EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

Efficiency Analysis of Provincial Government Expenditures on Education in Indonesia (Before and After Fiscal Decentralization)

Ecces: Economics Social and Development Studies

Widya Sylviana[1]*, Suyanto[2], Zulkefly Bin Abdul Karim[3], Karim Ilter ünlükaplan[4]
[1]Economics Department, Faculty of Economy and Business, Airlangga University, Indonesia
[2]Economics Department, Faculty of Business and Economics, University of Surabaya, Indonesia
[3]Faculty of Economics & Management, Universiti Kebangsaan Malaysia
[4]Cukurova University, Turkey

E-mail : widya-s@feb.unair.ac.id *

(Article history) Received: 2024-11-15, Revised: 2024-12-22, Accepted: 2024-12-24,
Available online: 2024-12-27, DOI: 10.24252/ecc.v7i1.13382,
Stable URL: http://journal.uin-alauddin.ac.id/index.php/ecc/index

Abstract:Efficiency Analysis of Provincial Government Expenditures on Education in Indonesia (Before and After Fiscal Decentralization)

Fiscal decentralization is closely tied to a country's economic development, with one of its main objectives being the enhancement of public service efficiency, particularly government spending. Government expenditures reflect policy decisions, including providing essential services such as education through HDI. However, many studies dispute the notion that decentralization automatically improves resource allocation efficiency. This research aims to: 1) assess the efficiency of government spending on education in regencies and cities before and after fiscal decentralization, and 2) identify factors influencing this efficiency. The study uses Data Envelopment Analysis (DEA) to evaluate efficiency levels and Tobit regression to analyze the factors affecting efficiency. DEA results show that regencies and cities in Papua have the lowest efficiency (63%), while those in Sumatera have the highest (92%). The Tobit regression model indicates that, for the pre-decentralization period, only the student-teacher ratio is significant, while after decentralization, population size, student-teacher ratio, and region dummy become significant. The findings suggest that improving efficiency in education spending, both before and after decentralization, is critical. Future research should expand the study period, include

other sectors like health, and consider the role of the private sector in education. This study contributes to understanding fiscal decentralization's impact on education efficiency and its broader implications for regional and national development.

Keywords: Decentralization; Government Expenditure; Education; Data Envelopment Analysis; Panel Tobit

INRODUCTION

Decentralization refers to transferring authority and responsibility from central to local governments, empowering local governments to foster economic development (Yao, 2006). This is reinforced by research (Helwa et al., 2017), which states that fiscal decentralization not only improves fiscal efficiency but also strengthens local government accountability through the provision of more responsive public services. Indonesia's local governance system, based on decentralisation, deconcentration, and co-administration, has evolved with revised laws, from Law No. 22 of 1999 to Law No. 23 of 2014. This shift has given local governments more responsibility for regional development, as they are more attuned to local needs than the central government. Local governments can now allocate their budgets according to regional needs, guided by performance-based budgets that measure the efficiency of public service delivery. Education is a key area that is essential for national development and enables a country to absorb modern technology and foster sustainable growth.

Unlike previous studies, which often focus on specific provinces or limited periods, this research comprehensively examines all regencies and cities in Indonesia, filling gaps in the literature on education expenditure efficiency. For example, Natan (2019) and Doriza, et.al., (2012) discusses provincial-level spending. This study extends these findings nationally, including regions formed post-decentralization. The results contribute to understanding how decentralisation impacts education efficiency, aiding policymakers in addressing disparities and improving resource allocation. The findings also support newly formed regions in evaluating their efficiency levels, ensuring equitable and effective budget distribution. This research enriches fiscal decentralisation, local government expenditure, and human development knowledge, providing a foundation for future studies and policy strategies.

This research can be beneficial and referred to by the central government and regional governments regarding regencies and cities that are efficient and inefficient in allocating budgets in the education sectors. In addition, the findings will help to look into the factors that contribute to the factors that cause efficiency in education before and after fiscal decentralization.

