bangka Belitung province, Indonesia, as a unit of observation is 7 (seven) sub Provincials/Regencies/Muncipalities for 15 years during the period 2006–2020.

First, we estimate a standard linear panel data model without accounting for spatial effects. This model is used to both verify the robustness of the estimation results obtained from spatial panel data models and to serve as a reference for those results. The standard linear regression model's formulation is provided below (Baum, 2006).

$$y_{it} = x_{it}\beta_k + z_i\delta + u_i + \varepsilon_{it} \tag{1}$$

Where t is the time series dimension, from 2006 to 2020, i stands for the individual regions (N = 7), and y is the dependent variable. For the explanatory variables that change over time and across individuals, x_{it} is the 1 x k vector of observations, and β is the k x 1 vector of coefficients for x. The time-invariant variables z_i are a 1 x p vector that vary only over individuals, and the corresponding p x 1 vector of coefficients is δ. ε_{it} is a disturbance term that changes with the individual and time, while u_i is an individual-level effect that cannot be directly observed or measured. If ε_{it} is related to x_{it}, the panel data model is a fixed-effects model; otherwise, it is a random-effects model (Fotheringham & Rogerson, 2009).

The study used spatial regression analysis with panel data to investigate the presence of the flypaper effect in the presence of spatial interdependence in Bangka Belitung. A weighting matrix (W) is required when performing spatial regression modeling. The effects of land bordering among regencies in Bangka Belitung are irrelevant because the island is divided into two main islands. Because not all regions physically (by land) border each other, adjustments are required. To describe the flow of labor, the approach with row normalized queen contiguity modified matrix with direct transportation connection is used (Baltagi et al., 2012).

$$
W_{ij} = \begin{array}{c}
\text{Link} \\
1901 \\
1902 \\
1903 \\
1904 \\
1905 \\
1906 \\
1971
\end{array}
\begin{bmatrix}
1901 & 1902 & 1903 & 1904 & 1905 & 1906 & 1971 \\
0 & 0 & 1 & 1 & 1 & 0 & 1 \\
0 & 0 & 0 & 0 & 1 & 1 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 \\
1 & 0 & 1 & 0 & 1 & 0 & 1 \\
1 & 1 & 1 & 1 & 0 & 0 & 1 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 0
\end{bmatrix}
$$

General Spatial Model (GSM) or Spatial Autocorrelation (SAC), Spatial Durbin Model (SDM), Spatial Durbin Error Model (SDEM), Spatial Error Model (SEM), Spatial Autoregressive Model (SAR), and Spatial lag-X (SLX) were used to analyze the data in this study (Elhorst & Vega, 2013 and Elhorst, 2014). The General Nesting Spatial (GNS) model is a fairly comprehensive model that includes all possible interaction effects.

$$
y = \rho W_1 y + X^* \beta^* + W_2 X \theta + u \tag{2}
$$
$$
u = \lambda W_3 u + \varepsilon
$$

The model formed If $\theta=0$, $\rho \neq 0$, and $\lambda \neq 0$ is the General Spatial Model (GSM) or Spatial Autocorrelation (SAC). If $\theta \neq 0$, $\rho \neq 0$, and $\lambda=0$ are present, the model formed is the Spatial Durbin Model (SDM). The Spatial Error Model (SEM) is formed If $\theta=0$, $\rho=0$, and $\lambda \neq 0$. The Spatial Autoregressive Model (SAR) is formed when $\theta=0$, $\rho \neq 0$, and $\lambda=0$. If all $\theta \neq 0$, $\rho=0$, and $\lambda=0$ the model formed is Spatial lag-X (SLX), and if all $\theta=0$, $\rho=0$, and $\lambda=0$, the model formed is Ordinary Least Square (OLS).

