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The Link Between Financial Development and Poverty: A Spatial Analysis of Indonesia

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ABSTRACT

Research Originality: This research is original in its examination of the spatial influence of financial development on poverty in Indonesia.

Research Objectives: This study investigates the impact of financial development on poverty reduction in Indonesia.

Research Methods: This study employs a spatial econometric approach, analyzing data from 2016 to 2021. Key variables include credit-to-GDP ratio, third-party funding-to-GDP ratio, government spending, the human development index, and deposits-to-GDP ratio.

Empirical Results: The findings reveal significant spatial dependence in poverty across Indonesian regions. The credit-to-GDP ratio did not significantly reduce poverty, whereas the third-party funding-to-GDP ratio showed a positive and significant effect on poverty reduction. Government spending, the human development index, and the deposits-to-GDP ratio contributed to poverty alleviation.

Implications: These results suggest that Indonesia's financial sector development has not effectively reduced poverty. Policymakers should focus on targeted financial reforms, regional coordination, and improving socio-economic factors to enhance poverty reduction efforts.

Keywords:

spatial econometrics; financial development; poverty; regional interdependence

How to Cite:

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INTRODUCTION

Poverty has been a social issue of concern throughout history, particularly in developing countries (Daimon, 1998; Liu & Xu, 2016). In the effort to alleviate poverty, Indonesia has made remarkable strides since the post-monetary crisis of 1998, with a decline from 24.2% in 1998 to 9.57% in 2022. However, Nugroho et al. (2021) have noted that poverty reduction efforts have slowed in recent years, with an average decrease of 0.31% per year from 2015 to 2019, compared to 0.8% from 2008 to 2015. Moreover, Indonesia is relatively vulnerable to poverty, with 22.4% of its population living in poverty or at risk of it (World Bank, 2022). The country is susceptible to various shocks such as economic crises, health crises, inflation, and natural disasters (Dartanto, 2022; Fitriadi et al., 2022; Skoufias et al., 2012; Suryahadi et al., 2012), making poverty alleviation a critical priority for the government (Olivia et al., 2020; Sparrow et al., 2020).

Numerous recent studies have attempted to identify the underlying factors in poverty alleviation (Deng et al., 2020; Fahad et al., 2022; Y. Liu & Xu, 2016; Su et al., 2021). Some literature highlights the importance of financial development in reducing poverty in developing countries (Appiah-Otoo et al., 2022; Beck et al., 2007; Cepparulo et al., 2017; Zhu et al., 2021). Financial development can enhance the chances of poor people accessing finance by addressing financial market failures, such as information asymmetry and high borrowing costs for borrowers (Jalilian & Kirkpatrick, 2002). It also enables the poor to start micro-enterprises using savings or loans, improving access to financial services, increasing employment opportunities, and ultimately reducing poverty (Appiah-Otoo et al., 2022).

In their study in Egypt, Abosedra et al. (2016) found that poverty could be reduced through the development of the financial sector, mainly when domestic credit for the private sector was used as a measure. This finding confirmed the direct impact of financial sector development in providing better access to financial services such as credit and insurance for people experiencing poverty in Egypt. The study also showed the indirect impact of financial sector development on poverty reduction through economic growth. However, this was only evident when M2 was used to measure financial sector development, and infant mortality per capita was used to measure poverty. These findings are consistent with studies by Uddin et al (2014) in Bangladesh, Sehrawat & Giri (2016) in India. Several researchers have shown that a sound financial development system can reduce poverty (Erlando et al., 2020; Kaidi et al., 2019; Sehrawat & Giri, 2016). Using data from 44 Sub-Saharan African countries from 2010-2019, (Acheampong et al., 2021) found that financial development significantly reduces poverty for both men and women. These findings are consistent with those of (Akhter & Daly, 2009; Odhiambo, 2009, 2010; Rewilak, 2017; Uddin et al., 2014).

