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Modelling Economic Policy Issues

Narrowing the gap: Dynamics of Indonesia's public expenditure performance in economically lagging districts

Ardi Sugiyarto [a], Boon L. Lee [b], Clevo Wilson [b,*]

[a] Fiscal Policy Agency, Ministry of Finance, Jl. Dr. Wahidin Raya No.1, Jakarta, 10710, Indonesia
[b] School of Economics and Finance, Queensland University of Technology, 2 George Street, Brisbane, Queensland 4000, Australia

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ABSTRACT

This study investigates public expenditure efficiency in Indonesia's economically lagging districts within a framework of fiscal decentralization from 2005 to 2019. Using Data Envelopment Analysis (DEA) and the Färe-Primont Productivity (FPP) index, it assesses spending efficiency and productivity changes in lagging districts compared to non-lagging ones. The results reveal significant regional disparities, with eastern Indonesia, particularly Papua and Maluku, underperforming compared to more developed areas such as Java and Sumatra, though some lagging regions have improved over time. The declining productivity of spending underscores the need to anticipate public service costs in newly established, often underdeveloped districts, while also emphasizing the importance of cooperation and close coordination with parent districts. The socio-economic factors influencing efficiency include urbanization, density, literacy rates, local tax revenue, and grant allocations, with reliance on central government grants reducing efficiency. While the Pembangunan Daerah Tertinggal (PDT) program has improved expenditure efficiency since its implementation in 2005, it has not necessarily led to all districts graduating from lagging to non-lagging status. Continued central support and targeted interventions are crucial to addressing infrastructural and socio-economic challenges. Reassessing the 'lagging' status policy and providing complementary support are essential for sustaining regional development while maintaining improvements in public expenditure efficiency.

1. Introduction

Indonesia's fiscal decentralization policy is designed to enhance public service provision and societal welfare by conferring autonomy to local governments in managing their own resources. The theory behind the improvement of public service provision is that local governments have better knowledge of local preferences and needs. A number of studies view fiscal decentralization as an effective policy that fosters regional economic growth and reduces poverty and inequality (Galasso and Ravallion, 2005). But despite the optimistic expectations surrounding decentralization, there is a lack of conclusive evidence supporting a consistent positive impact of fiscal decentralization on local development across diverse regions within a nation-state. Hill's (2008) empirical observations underscore the emergence in Indonesia and the Philippines of widening disparities and heightened poverty in specific regions post-implementation of decentralization. This adverse impact is attributed to potential inefficiencies in government services, escalating costs of public provision and the looming threat of corruption, as discussed by Tanzi (2001). Furthermore, Ravallion's (1998)

* Corresponding author.
E-mail addresses: ardi.sugiyarto@hdr.qut.edu.au (A. Sugiyarto), bl.lee@qut.edu.au (B.L. Lee), clevo.wilson@qut.edu.au (C. Wilson).

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study of federal governmental systems highlighted that limited government institutional and financial capacity in poor regions leads to societal preferences not being accommodated, compounding the challenges to effectively realizing decentralization goals. This outcome is evident despite the implementation of affirmative policies aimed at channelling public funds to poor regions. Thus, consistently attaining positive outcomes from fiscal decentralization remains a formidable challenge. This underscores the problem that the effectiveness of decentralization is contingent upon both the developmental stage and the quality of institutions (Nirola et al., 2022). Thus, an examination of the performance of poor lagging regions within a framework of fiscal decentralization can provide policymakers with the means to tailor interventions that address specific challenges and pave the way for holistic and equitable growth.

Notwithstanding the establishment of fiscal decentralization in 1999, Indonesia still confronts the challenge of regional inequality, wherein particular districts exhibit accelerated development while others in economically disadvantaged regions lag behind (Mahi and Qibthiyyah, 2015). The complex interaction of heterogeneous social, demographic, geographic and economic conditions exacerbates the predicament, contributing to an asymmetrical development landscape. Rodríguez-Pose and Ezcurra (2010a) argue that regional disparities arise from a combination of factors, including inadequate administrative capacity, insufficient financial resources and uneven distributions of resources. Considering this gap, an affirmative policy is seen to be essential (Talitha et al., 2020) by emphasizing the need for central government support to uplift and accelerate development in disadvantaged areas. In other words, targeted interventions and policies are needed for a more balanced and inclusive development across the country.

Indonesia's central government (falling directly under the purview of the Indonesian president) more than two decades ago sought to alleviate subnational developmental imbalances by prioritizing the acceleration of progress in underdeveloped regions. This was affected by passing into law in 2000 the establishment of a ministry devoted to the development of disadvantaged regions called the Ministry of Villages and Development of Disadvantaged regions, popularly known as Pembangunan Daerah Tertinggal (PDT). The PDT policy program is tasked with assisting the president in the upliftment of disadvantaged regions in the country. The program was implemented starting from 2005 during President Susilo Bambang Yudhoyono's tenure (Nasrudin, 2016). The PDT policy program aims to expedite development by channelling public funds into underdeveloped districts, thereby narrowing the development gap. However, the outcomes of this program have varied due to divergent responses from local governments. On the one hand, directed allocation of public funds can empower local governments to provide ample resources for public service delivery, thereby fostering the welfare of the local people. But on the other hand, this funding has the inherent risk of promoting inefficient spending, potentially leading to suboptimal outcomes. There is a concern that even with significant funding and support from the central government, underdeveloped regions may struggle to catch up if their expenditure performance is lacking. This underscores the need for a careful balance to ensure that decentralization efforts yield positive and impactful results without inadvertently encouraging inefficiencies in resource utilization.

Given that the spending behavior of local governments significantly influences the success of PDT program policies, which strive to promote developmental convergence, it is essential to rigorously assess their expenditure performance. However, studies examining local government spending efficiency in Indonesia are still limited. Among these are studies by Yusfany (2015) and Kurnia (2012), which provide a general overview of local government performance. However, they do not provide a specific explanation of the performance disparities between lagging and non-lagging districts. Thus, a more focused examination of spending efficiency in lagging districts can allow a more comprehensive evaluation of the benefits derived from PDT program policies. Moreover, identifying the factors that explain public expenditure performance differences is also critical to provide input for policymakers in enhancing the effectiveness of PDT program policies.

Given these findings, this study assesses local governments' spending efficiency in Indonesia, focusing on economically lagging districts. The study has two objectives. First, this paper will evaluate the efficiency of districts with "lagging" status to show their performance in managing expenditures compared to non-lagging districts and illustrate their spending performance development over time. Second, a second-stage regression analysis is used to identify the socio-economic factors influencing the spending efficiency of lagging districts in Indonesia. In line with the objectives, this paper is expected to contribute to the literature on local government efficiency in two ways. First, this paper shows the extent to which local government spending differs between lagging and non-lagging regions. In doing so, this study represents the first systematic evaluation of PDT-based program policies in Indonesia, offering novel insights into their effectiveness and policy implications. Additionally, it contributes to the literature by applying the Färe-Primont Productivity (FPP) index to assess the evolution of local government efficiency. This approach provides a robust framework for monitoring public expenditure performance and identifying sources of inefficiency over time. To the best of our knowledge, this method has been rarely applied in studies relating to the local public sector.

2. Background of "lagging districts" status policy in Indonesia

Based on the ministerial decree (Ministry of Lagging Regions) number 1/2005, lagging districts are labelled as underdeveloped because of several factors which include disadvantages due to geography/location, natural and human resources, lack of infrastructure, social conflicts and unequal policy treatment. Lagging districts in Indonesia can be divided into five subcategories based on geographical characteristics: (1) located near forests and mountains with little access to the other districts, (2) situated on a small island, which is isolated from the main island, (3) located on the border of the country, (4) vulnerable to natural disasters, (5) located in remote coastal areas.

The government of Indonesia established the lagging districts policy program (i.e. PDT) in the national development strategy with the hope of prioritizing and accelerating the development of underdeveloped regions (Peraturan Presiden Republik Indonesia, 2005). The PDT policy program status is granted based on the six essential criteria represented by specific indicators: gross regional domestic

product (GRDP), human development, local public finance, infrastructure and particular regional characteristics. The indicator criteria for determining the 'lagging' status are shown in Fig. 1.

Based on the National Strategy of Lagging Regions Development Acceleration, there are at least three significant implications if the district qualifies for PDT policy program status. First is the affirmative policy to help accelerate the district's development. Second, is the mainstreaming of funding, including intergovernmental transfers to finance development in the districts. Lastly, is the people empowerment development approach in lagging districts (Menteri Negara Pembangunan Daerah Tertinggal Republik Indonesia, 2005)

Based on the ministerial decree of the Ministry of Lagging Regions (PDT) number 1/2005, 199 districts were stipulated as lagging regions for the period 2005–2009. Fig. 2 shows that the majority of the lagging districts (marked in orange) are located in the eastern part of Indonesia. On the other hand, there are only a few lagging districts in the island of Java, indicating that this region's development is relatively more advanced than that of others. Java has unique characteristics that are different from those of other regions. First, it has a very large population. Second, Java has a relatively well-established major infrastructure and economic centers, which gives this region comparative advantages over the other regions. In contrast, the eastern regions of Indonesia have many districts that have been provided with PDT policy program status. Over 100 lagging districts are to be found in the eastern part of Indonesia, spread in Sulawesi, Nusa Tenggara Timur (East Nusa Tenggara), Papua and Maluku.