4. RESULTS AND DISCUSSION
Overview of Local Government Expenditure

The expenditure data (BELANJA) of Bangka Belitung during 2006 to 2020 is depicted in Figure 1, with dark areas indicating higher expenditure and lighter areas indicating lower expenditure. The regions of Bangka (1901) and Belitung (1902) have higher expenditure, exceeding 838 billion rupiah, while the regions of Bangka Selatan (1905) and Bangka Tengah (1904) have lower expenditure.
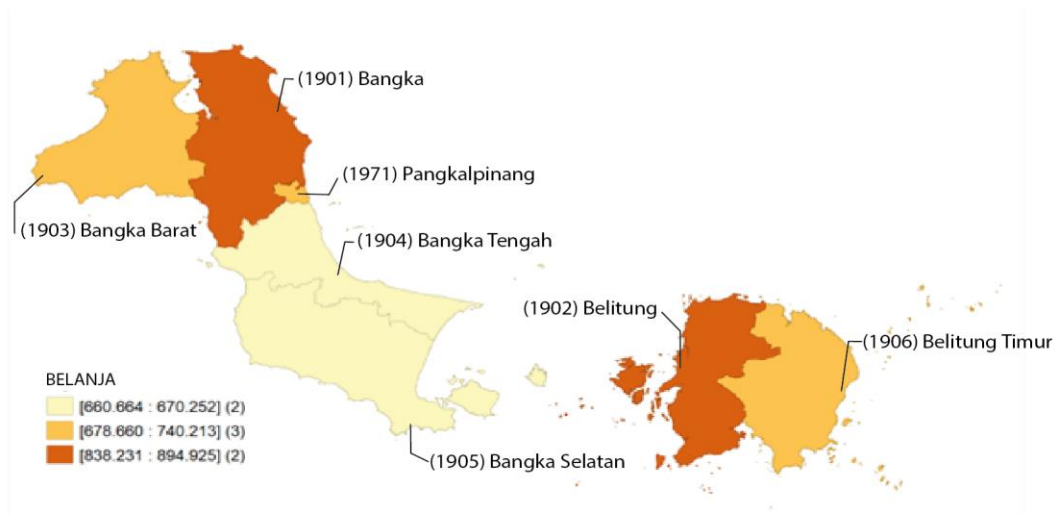
Figure 1 Average of Local Government Expenditure (BELANJA) in 2006-2021 (Billion Rupiah)

    The relationship between the BELANJA and other financial variables such as General Allocation Funds (DAU), Special Allocation Funds (DAK), Other Share Funds (DBH), and Government Regional Income (PAD) in the Bangka Belitung regencies is displayed in Figure 2. The data covers a period of 15 years from 2006 to 2020, with each regency serving as the unit of observation.
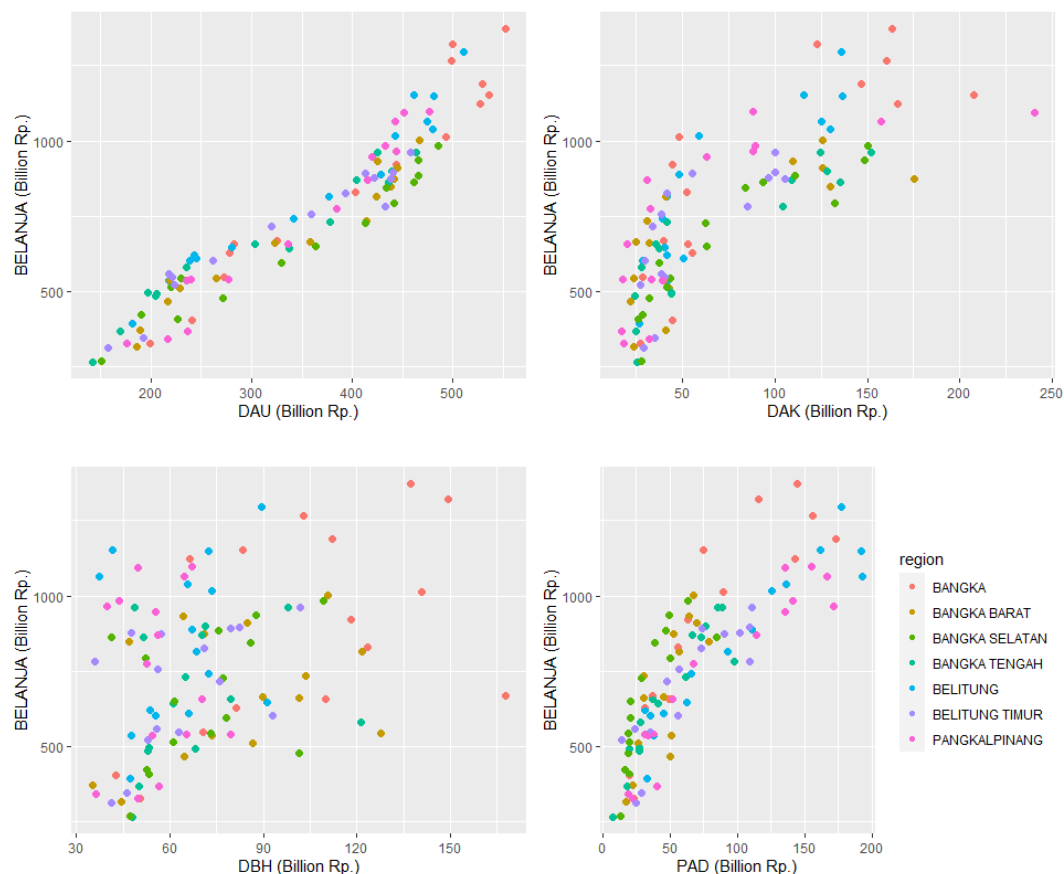