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

Additionally, the study will also help how the impact of fiscal decentralization on the level of education efficiency. This research also contributes to regencies and cities formed after fiscal decentralization and will also be known to the newly formed regencies and cities that are efficient or inefficient.

This research will analyze the efficiency of local government expenditure in regencies and cities in Indonesia and determine factors influencing the efficiency of regencies and cities government expenditures on education before fiscal decentralization and after fiscal decentralization. In this study Data Envelopment Analysis (DEA) and panel Tobit regression are employed. The local government expenditures to be analyzed are those in education before fiscal decentralization (1994-2000) and after fiscal decentralization (2001-2019). Researchers used the research year until 2019 to avoid the Covid pandemic in 2020. The study by Helwa et al., (2017) confirmed that DEA is an effective analytical tool to assess the performance of local government systems in different countries and suggested its use to help make better policy decisions.

LITERATURE REVIEW

Afonso and Fernandes (2005) analyze public sector efficiency through an international comparison, highlighting how fiscal decentralization can improve responsiveness to local needs and lead to inefficiency if not properly managed. They stress the importance of local managerial capacity to ensure effective budget management. Ebel and Yilmaz (2002) examine fiscal decentralization in developing countries, finding that while it can enhance local government responsiveness, it also risks increasing dependence on central government transfers, potentially leading to fiscal imbalances and inefficient spending without proper oversight. World Bank (2008) discusses intergovernmental fiscal transfers, emphasizing that transparent and accountable transfer systems are crucial for efficient spending at the local level. Despite the benefits of decentralization, without well-designed fiscal transfer systems, local governments may face budgetary imbalances and inefficiencies in expenditure. These studies collectively suggest that while decentralization can improve public service delivery, it requires strong management and oversight to prevent inefficiency and waste in local government spending.

While decentralization has drawbacks, such as making regions solely responsible for defense, security, and macroeconomic policy, it offers significant benefits. It drives the creation of new regencies and cities, promoting regional development and addressing imbalances caused

by central-oriented growth (Iskarno, et al*.,* 2014). Post-2001, regions with less infrastructure invested more in health and physical infrastructure, though less in education (Kis-Katos and Sjahrir, 2017). Additionally, decentralization stimulates competition among regions, fostering continuous improvement and innovation beyond resource availability or low labor costs (Iskarno, et al*.,* 2014). Decentralization has a positive impact on the performance of local governments in providing public services. Jenzie and Seddon (1999) researched the impact of decentralization on infrastructure. The results of her research indicate that decentralization has a considerable impact on infrastructure. In addition, decentralisation also provides better performance in terms of economic growth.

The Indonesian government utilises decentralization to enhance public services by aligning with local needs while fostering regional and national socio-economic development. Decentralization is anticipated to improve cost efficiency, strengthen democracy, increase public participation, and promote government accountability. Through State and Regional Budgets (APBN and APBD), government expenditures translate policies into actions that aim to enhance public welfare and stimulate regional economic growth. Education, a crucial determinant of human resource quality and a key Human Development Index (HDI) component, plays a pivotal role in public policy. Efficiently addressing educational needs supports human development and accelerates regional advancement alongside health and income improvements.

This study analyses government expenditures' efficiency in the education sector across regencies and cities in Indonesia, considering the country's vast territory and diverse characteristics. Local governments' ability to utilize natural and human resources effectively plays a crucial role in improving public welfare. Law No. 9 of 2015 highlights the need for efficient and effective regional governance, emphasizing regional diversity and the importance of granting local autonomy within a unified state administration system. The focus on education arises from disparities in infrastructure across Indonesia, necessitating targeted government attention to enhance educational quality. Prior studies indicate that government spending significantly impacts education quality (Astri, et al*.,* 2013). Education is critical for improving individuals' lives and driving sustainable growth, as emphasized by Todaro and Smith (2015), who view education as a cornerstone of human capital development.