Table 1 shows the number of lagging districts evaluated every five years under the PDT policy program. The government assesses the status of these districts during this period to determine whether they should remain classified as "lagging" or should no longer be considered disadvantaged. In 2009, 50 districts were elevated from the lagging region status, although 149 remained as lagging districts. In 2010, thirty-four new districts were stipulated as being afforded PDT policy program status, providing a total of 183 lagging districts. During the period in which President Jokowi was in office, the districts with PDT policy program status decreased significantly to 122 in 2015. Further, in 2020, according to president decree number 131/2020, the districts with PDT policy program status were only 62. Java, Bali, and Kalimantan as a result in 2020 have no districts qualifying for PDT status, indicating that these region's development level is relatively better than others. The evolution of lagging districts' development in Indonesia is shown in Fig. 3. This study focuses on analyzing the spending efficiency performance of lagging districts and their development over three periods of analysis.

3. Literature review

3.1. Examining the efficiency of local public expenditures

Efficiency can be viewed as a measure that describes how well a decision-making unit uses resources in the public goods and services production process. Measurement of efficiency is the ratio of maximum potential output given a certain amount of input or the ratio of the minimum possible observed input given a certain amount of output. Afonso and Fernandes (2006) argue that one possible method to evaluate the efficiency of local public expenditure is by comparing how well each government unit transforms expenditure into local services.

In local government spending efficiency analysis, financial expenditure is often used as an input variable. The most popular proxies of input variables are 'current expenditure' (Lo Storto, 2016), 'total expenditures' (Cordero et al., 2017), and 'personnel expenditures' (e.g. Cordero et al., 2017). However, when assessing the efficiency of specific local government services, nonfinancial input variables come into play. For example, in health services, input variables such as the 'number of nurses', the 'number of administrative staff', and the 'number of hospitals' are used to estimate efficiency (De Sousa and Stošić, 2005).

Based on the output indicators used in this analysis, the studies assessing local government efficiency analysis are divided into two groups. The first group focuses on specific output indicators, namely individual local service indicators representing the local government's specific services. For example, studies from Eom et al. (2022) and Jiang and Andrews (2020) focus on government spending efficiency in the education and health sectors. In addition, there are further studies focused on infrastructure services, such as road maintenance services (Kalb, 2014) and water supply (Benito et al., 2019). The second group uses a single aggregate indicator to

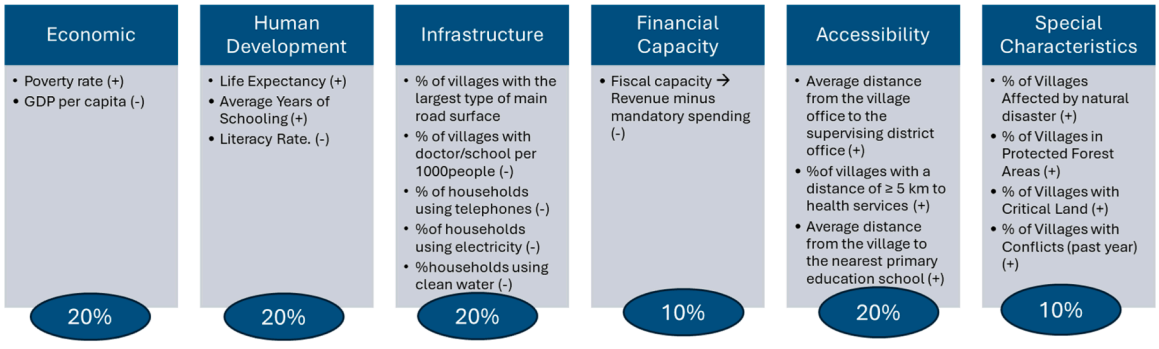


Fig. 1. List of indicators to determine "Lagging" status.

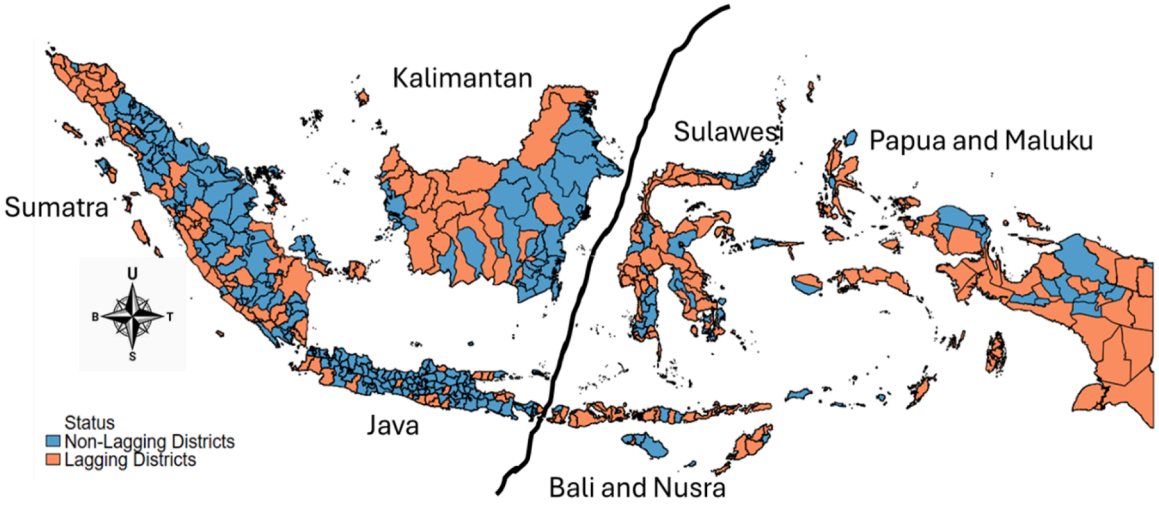


Fig. 2. Lagging districts in Indonesia (Based on Medium Term National Development Plan, 2005).

Table 1
Numbers of lagging districts by region.

Regions	2005	2010	2015	2020
Bali and Nusra	23	28	26	14
Java	17	9	6	0
Kalimantan	21	16	12	0
Papua and Maluku	39	50	47	38
Sulawesi	41	34	18	3
Sumatra	58	46	13	7
Total	**199**	**183**	**122**	**62**

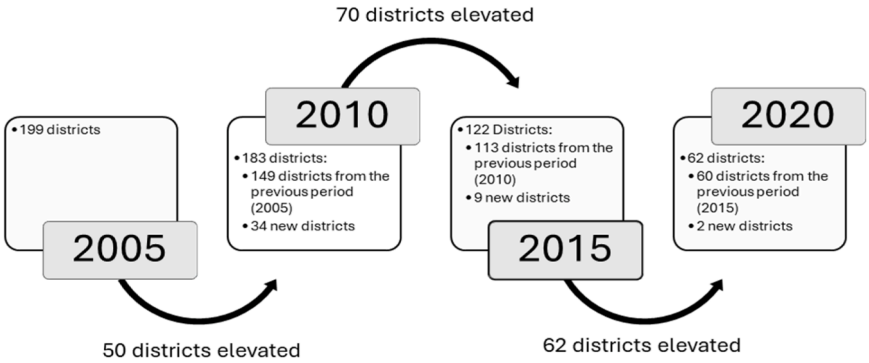


Fig. 3. Evolution in the number of lagging districts.

represent all public services provided by the local government. For example, Afonso and Fernandes (2006) used the total municipal output index (TMOI) to evaluate overall government performance in multiple sectors, including administration, education and the environment. Output indicators generally measure the quantitative aspects of public service delivery, with less emphasis on qualitative dimensions due to data limitations. However, where data are available, some studies have attempted to address this gap. For example, research in Spain (e.g., Balaguer-Coll and Prior, 2009; Zafra-Gómez et al., 2010) incorporated qualitative aspects by using technical quality indices for infrastructure and public service ratings.

Regarding the measurement techniques used to estimate local government efficiency, there are two popular approaches: non-parametric and parametric. The non-parametric approach, distinguished by its absence of assumptions regarding functional form and its ability to handle multiple inputs/outputs flexibly (Narbón-Perpiñá et al., 2020), proves well-suited for the varied nature of local government contexts (Ruggiero, 2007). The most common tool to estimate efficiency in the non-parametric approach is DEA, introduced by Charnes et al. (1978). Noteworthy studies employing the non-parametric approach to evaluate local government efficiency include those conducted by Ashworth et al. (2014). Conversely, the second approach is the parametric approach which assumes a

specific functional form between input and output variables. This approach applies stochastic frontier analysis (SFA) to estimate the efficiency score (Meeusen and Broeck, 1977). Some of the early studies of local government cost efficiency analysis using SFA include Deller et al. (1988), De Borger and Kerstens (1996a), and Worthington (2000).

In an examination of the evolution of decentralization, evaluating local government performance over time has become crucial. Consequently, recent studies on local government efficiency have inquired into this dynamic perspective. The first was a study by Balaguer-Coll et al. (2010), which used Malmquist productivity index (MPI) derived from the deterministic frontier production function to measure efficiency gains from decentralization over time in Spain from 1995 to 2000 and from 2000 to 2005. Post 2010, there have been a limited number of studies directly examining changes in local government spending efficiency, with many opting for the MPI to measure productivity and efficiency improvements in public expenditure. One example is a study by Kutlar et al. (2012), which attempts to examine changes in the technical efficiency of local government expenditure of 25 municipalities in Turkey. This highlights the decrease in efficiency spending in both growth and level in the period 2006–2008. In addition, other studies by Xiaokun (2013) also applied the MPI framework to analyze the financial public expenditure efficiency development of the local government in the Chinese western provinces or cities from 2001 to 2010.