Figure 2. Relationship Between Local Government Expenditure (BELANJA) and Explanatory Variables (DAU, DAK, DBH and PAD)

    The relationship between BELANJA and DAU, BELANJA and PAD has a clear linear relationship. The greater the DAU provided by the center Government or the PAD received by the

regions, the maximum regional spending will be followed. While for the relationship between BELANJA and DAK, a linear relationship occurs when DAK is low (<75 Billion), but gets more nonlinear when DAK starts to increase above 100 billion. Meanwhile, the relationship between BELANJA and DAK has an irregular tendency.

Table 1 Summary Statistics

Variables	Obs	mean	sd	min	max
Local Goverment Expenditure (BELANJA) Rp.	105	740,147	261,946	264,955	1.372,937
General Alocation Funds (DAU) Rp.	105	348,381	113,276	141,884	552,781
Special Alocation Funds (DAK) Rp.	105	70,225	49,605	16,952	240,659
Other Share Funds (DBH) Rp.	105	72,023	27,167	35,092	167,894
Government Regional Income (PAD) Rp.	105	66,229	47,149	7,722	193,194

*In Billion (Rp.)

On average, BELANJA is the largest compared to all existing income during the period 2006-2020. Half of the expenditure is obtained from the DAU. Meanwhile, on average the DAK, DBH and PAD received contribute only one tenth of BELANJA. This shows that the regional dependence on funds provided is greater than the original regional revenue.

Selection of the Best Model

The Chow and Hausman tests were used in the study to determine the best panel model for the data. To compare the parameters of the common effect model and the fixed effect model, the Chow test was used. The p value was less than 0.05, indicating that the null hypothesis was rejected, indicating that the fixed effect model was superior to the common effect model. The Hausman test, on the other hand, was used to compare the parameters of the random effect model and the fixed effect model. The results showed that the p value was greater than 0.05, indicating that the random effect model outperformed the fixed effect model. As a result, in the following stage of the analysis, the panel data was modeled using the random effect model.

This section explains why it is critical to check for spatial dependence in panel data before performing a spatial regression analysis. The authors used a Lagrange multiplier test for both the lag and error to see if the panel data was spatially dependent. The results revealed that the p-value was less than 0.05, indicating that the panel data is spatially dependent. It is possible to conclude that the local government expenditure (BELANJA) panel data has a spatial dependence on the response variable, which is more likely to lag. This is also supported by the spatial dependence of the Pesaran CD Test at the 5% significance level, implying that there is a spatial dependence on the panel data of local government expenditure (BELANJA) (Hoyos & Sarafidis, 2006).