Although previous literature has helped improve our understanding of the relationship between financial development and poverty reduction (Beck et al., 2007; Donou-Adonsou & Sylwester, 2016; Erlando et al., 2020), most of the existing literature on financial development and poverty reduction does not consider the role of spatial interdependence, particularly in the context of Indonesia. Studies by Jalilian and Kirkpatrick (2005) and

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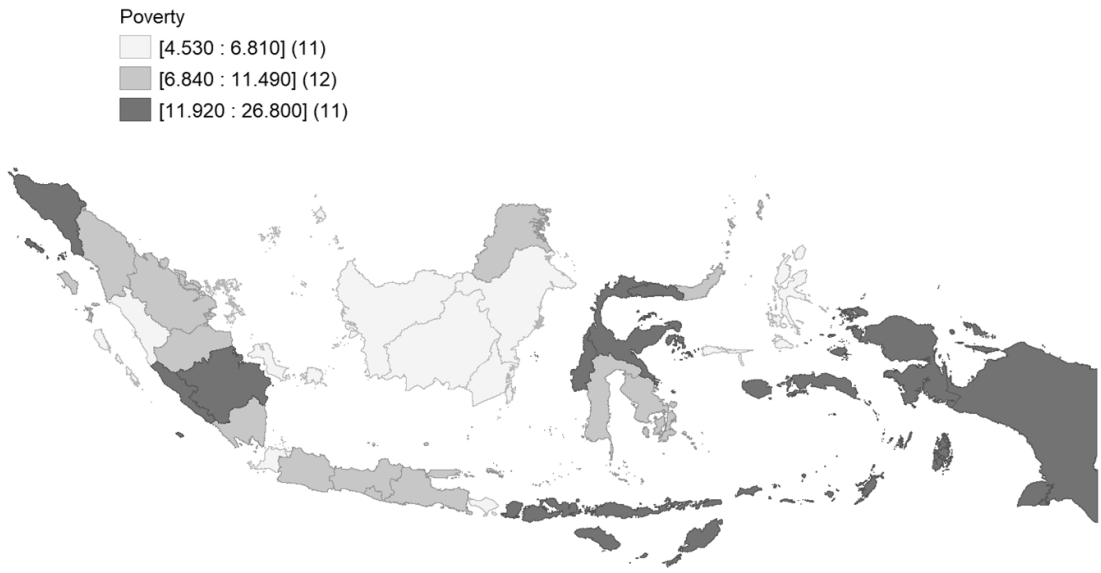
Kiendrebeogo and Minea (2016) emphasize the potential for spatial spillover effects but do not explicitly address these in their empirical models. In addition, while significant progress has been made in understanding the direct effects of financial development, research on its spatial dynamics and interactions across regions remains scarce. This study aims to fill these gaps by analyzing the spatial influence of financial development on poverty in Indonesia using a spatial panel data econometric model. Unlike previous research, which primarily focuses on direct impacts, this study incorporates spatial interdependence to re-examine how financial development in one region influences poverty in neighboring regions. The novelty of this research lies in its focus on spatial spillover effects and its application to Indonesia, a country characterized by significant regional disparities.

METHODS

This study covers 34 provinces in Indonesia, as seen in Figure 1. Most Indonesians still live below poverty (Tohari et al., 2019). There are many areas with high poverty rates, especially in eastern Indonesia, which includes Papua, West Papua, Maluku, East Nusa Tenggara, West Nusa Tenggara, Central Sulawesi, West Sulawesi, as well as two areas in western Indonesia, namely South Sumatra, and Aceh. Meanwhile, areas with moderate poverty rates are mostly located in western Indonesia, including North Sumatra, Jambi, Riau, Lampung, North Kalimantan, West Java, Central Java, Yogyakarta, East Java, and three areas in eastern Indonesia, namely Southeast Sulawesi, North Sulawesi, and South Sulawesi. Similarly, areas with low poverty rates are mostly located in western Indonesia. The geographical condition, high diversity, population size, and many other factors pose significant challenges in alleviating poverty in Indonesia (Nugroho et al., 2021).