Despite its importance, research on government expenditures in education remains limited, with existing studies primarily examining provincial-level data (Doriza et.al., 2012). This study evaluates the impact of fiscal decentralization on interprovincial primary education access gaps in Indonesia, using panel data from 440 regions over the period 2005-2009.

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

Decentralization in Indonesia, driven by the vast territory and uneven development under centralized governance, shifted financial planning and management to local governments, enabling them to address regional needs with greater autonomy. This research comprehensively analyses efficiency variations across Indonesia's regencies and cities in education expenditure.

Based on the problems that have been proposed, research objectives and literature review, the hypotheses in this research are:

Table 1. The Hypotheses of Research

Variables	Expected Sign	Literature Review
Per capita income	Positive	Afonso and Aubyn (2005)
Population Density	Negative	Da Cruz and Marques (2014)
Student teacher ratio	Negative	Chakraborty (2009)
Dummy region	Positive	Jayasuriya and Wodon, (2011)
Dummy time	Positive	Buehn, et al., (2013)

METHODS

This study uses one main variable in the calculation of input efficiency. The input variable is local government spending on education. The output variable is the education indicator. The eight education indicator variables include the mean years of schooling population aged 15 years and over, literacy rate, teacher and student ratio, and enrollment rate (elementary school to senior high school). The efficiency calculation in this study uses Decision-Making Units (DMUs) in the form of regencies and cities in Indonesia, spanning from 1994 to 2019. The number of DMUs increased over time due to the creation of new autonomous regions after fiscal decentralization. Before decentralization, there were 336 regencies and cities, and by 2019, this number grew to 357.

Secondary data for this study was sourced from the Central Bureau of Statistics (BPS), Ministry of Education and Culture, and the Ministry of Finance's Directorate General of Fiscal Balance (DJPK). The study covers two periods; before fiscal decentralization (1994-2000) and after decentralization (2001-2019). The methods used for analysis are Data Envelopment Analysis (DEA) and panel Tobit regression. Data was collected through documentation, tabulation, and calculation for analysis.