Table 2 The Parameter Estimation from Panel Data Regression and Spatial Dependency Test

Variables	Common		Fixed Effect		Random Effect	
	Estiamation	P-value	Estiamation	P-value	Estiamation	P-value
lnDAU	.5671379***	0.000	.6272301***	0.000	.5671379***	0.000
lnDAK	.0910692***	0.000	.1078795***	0.000	.0910692***	0.000
lnDBH	.154958***	0.000	.1876522***	0.000	.154958***	0.000
lnPAD	.1618927***	0.000	.1077601***	0.001	.1618927***	0.000
Constant	2.111577**	0.016	.6221333	0.517	2.111577**	0.015
Observations	105		105		105	
R-squared	0.9477		0.9432		0.9243	
Number of district			7		7	
Chow Test	2.48**	0.0287				
Hausman Test	1.68	0.7936				
Wooldridge Test for Autocorrelation	11.884**	0.0137				
LM Spatial Lag	6.7021***	0.00963				
LM Spatial Error	5.9777**	0.01449				
Pesaran CD test of cross sectional dependence in panels	6.5902***	0.00000				

*** p<0.01, **p<0.05, *p<0.10

Three spatial models were tested in Bangka Belitung to determine the presence of the flypaper effect while accounting for spatial interdependence: the spatial autoregressive model (SAR), the spatial error model (SEM), and the spatial durbin model (SDM). The Wald Test results showed that the SDM model outperformed SAR with a p-value less than 0.05, and SEM outperformed SDM with a p-value less than 0.10. The SDM model was chosen because it had the highest R2, AIC, and log likelihood value of the two remaining models.

Table 3 The Parameter Estimation from Spatial Model Using Adjusted Queen Contiguity Matrix

Variables Ln BELANJA	SAR		SEM		SDM	
	Estiamation	P-value	Estiamation	P-value	Estiamation	P-value
lnDAU	.4469249***	0.000	.5300096***	0.000	.384469***	0.000
lnDAK	.0799406***	0.000	.1038111***	0.000	.1456125***	0.000
lnDBH	.1595407***	0.000	.1617901***	0.001	.1403868***	0.001
lnPAD	.1347241***	0.000	.165103***	0.000	.1771042***	0.000
Constant	1.153222	0.200	2.530712**	0.043	.0805701	0.939
W*lnDAU					.071109	0.614
W*LnDAK					-.0959278**	0.029
W*lnDBH					-.0460392	0.361
W*lnPAD					-.1275956***	0.002
rho	.1825309**	0.035			.3776563***	0.000
lambda			.1007771***	0.000		
AIC	-202.9094		-209.5342		-209.1367	
BIC	-181.6777		-188.3027		-177.2892	
R²	0.9451		0.9475		0.9508	
Log-likelihood	119.4547		112.7672		116.5684	

Wald test		
H_0:SAR H_1:SDM	17.31***	0.0017
H_0:SEM H_1:SDM	8.22*	0.0839

*** $p<0.01$, ** $p<0.05$, * $p<0.10$

Table 3 shows that the Spatial Durbin Model (SDM) has all of its independent variables statistically significant at 1% significance level. Furthermore, at a significance level of 10%, its spatial lag independent variables (W*DAK and W*PAD) are statistically significant.

The Flypaper Effect

The flypaper effect was discovered by comparing the impact of lnDAU, lnDAK, and lnDBH on lnBELANJA with the impact of lnPAD in the chosen Spatial Durbin Model (SDM). The flypaper effect exists when the effect (coefficient value) of lnDAU, lnDAK, and lnDBH on lnBELANJA exceeds the effect of lnPAD and is statistically significant. According to Table 3, the selected Spatial Durbin Model (SDM) results show that the parameter for lnDAU (0.384469) is greater than lnPAD (0.1771042). This indicates the presence of the flypaper effect on lnDAU in the Bangka Belitung Islands with spatial dependencies between 2006 and 2020. These findings are consistent with those of previous studies, such as Subangka (2017).

Table 4 shows the spillover effect of changes in independent variables on the dependent variable in the spatial regression, expressed as direct, indirect, and total effects. The effect of independent variables (lnDAU, lnDAK, lnDBH, and lnPAD) on lnBELANJA is compared. At the 1% significance level, all independent variables have a significant direct effect on the dependent variable. However, at the 5% confidence level, the indirect effect is only significant for the independent variable lnDAU. At the 10% level of significance, the total effect of all variables except lnPAD is significant.