Figure 1. Poverty Rate of Indonesia, 2021



Source: author's calculation

The secondary data was used in this study. The panel data consists of 34 provinces in Indonesia for 6 years (2016-2021). The data was obtained from various sources, such as the Central Bureau of Statistics (BPS) and the Central Bank of Indonesia (BI). The data obtained from these institutions are dominant because they are extensive and relatively consistent every year. As for the variables used in this study, the dependent variable is poverty, measured using the poverty rate (Honohan, 2004; Kiendrebeogo & Minea, 2016), which is defined as the proportion of the population living below the poverty line. For the independent variables, financial development is proxied by the proportion of credit to Gross Regional Domestic Product (GRDP) and the proportion of third-party funds to GRDP (Acheampong, 2019; Akhter & Daly, 2009; Cepparulo et al., 2017). Following previous studies, other variables used to control the poverty variable are economic growth, proxied by GRDP per capita, government expenditure, proxied by the ratio of total government expenditure to GRDP, and the human development index (Anderson et al., 2018; Cepparulo et al., 2017; Erlando et al., 2020). Table 1 presents the more detailed information about the operational variables.

Table 1. Operational Variables

Variables	Definitions	Measurements	Sources	References
Poverty	Proportion of the population living below the poverty line	Poverty rate (%)	BPS	(Honohan, 2004; Kiendrebeogo & Minea, 2016)
Credit-to-GRDP Ratio	Volume of credit extended to the economy relative to the gross regional domestic product (GRDP)	Total credit/ GRDP	BI/BPS	(Acheampong, 2019; Akhter & Daly, 2009; Cepparulo et al., 2017)
Third-Party Funds-to-GRDP Ratio	Total deposits held by financial institutions relative to GRDP	Total third-party funds / GRDP	BI/BPS	(Acheampong, 2019; Akhter & Daly, 2009; Cepparulo et al., 2017)
Economic Growth	Indicator of economic performance and its potential to reduce poverty	GRDP per capita	BPS	(Anderson et al., 2018; Cepparulo et al., 2017; Erlando et al., 2020)
Government Expenditure	Fiscal policy efforts aimed at poverty alleviation	Total government expenditure/ GRDP	BPS	(Anderson et al., 2018; Cepparulo et al., 2017; Erlando et al., 2020)
Human Development Index (HDI)	Composite measure of education, health, and income dimensions	Index	BPS	(Anderson et al., 2018; Cepparulo et al., 2017; Erlando et al., 2020)

In traditional econometric theory, it is assumed that there is no difference between regions within the same space, so this theory does not consider the correlation between neighboring regions (Wang & Guan, 2017). This assumption contradicts reality, especially in regional studies, where each area has an uneven or heterogeneous distribution of

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resources. A spatial autocorrelation test can be used to analyze the dependence between spatial observation units. If the distribution of observations in neighboring areas is similar, then positive spatial autocorrelation occurs. Otherwise, negative spatial autocorrelation occurs. There are several techniques for measuring spatial interactions to overcome autocorrelation; we use Moran's I coefficient (Moran, 1950), one of the commonly used measures of spatial autocorrelation. The Moran's I index is defined as follows:

$$Moran'sI = \frac{\sum_{i=1,j=1}^{n} W_{ij}(Y_i-\bar{Y})(Y_j-\bar{Y})}{S^2 \sum_{i=1,j=1}^{n} W_{ij}} \quad (1)$$

which:

$$S^2 = \frac{1}{n}\sum_{i=1}^{n} (Y_i - \bar{Y})^2, \bar{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i \quad (2)$$

Tobler's First Law of Geography states that everything on the geographic surface is related to everything else and that things close together are more related than far apart things (Tobler, 1970). As one of the capital factors, financial development can flow through neighboring regional capital markets (Zhu et al., 2021). This fact means that financial development can create an interaction effect among regions. Thus, the impact of financial development on poverty reduction can have a spatial spillover effect. Traditional econometric models do not consider spatial factors, which can result in less accurate estimation results (Tang et al., 2023). Therefore, this study uses spatial econometric models as an analytical tool.

The Spatial Autoregressive (SAR) model and the Spatial Error (SEM) model are the most used among the various spatial measurement models commonly used. The SAR model is suitable for controlling spatial impacts on the dependent variable when evaluating the influence of poverty levels in one region on surrounding areas (W. Liu et al., 2023). Mathematically, it can be formulated as follows:

$$poverty_{it} = \alpha_i + \rho W poverty_{it} + X_{it}\theta + \varepsilon_{it} \quad (3)$$

where $poverty_{it}$ represents the poverty rate of the province, W is the spatial weighting matrix, ρ is the spatial autoregressive coefficient, X_{it} is independent variables, θ is the coefficient of the independent variable, and ε_{it} is the random error.