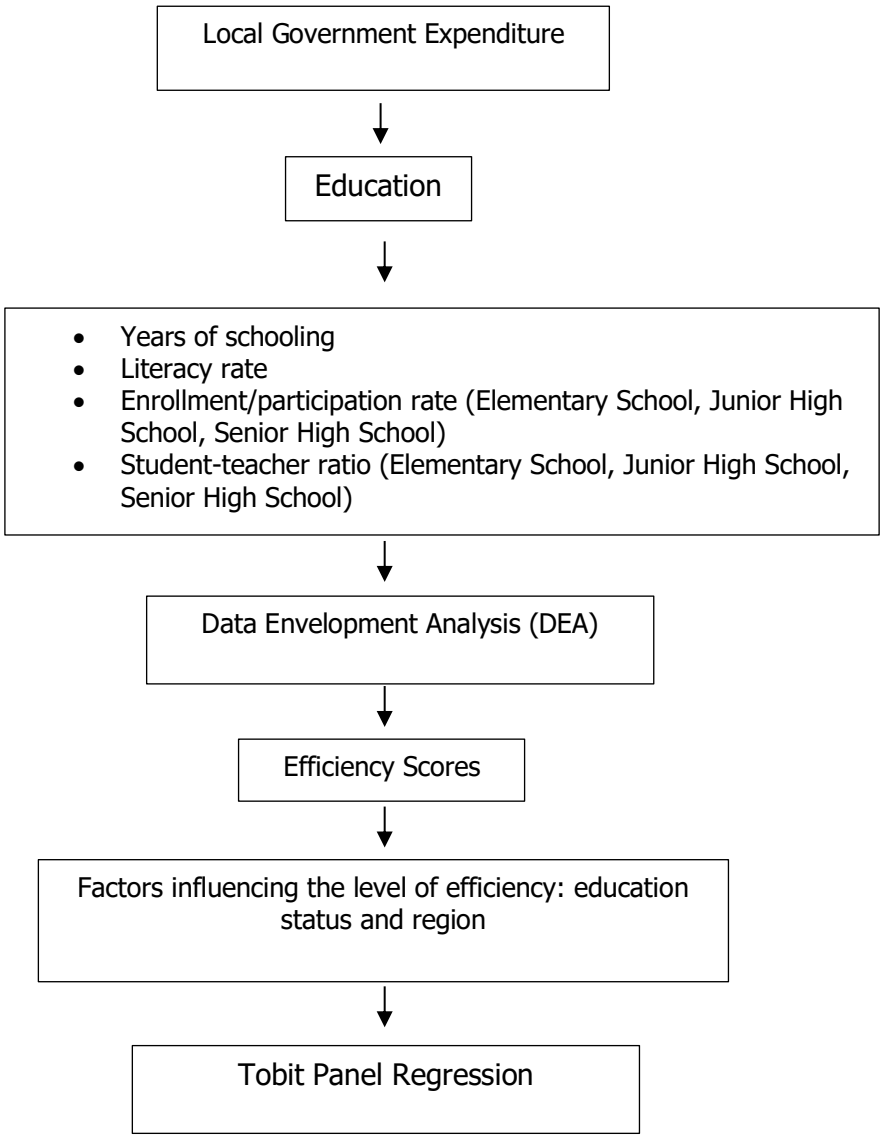

Figure 1. Research Framework

DEA is used as a performance evaluation tool, assigning each DMU an efficiency score ranging from 0 to 1. A score of 1 represents optimal efficiency, while a score below 1 indicates inefficiency. DEA assumes that all evaluated entities use the same inputs to produce similar outputs, with positive data and variable inputs and outputs. Tobit regression is employed to examine factors affecting the efficiency of government expenditures on education, addressing the study's second objective. This model is suitable for analysing censored data, where the dependent variable is only observed for part of the sample. Using Maximum Likelihood (ML) estimation, Tobit regression addresses issues of bias and inconsistency in OLS estimation, as introduced by Tobin (1958). The model assumes that independent variables are unlimited in

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

value, while the dependent variable is limited, and it is robust against autocorrelation, heteroscedasticity, and multicollinearity.

Pardo-fern (2013) This paper examines the wide-spread practice where data envelopment analysis (DEA) efficiency estimates are regressed on some environmental variables in a second-stage analysis. In the literature, only two statistical models have been proposed in which second-stage regressions are well-defined and meaningful. This study uses a research framework based on production and efficiency theory. Local government expenditures, including those in sectors like education, health, public works, and capital investment, are aimed at regional development. Education, as a key factor in human resource quality, significantly impacts development. The study focuses on education efficiency, using input variables such as local government spending on education (from APBD) and output variables like schooling years, student-teacher ratios, enrollment rates, and literacy rates. The empirical methods include Data Envelopment Analysis (DEA) and panel-data Tobit regression, with variables like population density, GDP per capita, student-teacher ratios, and regional dummies.

The Tobit models for examining the relationship between TE, education status, and region-spesific characteristic can be constructed as follows:

$$TE_{it} = \alpha_0 + \beta_1 POP_{it} + \beta_2 GDP_{it} + \beta_3 RGM_{it} + \beta_4 RGN + \varepsilon_{it}$$

While the variables used in education sector are population (POP), GDP per capita (GDP), the ratio of the number teachers and students (RGM), and region dummy variabel (1, if from cities region).

Several studies have highlighted the influence of population density on public sector efficiency in education (Kis-Katos and Sjahrir, 2017; Ghafoor, 2024). Afonso and Aubyn (2005) found that higher GDP is often linked to better education outcomes, while (Bose, et.al., 2007) there is no significant relationship between GDP and public expenditure. A smaller student-teacher ratio is also associated with better learning outcomes (Chakraborty, 2009). Additionally, Jayasuriya and Wodon, (2011) urban areas generally offer more affordable access to education than rural areas. These factors collectively impact education efficiency, with better education status leading to higher efficiency scores.