The MPI is commonly utilized for its key features, including its ability to decompose productivity change sources and its independence from assumptions about prices and technological structure, making it pertinent for public sector analysis (Kutlar et al., 2012). However, limitations exist, with Dakpo et al. (2019) highlighting that the MPI lacks the transitivity property and is only suitable for two-point data. O'Donnell (2012) highlighted those alternative measures such as the Fare-Primont Productivity (FPP) index is superior to the MPI in multilateral and multitemporal comparisons and are multiplicative, complete and decomposable into technical change and various measures of efficiency change. Considering the strengths of the FPP index over the MPI, this paper contributes to the literature by applying the FPP index to investigate how the spending efficiency of local government changes over time.

3.2. Determinants of local government efficiency

The literature identifies five major categories of environmental factors influencing local government efficiency: socio-demographic, political, economic, institutional and geographical. Among these, socio-demographic factors - particularly population size and density - have been extensively studied. For example, De Borger and Kerstens (1996a) find a positive correlation between these factors and efficiency, suggesting economies of scale with increased population concentration. Furthermore, the diversity of the population and citizens' education level are significant determinants of efficiency differences. Nikolov and Hrovatin (2013) show that ethnically fragmented municipalities tend to exhibit lower efficiency, while education plays a crucial role in enhancing the quality of the labour force and improving political participation and local control (Radulovic and Dragutinovic, 2015).

Political factors are another key determinant of local government efficiency, as they shape public sector decision-making. Power distribution, participation, and the degree of fragmentation or concentration influence policy choices and service delivery. For example, Vanden Eeckhaut et al. (1993) found that single-party local governments are less efficient than those with multi-party coalitions. Similarly, Sørensen (2014) noted that party competition boosts efficiency. Moreover, studies over the past decade (Asatryan and De Witte, 2015) show that higher political participation by citizens is linked to greater local government efficiency.

Economic conditions play a significant role in determining local government efficiency as well. While studies by Asatryan and De Witte (2015) indicate a positive impact of higher income levels on efficiency, Monkam (2014) found the opposite. Real economic activities in the local area also play a role, with Sung (2007) suggesting that commercial activity might decrease efficiency and D'Inverno et al. (2018) proposing that municipalities with high tourism activities tend to be less efficient. Moreover, the government's fiscal condition, representing financial characteristics, is also important in explaining efficiency differences among local governments. Balaguer-Coll et al. (2007) argue that more available resources are to finance the budget raises the possibility that local government spending becomes inefficient. Empirical studies suggest that local tax has a positive effect on local government cost efficiency (Boetti et al., 2012), while it is found there is a negative effect of grants/transfers on local government efficiency (Agasisti et al., 2016).

Since the 2000s, institutional factors have been drawing attention as a determinant of local government efficiency. Proxies, including technology levels (Sampaio De Sousa and Stošić, 2005) and characteristics of leaders and employees (Boetti et al., 2012), represent different facets. Managerial forms, such as municipal cooperation, can either enhance efficiency by reducing fixed costs (Arcelus et al., 2015) or result in less efficient provision because it attracts underperforming municipalities (Perez-Lopez et al., 2015). In addition, control mechanisms, such as direct local people's participation and adopting accrual accounting, also impact efficiency in public service provision.

4. Research methods

4.1. Measuring efficiency with data envelopment analysis

This study employs DEA because (1) there is no requirement for the functional form of production function, (2) it creates a measurement unit that allows us to compare best practices and all DMUs, (3) it is not subject to a statistical problem such as specification error and endogeneity as it uses linear programming and (4) it can handle multiple inputs and outputs (Ruggiero, 2007).

In the efficiency estimation, the efficiency of a DMU can be defined as the maximum ratio of the linear combination of outputs to the linear combination of inputs (Cuadrado-Ballesteros et al., 2013). The value of the ratio ranges between 0 and 1, where a value of 1 indicates a point on the frontier, which means a technically efficient DMU. Estimation of efficiency in DEA is performed using a linear model as follows:

$$\begin{aligned} &\min_{\theta_0 \lambda_i} \theta_0 \\ s.t.\ \theta_0 x_{k,0} &- \sum_{i=1}^{n} \lambda_i x_{k,i} \geq 0 \ with\ k = 1, \ \ldots, \ m \\ -y_{r,0} &+ \sum_{i=1}^{n} + \lambda_i y_{r,i} \geq 0 \ with\ r = 1, \ \ldots, \ s \\ &\lambda_i \geq 0 \ i = 1, \ \ldots, \ldots, \ n \end{aligned} \tag{1}$$

where i denotes decision-making unit analysis, and θ is a scalar that satisfies $\theta \leq 1$. The value of θ represents the efficiency score of the local government for each district. The x_i and y_i denote the input used and output produced, respectively. $k(r)$ indicates the number of inputs (outputs) used in production.

This paper uses the variables return to scale (VRS) assumption because it is expected that all local governments are not operating at the optimum production scale. As noted in Worthington and Dollery (2000), most local governments generally operate on a non-optimal scale because of regulatory, geographical and institutional constraints. This study applies the input orientation, focusing on the input reduction with the given output level in line with that of De Borger and Kerstens (1996b). This input orientation is preferred because it is assumed that outputs are exogenous, which is determined based on regulation and demand from the local people, while inputs are controlled by the local government.

4.2. Data on input and output variables for DEA

The data is drawn from the Indonesia Database for Policy and Economic Research (INDO-DAPOER), World Bank, and SUSENAS (Socio Economic National Survey of Indonesia) covers all districts in Indonesia for the period 2005–2019. Since providing PDT policy program status for lagging districts is dynamic and is based on the central government's policy, this study categorizes the lagging districts accordingly based on the related law for every period. For this reason, the analysis is conducted in a five-year framework commencing from the period when the PDT policy program status is updated.

The physical input of public goods and service provision is often unavailable (Kalb et al., 2012). Hence, the inputs are proxied by

Table 2
Descriptive statistic input and output variables.

Periods 2005–2009 (number of Districts/Municipalities = 317)				
Variables	Mean	sd	min	max
Input variables				
total_exp (Billion Rp)	540.1	362.9	59.2	3977.0
Output variables				
student_primary	76,892	78,253	3085	612,603
student_junior	27,382	28,054	550	212,603
n_birth_att	37,990	40,394	618	330,162
hh_water	80,309	96,025	738	726,450
hh_sanitation	92,071	102,489	1978	771,912
Population	578,727	588,995	43,143	4102,049
Periods 2010–2014 (number of Districts/Municipalities = 472)				
Variables	Mean	sd	Min	Max
Input variables				
total_exp (Billion Rp)	926.4	637.7	99.3	7382.6
Output variables				
student_primary	63,397	71,215	1325	760,510
student_junior	20,015	23,003	231	228,412
n_birth_att	37,910	43,255	103	350,828
hh_water	80,366	108,058	107	776,788
hh_sanitation	85,893	107,646	93	936,263
Population	489,244	577,420	12,961	5331,149
Periods 2015–2019 (number of Districts/Municipalities = 491)				
Variables	mean	sd	min	max
Input variables				
total_exp (Billion Rp)	1490.1	921.9	292.9	9162.7
Output variables				
student_primary	57,728	66,864	2485	763,187
student_junior	24,265	28,739	656	293,689
n_birth_att	17,135	21,024	55	214,089
hh_water	94,530	127,927	89	954,119
hh_sanitation	103,405	133,846	696	1239,321
Population	503,702	610,008	13,615	5965,410

the input cost, which is the total local government expenditure as is shown in a study by Bischoff et al. (2019). This input variable is termed 'total_exp'.

The study uses output variables covering primary education, secondary education, health, basic infrastructure and global services proxied by six variables. For the output of local government in the education sector, this study will use the (1) number of students in primary school education, termed 'student_primary' and (2) number of students in junior high school, termed 'student_junior'. Proxy output for health services is (3) the number of births attended by skilled medical workers, termed as 'n_birth_att'. The number of households with access to water (4) is termed as 'hh_water' and (5) number of households with access to sanitation, is termed as 'hh_sanitation' both of which are used as output variables to represent services of basic infrastructure. Moreover, to capture the efficiency of the local government in providing general administrative services, the population numbers are used as an output proxy (Geys and Moesen, 2009). We term this as 'population'.

Descriptive statistics for the data for the input and output variables used in the DEA estimation are presented in Table 2.

4.3. Analyzing efficiency change

This study also attempts to measure the efficiency change performance of local governments over time by using the FPP index. Efficiency change reflects the development of the decision-making unit's capacity to manage resources to produce output over time. Following O'Donnell (2012), the FPP index can be defined as the ratio between the total factor productivity (TFP) in a certain period and the TFP in the benchmark period (t). To evaluate the productivity change of $n = 1, \ldots, N$ DMUs over $t = 1, \ldots, T$ periods, a benchmark technology from the initial period (period t) is used as the reference standard. This approach allows for an analysis of each DMU's efficiency and productivity change relative to the initial period. The TFP can be calculated as the ratio of the quantity index of output to the quantity index of input derived based on the Shepard input and output distance function. The TFP can be computed as follows:

$$TFP_t = \frac{D_t^0(\bar{x}, y^t)}{D_t^I(x^t, \bar{y})} \tag{2}$$

From Eq. (2), the FPP Index can be computed as follows:

$$FPP_{t,t+1} = \frac{D_t^0(\bar{x}, y^{t+1})}{D_t^I(x^{t+1}, \bar{y})} \times \frac{D_t^I(x^t, \bar{y})}{D_t^0(\bar{x}, y^t)} \tag{3}$$

In the practical application, the reference input/output vectors are chosen in the specific analysis period (Dakpo et al., 2019). In this study, the reference/benchmark is the beginning time of each analysis period, which are the years 2005, 2010 and 2014. These years are chosen because, in these years, the status of the lagging district is set by the central government. Following the framework developed by O'Donnell (2010), the FPP index then decomposes into several components.