Table 4 Direct, Indirect and Total Effect of Spatial Durbin Model (SDM)

Variables	Direct effect		Indirect Effect		Total Effect	
lnDAU	.4180633***	0.000	.3193506**	0.030	.7374139***	0.000
lnDAK	.1382459***	0.000	-.0593629	0.211	.078883*	0.058
lnDBH	.1443205***	0.000	.0039284	0.946	.1482489***	0.009
lnPAD	.167477***	0.000	-.0884654	0.113	.0790115	0.275

*** $p<0.01$, ** $p<0.05$, * $p<0.10$

DAU funds typically remain in the same location where they were initially disbursed. This is known as the flypaper effect. This phenomenon is thought to be caused by the relatively small size of the Government Regional Income (PAD), which forces the municipality of Bangka Belitung to continue relying heavily on central government funding and spatial relationships between regions.

These findings suggest that there is a mimic behavior in the Bangka Belitung Province, where the level of local spending (BELANJA) is influenced in part by the level of spending in its neighbors. At a significance level of 1%, the spatial dependence on dependent variables (rho) was found to be 0.3776563, which was statistically insignificant. This indicates that a 10% increase in BELANJA in one region of Bangka Belitung will result in a 37% increase in BELANJA in other regions. This finding supports the previously proposed theory of welfare competition in Bangka Belitung.

This finding suggests that the bureaucratic model influences the occurrence of the flypaper effect in Bangka Belitung Province, where budget-maximizing behavior by bureaucrats or local politicians leads to a greater influence of DAU (grant) compared to PAD (tax). The small contribution of PAD to local spending (BELANJA), which is only about 10% on average, demonstrates the flypaper effect. Due to bureaucratic and political regulations, as well as the

financial relationship between the central and local governments, the district's ability to collect taxes is limited. Furthermore, municipal low PAD is influenced by a variety of macroeconomic conditions, including regional economic conditions, income inequality, fiscal independence, unemployment, poverty, and regional competitiveness.

According to fiscal illusion theory, the local government in Bangka Belitung is misleading the community by increasing public budgets, but the budget is actually spent based on the government's preferences, which heavily focus on routine expenses such as salaries, meetings, and official trips. As a result, the municipalities in Bangka Belitung continue to rely on these expenditures. The flypaper effect highlights the regions' reliance on the central government to manage regional finances. Due to the limitations of their jurisdiction and regulations, local governments have been unable to diversify their sources of regional income.

5. CONCLUSION AND SUGGESTION
CONCLUSION

The purpose of this paper is to investigate the occurrence of the flypaper effect in Bangka Belitung Province. The study focuses on the spatial elements of the effect, and the data used in the study ranges from 2006 to 2020. Municipal governments in the province are primarily funded through fiscal transfers, with DAU accounting for more than half of their expenditure. DAK, DBH, and PAD make relatively small contributions to local spending (BELANJA), averaging around 10%. As a measure, the research employs a static spatial model with a row-normalized queen contiguity matrix and direct transportation connections. According to the study, regions with better transportation connections are more likely to delegate fiscal responsibility to other areas. A spatial Durbin model will be used in the study. This paper provides evidence for the existence of the flypaper effect in the Indonesian province of Bangka Belitung Islands from 2006 to 2020. The findings show that DAU (fiscal transfer) has a significant impact on the flypaper effect, accounting for more than half of the financing of local expenditure (BELANJA). Due to the presence of spatial dependencies, the phenomenon of local expenditure in one jurisdiction results in a 37% increase in BELANJA in neighboring regions.

SUGGESTION

The analysis shows that Bangka Belitung's local expenditure is interdependent with other regions, and the spatial dependence of the flypaper effect cannot be overlooked. According to the study, more research is needed to investigate other weight matrices, variables, and dynamic effects. Collaboration between the government and local stakeholders is required to address these issues and harmonize regional regulations and bureaucracy.

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