The SEM model is used when there is spatial interaction between error terms (Zhu et al., 2021), and can be formulated as follows:

$$poverty_{it} = \alpha_i + X_{it}\theta + \mu_{it}, \ \mu_{it} = \beta W \mu_{it} + \varepsilon_{it} \quad (4)$$

where $poverty_{it}$ represents the poverty rate of the province, W is the spatial weighting matrix, β is the spatial autoregressive coefficient, X_{it} is independent variables, θ is the coefficient of the independent variable, and ε_{it} is the random error.

RESULT AND DISCUSSION

Table 2 presents the summary statistics of the variables used in the model. The average poverty rate is 10.73, with a standard deviation 5.61, indicating moderate variability among provinces. The minimum poverty rate is 3.42, reflecting relatively low levels in some regions, while the maximum is 28.4, highlighting significant poverty in others. Economic growth, measured by the natural log of GRDP (lnGRDP), averages 11.94 with a standard deviation of 1.14. This result suggests that economic performance is moderately concentrated, from 9.978 to 14.434, indicating disparities in provincial economic output. Government expenditure averages 5.26, with a standard deviation of 3.13, reflecting considerable variability in fiscal spending among provinces. The minimum expenditure of 1.752 suggests limited fiscal resources in some areas, while the maximum of 18.785 indicates substantial investments in others. The Human Development Index (HDI) averages 70.46, with a standard deviation 4.03. The lowest score is 58.05, indicating challenges in health, education, and income dimensions in some provinces, while the highest score, 81.11, reflects better human development in more advanced regions. As measured by the credit-to-GRDP ratio, financial development has an average of 43.69 and a standard deviation of 16.51. This result reveals significant differences in credit penetration across provinces, ranging from 14.353 to 98.416. Similarly, the third-party fund-to-GRDP ratio averages 36.55, with a high standard deviation of 25.29, indicating substantial disparities in financial sector activity. The minimum ratio is 14.065, while the maximum reaches 193.593, suggesting that some provinces have a highly developed financial sector.

Table 2. Summary Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Poverty	204	10.731	5.608	3.42	28.4
lnGRDP	204	11.937	1.142	9.978	14.434
Government Expenditure	204	5.261	3.126	1.752	18.785
HDI	204	70.463	4.025	58.05	81.11
Credit-to-GRDP	204	43.687	16.51	14.353	98.416
Third-party Fund to GRDP	204	36.55	25.29	14.065	193.593

We estimated the value of Moran's I for the poverty level for each year from 2016 to 2021 to explore the spatial dependence of poverty in Indonesia. The determination and weighting of the neighbors we used are based on Vidyattama (2013), which accounts for Indonesia's geographical condition as an archipelago. Neighbor weighting was not suitable for implementation in this study as it did not encompass the boundaries set by the sea. In the neighbor method, spatial weighting matrices are binary code, with 1 indicating a shared boundary and 0 indicating none. Indonesia consists of eight main islands separated by the sea; thus, several provinces do not have neighbors. Based on

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this consideration, we followed Miranti (2021), use of the inverse distance matrix, which allows all provinces to have at least one neighbor. The results of Moran's I test (see Table 3) reveal the presence of significant spatial autocorrelation in poverty levels across Indonesia from 2016 to 2021. Moran's I values range from 0.071 to 0.082, indicating a positive spatial autocorrelation, where regions with similar poverty levels are geographically clustered. The positive values suggest that provinces with high poverty rates are likely to be surrounded by other provinces with high poverty rates. Similarly, provinces with low poverty rates tend to cluster together. The corresponding p-values for all years are statistically significant at the 1% level, confirming that the observed spatial clustering is not due to random chance. The highest Moran's I value is observed in 2019 (0.082), indicating the most substantial spatial dependency during the study period, while the lowest value is seen in 2021 (0.071), showing a slight decrease in spatial autocorrelation. These results highlight the importance of accounting for spatial dependencies when analyzing poverty in Indonesia. The clustering patterns suggest that poverty reduction strategies must consider regional spillovers and neighboring effects, as the conditions in one province can influence the outcomes in adjacent provinces. The persistence of significant spatial autocorrelation over time underscores the need for coordinated and regionally integrated policies to address poverty effectively.