The decomposition of the FPP index is expressed as follows:

$$FPP_{t,t+1} = \mathrm{dTFPE}_{t,t+1} \times dMP_{t,t+1} \tag{4}$$

The further decompositions are expressed as follows:

$$\mathrm{dTFP} = dITE \times dISE \times dRME \times dMP \tag{5}$$

For each index, a value greater than one indicates improvement, while a value less than one indicates a decrease in efficiency (dITE, dISE, dRME) or technological regression (dMP).

4.4. Examining determinants of efficiency

This study incorporates eight variables as determinants of public spending efficiency. The first variable is 'urban', which represents a demographical factor. This variable can be defined as the share of the population living in urban areas. The higher value of 'urban' illustrates that the districts have fewer agricultural activities. This variable can be associated with urbanization level, which, in the study by Loikkanen and Susiluoto (2005), is associated with higher efficiency. The the variable is the literacy rate, which is termed 'literacy'. This variable shows the education level of people following the investigation by Da Cruz and Marques (2014). The level of people's education in a region is expected to affect the local government's efficiency positively. The third variable is 'density' which represents the population concentration within a district and is expected to positively influence public service efficiency due to economies of scale (De Borger and Kerstens, 1996a).

The fourth, fifth, and sixth variables are related to the macroeconomic and fiscal conditions of the local economy. These variables are gross domestic product per capita, termed 'gdppc', the share of local tax revenue on total revenue, termed 'tax', and grant per capita, termed 'grant'. The gross domestic product per capita variable represents the people's income level. This variable is expected to positively influence efficiency because the higher level of income leads to higher taxation revenue for the local government, which also causes a greater demand for public service among local people (Balaguer-Coll et al., 2013). The variable 'tax' is expected to impact local government efficiency positively (Monkam, 2014), while grants are predicted to have a negative effect following the flypaper effect theory.

The seventh variable is the dummy variable 'Java', which aims to account for geographical factors. Šťastná and Gregor (2015)

found that a district close to the regional center tends to be more efficient than a distant one. Based on this finding, this study uses Java Island as a dummy variable representing the demographic aspect of the district, where the districts have relatively comparative advantages compared to those located outside the island of Java. This island has a number of advantages because it has many economic centers and numerous urban regions with higher levels of economic activity, business and commerce (Mardiansjah et al., 2021).

The last determinant in this study used in this study is the institutional factor, represented by the quality of financial reports, referred to as 'report_quality.' The study uses the National Audit Board's (Badan Pemeriksa Keuangan) opinion as a proxy for financial report quality. A disclaimer opinion highlights the least reliable aspect of the report, indicating the auditor could not gather sufficient evidence to assess the quality, reflecting the local government's low capacity in financial management. Conversely, unmodified opinions show compliance with accounting standards, signalling higher financial management capacity. In this study, report quality is scored from 1 to 5, with 5 representing the best audit opinion.

The institutional quality variables could also be represented by other relevant indicators, such as local government capacity, proxied by the level of information and technology capacity (Seol et al., 2008), or the education level of municipal and district managers (Ibrahim and Karim, 2004). Additionally, factors such as corruption (De Sousa and Stošić, 2005) are also important. However, data at the local level are often unavailable, inconsistent, or lack standardization, and time-series data are particularly scarce. While these limitations make their incorporation into the analysis challenging, including such variables when data become available would be beneficial for enhancing the depth and comprehensiveness of future studies.

This study uses second-stage regression analysis to examine the impact of all possible factors on the spending efficiency of the local government mentioned above. The second-stage regression analysis is conducted by performing regression estimation, where the efficiency score obtained from the DEA estimation is treated as a dependent variable. In contrast, all variables representing determinant efficiency become the regressors (independent variables). The general model estimation for the second-stage regression is the follows:

$$\theta_{it} = \alpha + \beta_1 urban + \beta_2 literacy + \beta_3 density + \beta_4 gdppc + \beta_5 tax + \beta_6 grant + \beta_7 d_Java + \beta_8 report_quality + \varepsilon \quad (7)$$

The suitability of the regression model has been contentious. Simar and Wilson (2011) noted that the coefficients estimated from OLS regression will be inconsistent due to the correlation of DEA efficiency estimates. Moreover, the bounded value of unity in efficiency score causes the standard estimation on OLS to be inappropriate. This suggests a truncated regression estimation. For this reason, this study will apply truncated regression estimation.

Descriptive statistics of exogenous variables, which are considered determinants of efficiency, are presented in Table 3.

Table 3
Descriptive statistics of determinants of public spending efficiency.

Periods 2005–2009 (number of Districts/Municipalities = 317)				
Variable	Mean	sd	min	max
Urban	39.774	31.871	0.000	100.000
Literacy	91.775	7.165	38.340	99.830
Density	1.162	2.307	0.001	16.461
Gdppc	14.497	29.401	0.887	559.789
Tax	0.074	0.061	0.004	0.635
Grant	1.473	1.483	0.000	17.948
d_Java	0.315	0.465	0	1
report_quality	2.632	0.815	1	5
Periods 2010–2014 (number of Districts/Municipalities = 472)				
Variable	mean	sd	min	max
Urban	37.490	31.012	0.000	100.000
Literacy	93.326	8.564	10.930	100.000
Density	0.937	2.082	0.001	14.744
Gdppc	33.898	43.347	4.495	399.868
Tax	0.085	0.083	0.004	0.835
Grant	3.296	4.229	0.355	56.421
d_Java	0.235	0.424	0	1
report_quality	3.088	1.095	1	5
Periods 2015–2019 (number of Districts/Municipalities = 491)				
Variable	mean	sd	min	max
Urban	39.156	30.761	0.000	100.000
Literacy	95.463	5.691	43.356	100.000
Density	0.977	2.202	0.001	15.643
Gdppc	47.156	49.125	5.274	487.415
tax	0.125	0.108	0.003	0.874
grant	4.743	5.783	1	75
d_Java	0.228	0.420	0	1
report_quality	4.442	1.022	1.000	5.000

5. Results and discussion

5.1. Local government spending efficiency in lagging districts

Table 4 shows the overall mean technical efficiency (TE) score based on Eq. (1). For all local governments in Indonesia, the efficiency scores were 0.383 for 2005–2009, 0.281 for 2010–2014 and 0.459 for 2015–2019. This result indicates that local governments are generally inefficient, with the potential to reduce inputs (expenditures) by more than half while maintaining the same level of output. This result is similar to that of Yusfany (2015), who found that the overall technical efficiency score of local governments in Indonesia is relatively low. Table 4 also shows that the mean efficiency score for non-lagging districts ranges between 0.307 and 0.477. In contrast, the lagging district's spending efficiency is only below 0.397 on average for the three periods of analysis. This result highlights that lagging and non-lagging districts' TE scores significantly differ. Based on the average TE score for the three periods, it can be said that the non-lagging districts can produce 9.2 % more output than the lagging districts with the same amount of expenditure. In other words, lagging districts are less efficient in managing expenditures than non-lagging districts.

From 2005 to 2009, low Technical Efficiency (TE) scores highlighted inefficient local public expenditure, likely due to the initial adjustments required by the 2004 decentralization law and the extensive territorial splits during this period. New autonomous districts often underperformed compared to their parent districts, struggling to deliver public services effectively in their early stages (Bappenas and United Nations Development Programme, 2008). During the period, 2010–2014, spending efficiency further declined, partly due to a significant increase in central government transfers, which grew by over 19 % in 2011. Many districts were unable to fully utilize these additional resources, resulting in budget surpluses (Prasetiya et al., 2021). By 2015–2019, spending performance improved as local governments gained expertise in budget management. This improvement was further supported by a moratorium on territorial splits, which reduced administrative fragmentation and allowed governments to focus on delivering public services more efficiently.

Where districts are clustered into several regions, the efficiency level of public spending varies across the areas. For example, the districts in Java have a higher mean efficiency score, indicating they are relatively better than other districts in managing their public service expenditure. As expected, the Papua and Maluku regions show the lowest mean efficiency scores. The lower efficiency score in Papua may be because this region lacks infrastructure and is far from the center of economic activity (e.g., the Indonesia capital), which could undermine the region's development. This finding confirms Hill's (2008) study, which argues that the strategic position of local government is an important comparative advantage and can determine progress of development.

Fig. 4 reveals that lagging districts generally exhibit lower efficiency compared to non-lagging districts in most regions, highlighting disparities in public expenditure performance across and within regions. However, an interesting exception is found in the Java region, where lagging districts show relatively higher efficiency scores than those in other regions, even outperforming non-lagging districts elsewhere. This suggests that the higher efficiency of non-lagging districts in Java may have a positive spillover effect on lagging districts, supporting Day and Lewis's (2013) argument that geographical spillovers play a crucial role in regional growth and development. In Indonesia, such spillovers seem to operate mainly within regions, with little evidence of inter-regional spillovers, pointing to increasing regional divergence and a widening development gap. Additionally, lagging districts in Bali and Nusa Tenggara outperform non-lagging districts in these regions, indicating that despite initial disadvantages and lower development levels, lagging districts can still manage their budgets efficiently in this region.

The regional efficiency scores in Fig. 4 highlight the significant influence of geographical characteristics on the spending performance of lagging districts. Regions such as Kalimantan, Papua, and Maluku exhibit considerably lower average efficiency scores compared to other lagging districts across Indonesia. This disparity is likely driven by the vast size of these areas, sparse populations, and challenging terrains such as dense forests and mountainous landscapes, which significantly increase the cost and complexity of public service delivery. Additionally, many of these districts are located near international borders, making them geographically isolated and far from provincial capitals and administrative centers.

Efriandi (2021) draws attention to the unique challenges faced by districts in Papua, including rugged mountainous terrain, dispersed and sparsely populated settlements, and inadequate road and transportation infrastructure. These factors severely constrain local governments' ability to deliver essential services, such as healthcare and education, effectively. To address these challenges, merely increasing transfers to finance education and healthcare services may not be sufficient. Instead, supporting local governments in developing critical infrastructure, such as roads and telecommunications, is likely to be a more effective approach to closing the public service delivery gap. A tailored program specifically designed for lagging districts with severe geographical challenges may be essential to effectively address these persistent disparities, rather than applying a uniform PDT program policy to all lagging districts.

5.2. The evolution of spending efficiency in lagging districts

The FPP index result shows that all districts experienced significant decrease of public expenditure productivity in 2005–2009. The

Table 4
Average technical efficiency scores.

Status	Period 2005–2009	Period 2010–2014	Period 2015–2019	Average of 3 periods
Lagging	0.324	0.233	0.397	0.318
Non-Lagging	0.416	0.307	0.477	0.400
All Districts & Municipalities	0.383	0.281	0.459	0.374

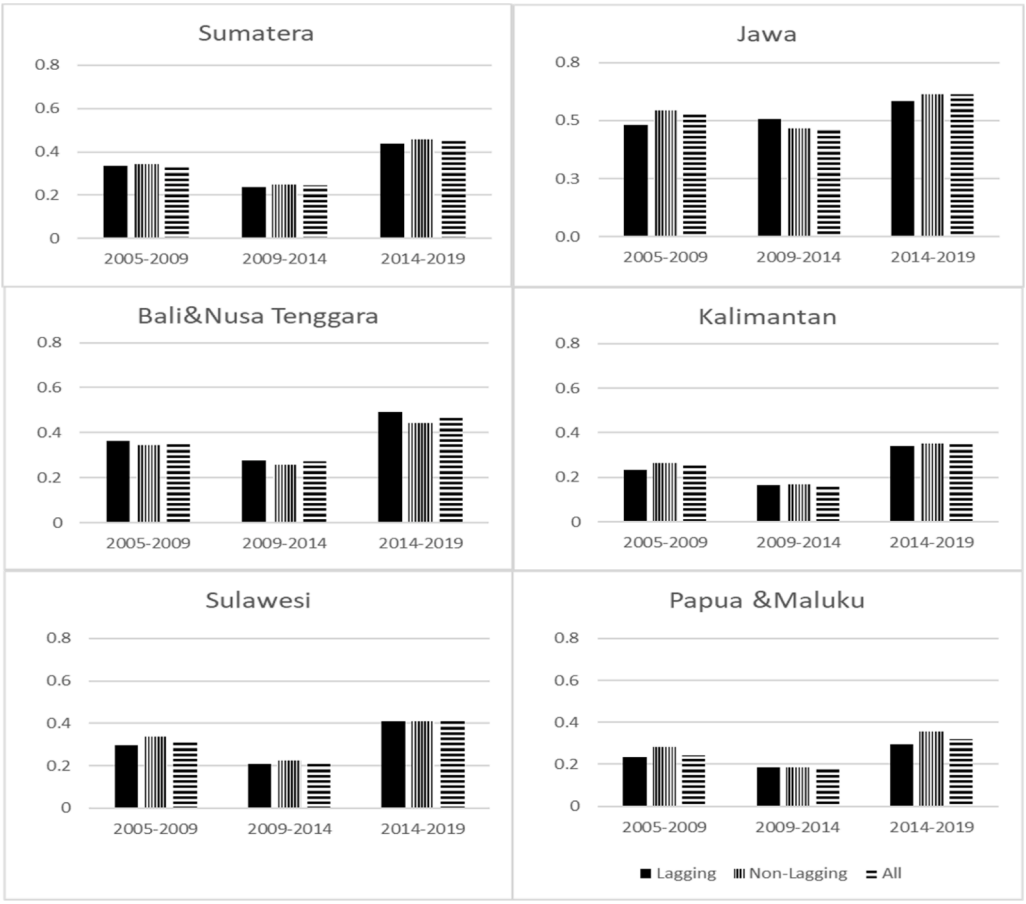


Fig. 4. Mean efficiency score by region.

figure of dTFP in Table 5 shows that, on average, all districts and municipalities' spending in Indonesia in 2009 was less productive compared to 2005. From the decomposition of the FPP index, we know that productivity decline was driven by technological regress and efficiency decrease.

In the period 2005–2009, the average dTFPE was 0.821, indicating that efficiency was declining. This figure shows that districts and municipalities are annually 17.9 % less efficient. For 2010–2014, productivity still showed a declining trend but less so compared to 2005–2009. In this period, spending efficiency remain stable, indicated by dTFPE close to one. In the last analysis period (2015–2019), spending efficiency increased slightly by about 1.1 %.

The value of dMP indicates that technical regression contributed to a decline in productivity. Across all analyzed periods, the dMP value remained below one, signifying that the technology available for producing public services was less effective, resulting in declining productivity. During the 2005–2009 period, the average dMP was particularly low (0.786), reflecting a 21.4 % technical regression. This decline may be associated with the implementation of the decentralization law enacted in 2004, which was still in its

Table 5
FPP index (productivity changes and its decomposition).

Productivity change	Average		
	2005–2009	2010–2014	2015–2019
dTFP (Total Productivity Change)	0.651	0.829	0.962
dMP (Technological Change)	0.786	0.937	0.952
dTFPE (Efficiency Change)	0.821	1.006	1.011
dITE (Input Technical Efficiency Change)	1.158	1.278	1.328
dISE (Input Scale Efficiency Change)	0.798	0.834	0.818
dIME (Input Mix Efficiency Change)	1.000	1.000	1.000
dRISE (Residual Input Scale Efficiency Change)	0.745	0.822	0.789
dISME (Input Scale Mix Efficiency)	0.745	0.822	0.789
dRME (Residual Mix Efficiency Change)	0.935	0.992	0.966

early stages. During this time, local governments were undergoing a learning process as they adjusted to their new responsibilities under the decentralization framework. Firman (2009) notes that, at the onset of decentralization, many local governments focused on exercising their newfound authority, often with a sense of euphoria. However, this enthusiasm sometimes led to insufficient attention to existing public services and inadequate cooperation with neighboring local authorities, resulting in inefficiencies and reduced effectiveness in public service delivery.

During the period, 2010–2014 and 2015–2019, the dMP value remaining below one suggests increasing costs of delivering public services. Despite budget increases, local governments were not consistently able to produce more outputs or improve public service delivery. One contributing factor may be the proliferation of districts, which significantly increased the fixed costs of government administration. While this expansion may have improved public service access in newly established districts, it also highlighted inefficiencies and underscored the need for a review of district creation policies. Furthermore, it points to the importance of fostering cooperation among local authorities to maintain optimal public service delivery. Hansen et al. (2014) and Firman (2014) emphasize that joint cooperation in public service provision can enhance efficiency by leveraging economies of scale and improving cost management. For newly established lagging districts, maintaining close cooperation and coordination with their parent districts is critical to ensuring the effective planning and provision of public services without unnecessary expenditure or duplication of resources. These efforts are essential to avoid inefficiencies and to optimize the use of limited resources, particularly in areas where technical and financial capacity may still be developing.

Since this study focuses on the evolution of public spending performance in lagging districts, we separated the average FPP index between lagging and non-lagging districts/municipalities. Fig. 5 shows that dTFPE index less than one, revealing that spending efficiency in lagging districts for period 2005–2009 decreased by an average of 22 %, while in non-lagging districts, it declined by around 16 %. However, in the 2010–2014 period, spending efficiency in non-lagging districts remained relatively stable, while lagging districts saw a 4 % improvement. In the final period of analysis (2015–2019), spending efficiency in non-lagging districts improved by 1 %, while the efficiency of lagging districts remained stable, with a dTFPE value of 1.00.

The decomposition of the FPP index reveals several interesting insights that explain the sources of efficiency improvements. First, the dITE indicates that while both lagging and non-lagging districts experienced improvements in pure technical efficiency across all periods, the growth in technical efficiency for lagging districts was higher. This suggests that lagging districts have made significant progress in managing their expenditures and are attempting to catch up with non-lagging districts and municipalities. Second, the dISE value, consistently less than one, shows that scale efficiency did not contribute to improving spending efficiency throughout the analysis period. This finding suggests that regional proliferation may not accelerate the delivery of public services to local populations. The division of districts appears to limit local governments' ability to establish an optimal scale for public service delivery. As a result, the effectiveness of public services is primarily determined by how well local governments manage their resources. This issue may be rooted in political factors, where the small size of districts reduces the likelihood of conflicts between different parts of districts or municipalities (Swianiewicz and Łukomska, 2019). Consequently, local government policies and activities can be implemented more effectively.

Another critical finding, as shown in Table 6, is that all districts experienced varying rates of improvement in technical efficiency, with a general trend of acceleration over time. The dITE figures reveal that non-lagging districts saw an average increase in technical efficiency of 13.9 % in 2005–2009, 22.4 % in 2010–2014, and 31.2 % in 2015–2019. In contrast, lagging districts experienced even stronger growth, with efficiency improvements averaging 19.2 %, 37.6 %, and 37.9 % during the same periods. This gradual improvement may be attributed to the increasing capacity of local governments to manage their spending more effectively over time. In the early stages of development, poorer regions often have weaker institutions, infrastructure, and education systems, leading to lower allocative and productive efficiency. However, as decentralization progresses, these areas gradually improve (Rodríguez-Pose and Ezcurra, 2010b).