Table 3. Moran's I Test Result

Year	Moran'I	P-Value
2016	0.073132882	0.00235***
2017	0.076772832	0.00165***
2018	0.077627387	0.00149***
2019	0.082056315	0.00099***
2020	0.071923422	0.00246***
2021	0.071162269	0.00241***

Note: *** significant at 1%

It is necessary to determine the appropriate model specification to describe the data used and to build a spatial econometric model for analyzing the effects of financial development on poverty. We used the Lagrange Multiplier (LM) test to determine whether the non-spatial model could be rejected. Lagrange Multiplier Lag (LM-lag) and Lagrange Multiplier Error (LM-err) tests are insignificant. In that case, a traditional panel model is selected, but a spatial econometric model is used if either test is significant. Furthermore, a Hausman test is conducted to choose between fixed or random effect models. The results supported the use of a fixed effect model. We used the spatial econometric model with fixed effects based on the results of the LM-Lag and LM-err tests and the Hausman test.

Table 4. Results of LM-Lag and LM-err Tests

LM-Lag	18.843**
LM-err	24.866**

Note: ** significant at 5%

Table 3 shows the estimation results between the OLS model and the SAR and SEM spatial econometric models. In the OLS model, government expenditure and the Human Development Index (HDI) are significant predictors of poverty reduction. Specifically, a 1-unit increase in government expenditure (as a percentage of GRDP) is associated with a 0.1395 percentage point reduction in poverty. In comparison, a 1-unit increase in HDI leads to a 0.4596 percentage point decrease in poverty. However, other variables, such as the natural logarithm of GRDP (lnGRDP) and the credit-to-GRDP ratio, are not statistically significant, indicating that economic output and credit availability alone do not directly influence poverty levels. Interestingly, the third-party fund-to-GRDP ratio shows a positive and significant relationship with poverty, suggesting that higher deposit levels may not necessarily translate into poverty reduction due to inequitable access to financial resources or inefficient allocation of funds.

Tabel 3. The Results of OLS and Spatial Econometric Estimations

	OLS(FE)	SAR	SEM
lnGRDP	-1.4083157	-0.6088132	-0.8329531
Government Expenditure	-0.1394570**	-0.1374133***	-0.1387082 ***
HDI	-0.4596451***	-0.5597664***	-0.3338076 ***
Credit to GRDP	0.0095947	0.0113853	0.0096009
Third-party Fund to GRDP	0.0484688***	0.0388622***	0.0429658 ***
F-Statistic	31.9746		
R-Square	0.49211		
ρ		0.58893***	
λ			0.39045***
Log-L		-342.6468	-92.27562

Note:*** significant at 1%, ** significant at 5%, * significant at 10%

The spatial econometric models—Spatial Autoregressive (SAR) and Spatial Error Model (SEM)—refine these findings by accounting for spatial dependencies. Both models confirm that government expenditure and HDI are significant and negatively associated with poverty. The coefficients for government expenditure are -0.1374 in the SAR model and -0.1387 in the SEM model, while the HDI coefficients are -0.5598 and -0.3338, respectively. These results highlight human development's and government spending's

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critical role in reducing poverty, even after accounting for spatial interactions. The SAR model's spatial lag coefficient (ρ) is 0.5889, and the spatial error coefficient (λ) in the SEM model is 0.3905, both significant at the 1% level. This result indicates strong spatial dependence, where the poverty levels influence poverty in one province in neighboring provinces. Such spatial spillover effects suggest that regional dynamics and interactions are essential to poverty outcomes.