Another factor contributing to the significant improvement in technical efficiency from 2010 onward is the implementation of Law 28/2009 concerning local taxes. This law may have enhanced public spending management by granting local governments the authority to raise and collect their own revenue, thereby providing them with the certainty and discretion needed to manage their budgets effectively. Olum (2014) argued that the success of decentralization depends on granting local governments clear authority, motivation, and resources, all of which this law supports.

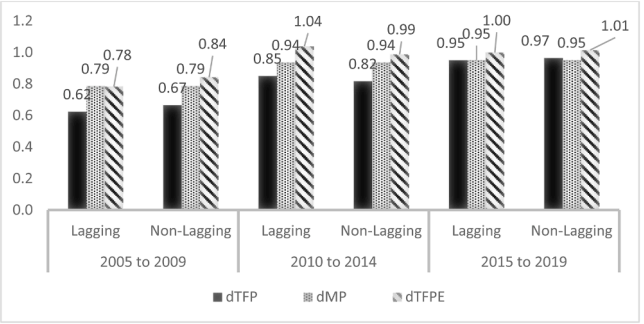


Fig. 5. Productivity, technological, and efficiency changes.

Table 6
Average FPP index and its decomposition (lagging vs non-lagging districts/municipalities).

	2005 to 2009		2010 to 2014		2015 to 2019	
	Lagging	Non-lagging	Lagging	Non-lagging	Lagging	Non-lagging
dTFP	0.624	0.666	0.851	0.818	0.951	0.965
dMP	0.786	0.786	0.937	0.937	0.952	0.952
dTFPE	0.783	0.843	1.039	0.987	0.999	1.015
dITE	1.192	1.139	1.376	1.224	1.379	1.312
dISE	0.739	0.830	0.791	0.858	0.792	0.825
dRME	0.937	0.933	1.017	0.979	0.949	0.971

Suppose that the indices are clustered by region, the results reveal that efficiency growth varies across both regions and periods. Table 7 shows that all districts in all regions experienced a decrease in efficiency (with dTFPE below 1), except for the lagging districts in Papua and Maluku. The general decline in efficiency among lagging districts suggests that the "lagging status" (i.e. PDT) policy program may not have been effective in channelling policies and funding to improve lagging districts overall. However, the efficiency improvements in Papua and Maluku's lagging districts indicate that development mainstreaming in these specific regions may have yielded positive results. This could be because these districts had previously received less attention, causing them to fall behind. After the implementation of the "lagging status" PDT policy program, the increased focus and attention on these regions may have contributed to more efficient public expenditure, thus improving service delivery.

Table 7 shows the solid trend that all districts both lagging and non-lagging experience the declining of scale efficiency (dISE<1) despite the solid improvement of pure technical efficiency (dITE>1). The decline of scale efficiency in other regions could be due to the district's splits, which may lead to local government operating on a non-optimum scale and therefore not delivering public service well. Given the typical limitation of resources in new districts, the demonstrated decline in scale efficiency in the findings validates Farmer's (2010) assertion that achieving comprehensive public service provision is feasible, but contingent upon the full exercise of autonomy in fiscal authority - which includes the ability to raise revenue.

Furthermore, Table 7 reveals a catch-up trend between lagging and non-lagging districts, as well as between less developed and more developed regions. The consistently higher improvement in pure technical efficiency (dITE) for lagging districts compared to non-lagging districts suggests that lagging districts are learning to manage their budgets more effectively, resulting in greater efficiency in delivering public services. In regions like Kalimantan, Papua, and Maluku, the higher dITE scores for both lagging and non-lagging districts highlight that, over time, these districts have made significant progress in managing their budgets and are catching up with districts in more developed regions, such as Java and Sumatra, which have traditionally had higher technical efficiency scores. These results indicate that less developed regions can improve their performance and potentially reach the same level of spending efficiency as regions like Java, provided the trend of improvement continues.

This study focuses on how public spending efficiency in lagging districts evolves over time, making it essential to examine the differing patterns of efficiency changes between districts that graduated from "lagging status" and those that did not. Fig. 6 shows that the pure technical efficiency (dITE) change in districts that graduated from "lagging status" was similar to those still classified as

Table 7
FPP index and its decomposition by regions.

Period 2005–2009								
	Lagging				Non-lagging			
	dTFPE	dITE	dISE	dRME	dTFPE	dITE	dISE	dRME
Sumatra	0.736	1.083	0.744	0.942	0.829	1.190	0.788	0.937
Java	0.818	1.019	0.890	0.910	0.869	1.040	0.922	0.923
Bali and Nusra	0.810	1.225	0.754	0.925	0.887	1.235	0.784	0.952
Kalimantan	0.779	1.271	0.690	0.951	0.805	1.234	0.725	0.957
Sulawesi	0.811	1.261	0.709	0.947	0.790	1.222	0.733	0.912
Papua and Maluku	1.056	1.566	0.715	1.006	0.814	1.347	0.627	1.028
Period 2010–2014								
Sumatra	1.003	1.316	0.799	1.006	0.969	1.195	0.854	0.997
Java	0.967	1.041	0.877	1.051	0.954	1.129	0.893	0.950
Bali and Nusra	1.058	1.309	0.852	0.994	1.012	1.225	0.868	0.966
Kalimantan	1.041	1.304	0.826	1.020	1.051	1.375	0.823	0.993
Sulawesi	1.070	1.707	0.644	1.007	1.027	1.322	0.835	0.991
Papua and Maluku	0.943	1.076	0.963	0.970	1.087	1.544	0.760	1.011
Period 2015–2019								
Sumatra	0.966	1.389	0.792	0.913	1.011	1.353	0.802	0.965
Java	0.987	1.176	0.924	0.918	0.955	1.093	0.914	0.971
Bali and Nusra	0.944	1.264	0.810	0.946	0.929	1.224	0.826	0.943
Kalimantan	1.072	1.471	0.793	0.947	1.197	1.597	0.780	0.999
Sulawesi	0.986	1.392	0.753	0.973	1.001	1.384	0.765	0.975
Papua and Maluku	1.033	1.449	0.777	0.957	1.068	1.445	0.795	0.962

lagging during the 2005–2009 period. However, in the 2010–2014 and 2015–2019 periods, the efficiency improvements in graduated districts were lower. This suggests that a district's capacity to manage its budget efficiently does not directly align with its graduation from lagging status.

The findings imply that overall local development is not solely determined by the performance of local governments in delivering public services. Other factors outside the scope of local government responsibilities, such as infrastructure, education, or national-level policies, may also affect development progress. These factors could influence whether a district moves out of lagging status, even if it improves its spending efficiency. This suggests that while funding mainstreamed to local governments may enhance public service delivery, achieving broader development goals requires central government intervention to address challenges beyond the local government's authority.

Despite improvements in spending efficiency not guaranteeing a graduation from lagging to non-lagging status, these improvements have significantly contributed to progress, as reflected in the development trends of lagging regions over three study periods (2005–2009, 2010–2014, and 2015–2019). Overall, the development indicators in lagging districts show noticeable progress being made. The Human Development Index (HDI) steadily increased by approximately 4 % every five years. Positive development was also evident in the reduction of poverty rates, particularly during the first period, with an overall average decline of 5 %. Furthermore, strong economic progress was observed in the lagging districts, with per capita GDP increasing >15 % during 2005–2009 and further growing by over 7 % and 8 % in the subsequent periods of 2010–2014 and 2015–2019, respectively. These consistent improvements in key indicators highlight the positive impact of the PDT policy program. However, income inequality showed mixed results, with improvements during 2005–2009 but stagnating or worsening in later years.

These findings suggest that local governments have responded effectively to the PDT program, as evidenced by improvements in public service delivery. However, addressing broader development challenges—particularly those related to income inequality—requires a more comprehensive approach that goes beyond the responsibilities of local governments. Key issues such as infrastructure development, education, and income distribution must be prioritized. This underscores the need for sustained central government support and targeted intervention. While the funding facilitated through the PDT program has enhanced public service delivery, achieving broader development goals requires a coordinated approach between local and national governments.

5.3. Determinants of local government spending efficiency

The magnitude of the coefficients for each explanatory variable is not the primary focus of the study. Instead, the sign and significance of the coefficients are more important, as they provide insights into how variables influence the efficiency of local public spending. Table 8 presents the estimated coefficients and their significance for all potential determinants of efficiency across the study

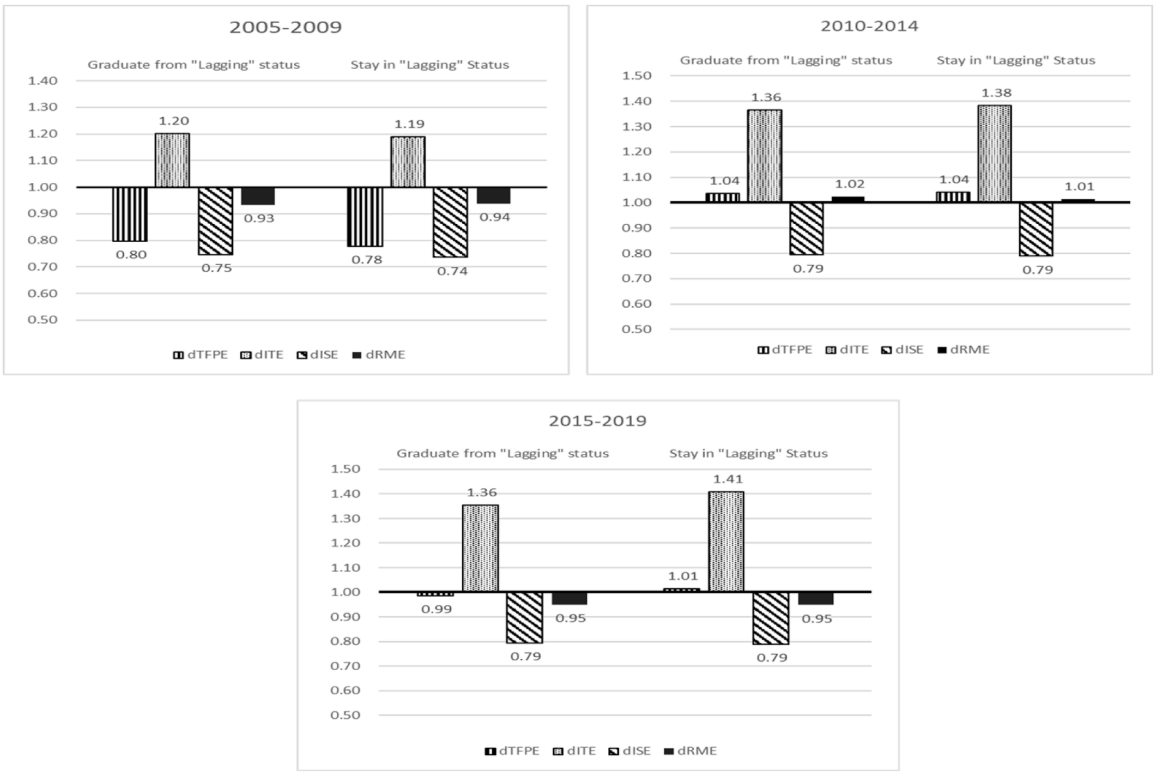


Fig. 6. Expenditure efficiency in lagging districts (graduated vs non-graduated).

periods.

The results show that the coefficient for "urban" is positive for non-lagging districts but turns negative for lagging districts. The positive coefficient for 'urban' variable suggests that higher urbanization is associated with more efficient districts, aligning with Loikkanen et al. (2011), who emphasized the role of urbanization in promoting local government efficiency. However, the negative sign for lagging districts may indicate that these regions struggle to adapt to urban growth. In the early stages of decentralization, the increasing demand for public services in urban areas may outpace local governments' ability to meet these needs, resulting in lower performance. This is consistent with the argument by Da Cruz and Marques (2014) that urbanization can increase public service costs due to agglomeration effects and greater complexity.

The effect of the literacy rate on local public spending efficiency in lagging districts is negative and significant in 2005–2009, but a positive impact is consistently observed for two subsequent periods. A higher literacy rate may positively influence efficiency because a more educated population can enhance the capacity of local governments to manage public spending, particularly in underdeveloped districts (Da Cruz and Marques, 2014). However, the negative effect found in non-lagging districts in 2010–2014 suggests that the relationship between education and efficiency may vary. In some cases, a more literate population may lead to a greater diversity of demands for public services that exceed local government capabilities, resulting in inefficiencies. This is supported by Šťastná and Gregor (2015), who found that a higher presence of university graduates increased cost inefficiency within Czech local governments.

Table 8 shows that, overall, higher population density in a district leads to greater spending efficiency, especially in lagging districts. This finding suggests that a more concentrated population in lagging districts can promote the efficiency of public services. In contrast, dispersed populations may lead to inefficiency, as delivering public services to scattered populations poses challenges in achieving economies of scale. Another finding from the regression results is that economic factors can explain differences in efficiency. Specifically, the results in Table 8 indicate that higher income levels in a district are associated with lower local government spending efficiency. This finding supports Monkam (2014), who argues that higher income levels may reduce people's motivation or incentive to actively participate in monitoring public expenditure, thereby leading to inefficiencies.

The coefficient for "tax" is insignificant during 2005–2009 but becomes positive and significant from 2010 onward in non-lagging districts, indicating that local governments relying on local revenue to fund their budgets are more efficient. This positive effect can be attributed to higher tax contributions from residents, which increase demands for accountability in service delivery and government performance (Monkam, 2014). These findings may be due to non-lagging districts typically having a stronger tax base, enabling greater efficiency. In contrast, the weaker tax base in lagging districts likely explains the negative coefficient observed in the regression results for these areas.

Additionally, the results show that the "grant" variable has a negative and significant effect on local government spending efficiency across all estimation periods. This indicates that transfers from the central government can lead to inefficient public spending allocations. This finding aligns with the "flypaper effect" theory, which suggests that grants create a fiscal illusion, leading local governments to make biased budgetary decisions. Bureaucrats, who generally have more information about revenue sources, may spend grant money freely to increase budgets without a corresponding improvement in public services, resulting in inefficiency. This underscores the argument that when local government capacity is insufficient, the delegation of responsibilities and resources from the central government should be accompanied by substantial support to ensure the desired outcomes are achieved (Ateh et al., 2020).

The geographical factor, represented by the dummy variable "Java," has a positive and significant coefficient for non-lagging districts, indicating that non-lagging districts in Java tend to have better spending efficiency than those outside the island. This can be attributed to Java's well-established infrastructure and economic activity centers, which create spillover effects that improve efficiency. This finding is consistent with Wang and Tao (2019) study, which highlights the spatial spillover effect of economic development in explaining efficiency differences in public service provision. The insignificant coefficient for lagging districts is expected, as few lagging districts are in Java, and those that were had graduated from lagging status by 2009.

The last variable in the model, "report quality," serves as a proxy for the institutional characteristics of local government. The regression results in Table 8 consistently show a negative coefficient for this variable, indicating that better financial report quality is associated with less efficient public spending in both lagging and non-lagging districts. This suggests that while local governments may demonstrate an ability to prepare good financial reports, this may also reflect their capacity to inflate budgets to maximize self-interest. This finding aligns with Niskanen's (2019), bureaucracy theory, which point out that bureaucrats, having superior knowledge of the actual costs of public services, tend to overspend to serve their own interests, exploiting the public's limited information.

6. Conclusions

The study evaluates the spending efficiency of lagging districts in Indonesia to assess their performance in managing public service expenditures. The analysis spans three periods, corresponding with the central government's policy program "PDT status" evaluations, conducted every five years. The DEA estimation reveals a relatively low technical efficiency (TE), with a notable disparity between lagging and non-lagging districts. The efficiency also varies by region, with Java scoring higher than other regions, while Papua and Maluku exhibit the lowest efficiency, highlighting regional disparities in public spending efficiency.

The study further examines efficiency development in lagging districts using the FPP index, which measures productivity, technological, and efficiency changes. It finds that while efficiency improved across all districts, lagging districts demonstrated higher pure technical efficiency than non-lagging ones, suggesting a growing capacity to manage expenditures. However, the study also highlights that improved efficiency does not guarantee that a district will shed its "lagging" status. This suggests that local government efforts alone are insufficient, and central government intervention, especially in areas beyond local control, is needed to accelerate development.

Table 8
Truncated regression analysis - determinants of spending efficiency of local governments.

	2005–2009						2010–2014						2015–2019					
	All		Lagging		Non-Lagging		All		Lagging		Non-Lagging		All		Lagging		Non-Lagging	
urban	−0.0001		−0.0014	***	−0.0001	***	−0.0001		−0.0011	***	0.0000		0.0004	***	−0.0023	***	0.0006	***
literacy	−0.0015	***	−0.0017	**	−0.0014		−0.0002		0.0009	***	−0.0021	**	0.0016	***	0.0035	***	−0.0004	
density	0.0060	***	0.1084	***	0.0045	**	−0.0004		0.3350	***	−0.0006		0.0004		0.4587	***	0.0014	
gdppc	−0.0004	***	−0.0009	*	0.0000	***	−0.0005	***	−0.0002	***	−0.0006	***	−0.0006	***	−0.0005	***	−0.0005	***
tax	0.0479		0.0826		−0.0771		0.1328	***	−0.6529	***	0.1883	***	0.1583	***	0.3955	***	0.0468	
grant	−0.0519	***	−0.0309	***	−0.0944	***	−0.0056	***	−0.0039	***	−0.0074	***	−0.0059	***	−0.0026	***	−0.0125	***
d_Java	0.1246	***	0.0631	***	0.0922	***	0.2128	***	0.1306	***	0.1923	***	0.1423	***	−0.0215		0.1244	***
report_quality	0.0078	*	0.0183	***	−0.0009		−0.0148	***	−0.0118	***	−0.0189	***	−0.0204	***	−0.0169	***	−0.0258	***
Constant	0.5266	***	0.4777	***	0.6162	***	0.3153	***	0.2166	***	0.5194	***	0.3833	***	0.1465	***	0.6406	***
Observations	1469		533		936		2336		826		1510		2440		558		1882	
Wald chi2	1258.3	***	331.6	***	1008.5	***	2082.6	***	872.3	***	1331.9	***	2036.5	***	750.2	***	1671.7	***

Notes: Significant (****$p < 0.01$, **$p < 0.05$, or *$p < 0.1$).

The study also identifies factors influencing efficiency across districts. Regression analysis shows that urbanization has varying effects on efficiency between lagging and non-lagging districts, while the impact of literacy rates is positive only for lagging districts. Fiscal factors, such as tax revenue and government grants, significantly influence efficiency. While improving local tax capacity promotes efficiency, reliance on grants can lead to inefficiency. Additionally, geographic proximity to economic centers, like Java, boosts efficiency. The study also suggests that a district's capacity for financial reporting may negatively impact efficiency, as it may indicate an inflated budget, aligning with bureaucracy theory.