Notably, the credit-to-GRDP ratio remains insignificant in all models, implying that credit availability has not had a meaningful impact on poverty reduction during the study period. Meanwhile, the positive and significant association between third-party funds and poverty persists across the spatial models, albeit with slightly reduced coefficients compared to the OLS model. This counterintuitive finding suggests that deposits may be concentrated among wealthier individuals or regions, limiting their poverty-reducing potential. It also raises questions about the inclusiveness and accessibility of financial systems in addressing poverty.

The phenomenon of financial sector development that has been unable to reduce poverty can occur due to several factors—first, the uneven distribution of access and benefits. Although the financial sector is growing, not everyone has equal access. Thus, the circulation of funds in the financial sector is only among people with access to substantial capital, and credit flows are not used for community economic development, such as improving SMEs and increasing the productivity of other communities. If this continues, the poverty rate may be difficult to decrease.

Second is the topography factor. Indonesia's geography and topology affect the development of the existing financial sector and poverty. As an archipelagic country with thousands of islands, Indonesia faces challenges in developing adequate infrastructure and inter-island communication. This result can hinder the growth of the financial sector in remote and hard-to-reach areas, so people in these regions have limited access to financial services and opportunities to improve their welfare. The topography of Indonesia, especially areas with mountains, valleys, and oceans, will make it difficult to access financial access. Most of Indonesia's areas are in the valleys and slopes of mountains, such as Papua Province, where 63 percent of all villages are located in valleys and mountain slopes; West Sulawesi Province, which is 51.67 percent; and East Nusa Tenggara Province, which is 51.16 percent. Meanwhile, the Maluku Province is an archipelago consisting of small islands with a sea area of 92.4 percent and 7.6 percent of land (Nanga et al., 2018).

Third is the infrastructure factor. Adequate infrastructure is essential in developing the financial sector and reducing poverty. From transportation infrastructure, road availability will facilitate accessibility and mobility of people in accessing financial services. However, there is still an infrastructure gap between provinces in Indonesia. Using the 2018 Indonesian Central Bureau of Statistics Village Potential Survey data, Nanga et al. (2018) found isolation and limited access to transportation infrastructure in Papua, West Papua, Maluku, and East Nusa Tenggara provinces.

Regarding telecommunications, Papua and West Papua provinces experience limitations compared to other regions. Eighty-five percent of villages are dominated by people who already use mobile phones (HP). However, in Papua Province, only about 19 percent of villages have residents who use mobile phones. The condition in West Papua Province is quite good, but its achievement is only 46 percent. Furthermore, only 10 percent of villages in Papua Province have 4G/LTE/3G/H/H+ signals.

The fourth factor is economic instability. Financial development accompanied by economic instability can also have a negative impact on poverty reduction efforts. Economic instability can lead to fluctuations in inflation rates, exchange rates, or financial crises, negatively affecting communities vulnerable to poverty. During this study, there was instability in Indonesia due to the COVID-19 pandemic. In the context of the COVID-19 pandemic, unequal distribution of its economic impact can worsen poverty. Some groups, such as informal workers and workers in other informal sectors, may experience significant income reductions or even lose their livelihoods due to the pandemic. This condition can significantly increase poverty rates and social inequality (Gibson & Olivia, 2020; Olivia et al., 2020; Suryahadi et al., 2020).

CONCLUSION

Indonesia has a strong spatial dependence on poverty rates from 2016 to 2021. This condition can be seen from the significantly positive Moran's I index values at the 1% level for each observed year. The results highlight the critical role of government expenditure and human development in reducing poverty. Increased government spending and improvements in the Human Development Index (HDI) are consistently associated with lower poverty rates, underscoring the importance of social services, education, and healthcare investments. However, economic output per capita (lnGRDP) and credit-to-GRDP ratios do not directly impact poverty reduction, suggesting that financial development alone may not be sufficient to alleviate poverty. Interestingly, the third-party fund-to-GRDP ratio positively correlates with poverty, indicating that financial resources, such as deposits, may not effectively alleviate poverty.

The Indonesian government needs to enhance the development of a more inclusive and sustainable financial sector. This condition can be achieved by optimizing the collection of third-party funds and their use to improve the community's welfare, especially for those still living in poverty. Additionally, spatial poverty mapping and targeted interventions are needed to address the strong spatial dependence on poverty rates in Indonesia.

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