From a policy perspective, the findings offer insights for evaluating the PDT policy program. Although lagging districts have shown improvements in spending efficiency, this alone is not sufficient to graduate them from their "lagging" status. Simply mainstreaming funds to these districts may not fully address the issue, as development acceleration also requires central government intervention. It is important to exercise caution when establishing new districts, particularly lagging ones, so as to avoid unnecessary operational costs. Close coordination between newly formed and parent districts is crucial to ensuring sustainable and adequate public services. Identifying key factors influencing efficiency is critical for improving public spending management especially, for determining fiscal transfers and tailored policy interventions that could promote efficiency while ensuring equitable development.

Furthermore, it should be emphasized here that incorporating qualitative measures of local government output is essential for a more comprehensive assessment of public sector performance. While current analyzes primarily focus on quantitative efficiency metrics, integrating qualitative dimensions will offer deeper insights into service delivery effectiveness. As more qualitative data become available, future research should refine these evaluations, contributing to better informed policy decisions and sustainable improvements in local governance.

CRediT authorship contribution statement

Ardi Sugiyarto: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Boon L. Lee:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Clevo Wilson:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Conceptualization.

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Appendix

Regression results
Determinants of spending efficiency (lagging vs non-lagging districts) – period 2005–2009

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Lagging	Non-lagging	All	Lagging	Non-lagging
Variables	TE	TE	TE	TE	TE	TE
urban	−7.05e-05	−0.00135***	−8.87e-05	−5.86e-05	−0.00135***	−7.53e-05
	(0.000150)	(0.000397)	(0.000176)	(0.000166)	(0.000483)	(0.000192)
literacy	−0.00109*	−0.00158*	−0.000300	−0.00154***	−0.00171**	−0.00135
	(0.000657)	(0.000932)	(0.00103)	(0.000570)	(0.000731)	(0.000958)
density	0.00399	0.113***	0.00182	0.00602***	0.108***	0.00451**
	(0.00247)	(0.0413)	(0.00240)	(0.00218)	(0.0396)	(0.00227)
gdppc	−0.000422**	−0.000879***	2.68e-05	−0.000402***	−0.000890*	2.36e-05
	(0.000193)	(0.000308)	(0.000169)	(0.000135)	(0.000462)	(0.000143)
tax	0.171	0.0333	0.0491	0.0479	0.0826	−0.0771
	(0.113)	(0.293)	(0.109)	(0.0733)	(0.287)	(0.0748)
grant	−0.0533***	−0.0314***	−0.0984***	−0.0519***	−0.0309***	−0.0944***
	(0.00704)	(0.00505)	(0.00826)	(0.00272)	(0.00314)	(0.00496)
d_Java	0.135***	0.0604**	0.106***	0.125***	0.0631***	0.0921***
	(0.0121)	(0.0295)	(0.0133)	(0.00918)	(0.0240)	(0.0112)
report_quality	0.00978**	0.0189***	0.00317	0.00779*	0.0183***	−0.000863
	(0.00431)	(0.00603)	(0.00580)	(0.00446)	(0.00623)	(0.00594)
/sigma				0.135***	0.123***	0.132***
				(0.00250)	(0.00376)	(0.00307)
Constant	0.480***	0.468***	0.509***	0.527***	0.478***	0.616***
	(0.0599)	(0.0885)	(0.0975)	(0.0526)	(0.0682)	(0.0905)
Observations	1487	534	953	1469	533	936
R-squared	0.454	0.374	0.503			

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Regression results

Determinants of spending efficiency (lagging vs non-lagging districts) – period 2010–2014

Variables	(1) All TE	(2) Lagging TE	(3) Non-lagging TE	(4) All TE	(5) Lagging TE	(6) Non-lagging TE
urban	−6.44e-05	−0.00116***	2.96e-06	−5.04e-05	−0.00111***	2.87e-06
	(0.000132)	(0.000260)	(0.000151)	(0.000117)	(0.000264)	(0.000147)
literacy	−0.000159	0.000806***	−0.00166**	−0.000159	0.000849***	−0.00209**
	(0.000314)	(0.000255)	(0.000777)	(0.000298)	(0.000240)	(0.000832)
density	0.000966	0.342***	0.000310	−0.000437	0.335***	−0.000634
	(0.00278)	(0.0413)	(0.00289)	(0.00170)	(0.0268)	(0.00195)
gdppc	−0.000527***	−0.000180***	−0.000627***	−0.000527***	−0.000188***	−0.000627***
	(6.28e-05)	(5.83e-05)	(7.89e-05)	(6.16e-05)	(7.09e-05)	(8.79e-05)
tax	0.199***	−0.691***	0.263***	0.133***	−0.653***	0.188***
	(0.0706)	(0.125)	(0.0821)	(0.0409)	(0.107)	(0.0470)
grant	−0.00571***	−0.00405***	−0.00760***	−0.00564***	−0.00390***	−0.00735***
	(0.000911)	(0.000729)	(0.00254)	(0.000639)	(0.000614)	(0.00110)
d_Java	0.217***	0.127***	0.199***	0.213***	0.131***	0.192***
	(0.00869)	(0.0301)	(0.0105)	(0.00648)	(0.0185)	(0.00831)
report_quality	−0.0168***	−0.0113***	−0.0222***	−0.0148***	−0.0118***	−0.0189***
	(0.00247)	(0.00248)	(0.00380)	(0.00229)	(0.00242)	(0.00339)
/sigma				0.114***	0.0786***	0.124***
				(0.00166)	(0.00193)	(0.00226)
Constant	0.318***	0.223***	0.484***	0.315***	0.217***	0.519***
	(0.0298)	(0.0262)	(0.0726)	(0.0271)	(0.0214)	(0.0782)
Observations	2351	827	1524	2336	826	1510
R-squared	0.465	0.493	0.462			

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Regression results

Determinants of spending efficiency (lagging vs non-lagging districts) – period 2015–2019

Variables	(1) All TE	(2) Lagging TE	(3) Non-lagging TE	(4) All TE	(5) Lagging TE	(6) Non-lagging TE
urban	0.000382***	−0.00229***	0.000497***	0.000421***	−0.00229***	0.000548***
	(0.000108)	(0.000281)	(0.000113)	(0.000109)	(0.000310)	(0.000117)
literacy	0.00176***	0.00345***	0.000140	0.00160***	0.00345***	−0.000428
	(0.000432)	(0.000376)	(0.000707)	(0.000412)	(0.000412)	(0.000769)
density	−0.000469	0.459***	0.000252	0.000373	0.459***	0.00140
	(0.00233)	(0.0383)	(0.00233)	(0.00151)	(0.0310)	(0.00153)
gdppc	−0.000659***	−0.000462***	−0.000570***	−0.000636***	−0.000462***	−0.000536***
	(6.26e-05)	(9.37e-05)	(7.14e-05)	(4.83e-05)	(8.91e-05)	(5.41e-05)
tax	0.226***	0.396***	0.127*	0.158***	0.396***	0.0468
	(0.0742)	(0.143)	(0.0745)	(0.0343)	(0.138)	(0.0358)
grant	−0.00574***	−0.00261***	−0.0121***	−0.00593***	−0.00261***	−0.0125***
	(0.000723)	(0.000434)	(0.00153)	(0.000429)	(0.000439)	(0.000910)
d_Java	0.144***	−0.0216	0.128***	0.142***	−0.0215	0.124***
	(0.00795)	(0.0208)	(0.00858)	(0.00625)	(0.0203)	(0.00692)
report_quality	−0.0211***	−0.0169***	−0.0263***	−0.0204***	−0.0169***	−0.0258***
	(0.00250)	(0.00292)	(0.00335)	(0.00223)	(0.00291)	(0.00296)
/sigma				0.107***	0.0828***	0.106***
				(0.00154)	(0.00248)	(0.00173)
Constant	0.367***	0.146***	0.582***	0.383***	0.146***	0.641***
	(0.0423)	(0.0373)	(0.0702)	(0.0390)	(0.0387)	(0.0751)
Observations	2453	558	1895	2440	558	1882
R-squared	0.465	0.574	0.475			

Notes: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Multicolinearity tests

2005–2009			2010–2014			2015–2019		
Variable	VIF	1/VIF	Variable	VIF	1/VIF	Variable	VIF	1/VIF
density	2.67	0.374507	urban	2.35	0.425082	tax	2.78	0.359901
d_Java	2.01	0.497929	density	2.21	0.453297	urban	2.41	0.414905
grant	1.33	0.753462	tax	2.02	0.495651	density	2.29	0.436915
literacy	1.32	0.760309	d_Java	1.37	0.729182	d_Java	1.47	0.681192
tax	1.29	0.776064	grant	1.33	0.750582	grant	1.30	0.769934
gdppc	1.22	0.816912	gdppc	1.30	0.770847	gdppc	1.20	0.833167
urban	1.19	0.837294	literacy	1.19	0.843824	literacy	1.17	0.851917
report_quality	1.14	0.874962	report_quality	1.14	0.877557	report_quality	1.11	0.897333
Mean VIF	1.52		Mean VIF	1.61		Mean VIF	1.72	

Notes: ** The results of the multicollinearity test indicate that the mean Variance Inflation Factor (VIF) is close to one, suggesting that multicollinearity is not a significant issue in the estimation model. Consequently, the regression model estimates can be considered robust concerning multicollinearity concerns.

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