RESULT AND DISCUSSION

This section will explain the results of an analysis of the efficiency of government expenditure in education. To facilitate interpretation, the grouping of regions is divided into 6 major islands in Indonesia. In addition, efficiency is also grouped into 3 groups of low, medium

and high, using the K-means method. K-means clustering is used to describe an algorithm that assigns each item to the cluster that has the nearest centroid (mean) (Johnson and Wichern, 2007). Each cluster may have different values depending on the data analyzed. The results of the average efficiency of government expenditure in education before decentralization can be grouped into 3 clusters, namely low, medium and high. The average efficiency is taken from the value of each grouping of six islands; Java, Sumatera, Kalimantan, Sulawesi, Bali and Nusa Tenggara, Maluku and Papua. This grouping uses K-means to facilitate interpretation.

Table 2. Cluster Information of Average Efficiency Government Expenditure in Education Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.65	0.79	0.96
Number of Islands in Each Cluster	1	1	4

Source: Secondary data output after processing, 2024; (Widya, 2024).

The grouping is clearly visible in low, medium and high order. The islands included in the cluster 1 category are Maluku and Papua. Then Sulawesi entered in cluster 2. Cluster 3 consisted of Java, Sumatera, Kalimantan, Bali and Nusa Tenggara.

The average value of efficiency after decentralization is better than before decentralization. The resulting cluster of K-means is divided into three low, medium, and high clusters. It should be noted that the clustering of these clusters is not always sequential from lowest to highest because the results of calculations using centroid means depend on the data used. Cluster is divided into three namely cluster one consisting of Bali Nusa Tenggara. The second cluster consists of four islands namely Java, Sumatera, Kalimantan and Sulawesi. Finally, cluster three consists of Maluku and Papua. Although the average value of efficiency is good and almost close to 1, it still needs improvement to be efficient.

Java Before Desentralization

Cluster 1 is made up of 73 regencies and 22 cities, which have an average efficiency of 0.97. Then, cluster 2 consists of 4 regencies and 1 city with an average efficiency of 0. The spacing of efficiency is 0 because the regencies and cities are new areas that did not exist before decentralization. The last, cluster 3, consists of 3 regencies with an average efficiency of 0.86. Cluster 1 shows that the scatterplot is tight, which means that the value of efficiency in each regencies and city is not too far away. Whereas in cluster 3 seen between scatterplots

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

has a considerable distance, where the value of efficiency has a gap that is quite far. The lowest value of efficiency is 0 because the 4 regencies and 1 city are new and have not been established before the era of decentralisation so there is no data. Furthermore, there are 6 regencies and 5 cities that have achieved an efficiency score 1.

Regencies and cities that have achieved efficiency score 1 are at central government (West Java Province, Cental Java Province, East Java Province, DKI Jakarta, and DIY). The efficiency range of 0.92-0.99 has been achieved by 84 areas (69 regencies and 15 cities), while the lowest range 0.8-0.89, has been reached by 3 regencies such as Sampang, Bangkalan, and Jember.

Three regencies in East Java Province have been reached the lowest range because based on Precidential Decree number 131/2015, Sampang is an underdeveloped region, especially in education. Data from the Central Bureau of Statistics (BPS) shows that primary school facilities in Sampang are the lowest compared to other regencies in Madura Island. We can observe that the three regencies are not efficient because Sampang is the regency in first place with the highest illiteracy rate, Bangkalan in the third place, and Jember has with illiteracy rate at number nine in East Java Province. In addition, the human development index of the three regencies is at the 10 lowest in East Java Province (Central Bureau of Statistics Indonesia, 2018). Regencies and cities that have highest score 1 (efficiency) because primary school facilities, literacy rate and mean years of schooling are good compared to other regencies and cities.

Java After Decentralization

The efficiency of the government expenditure on education in Java is divided into 3 clusters. Cluster 1, with the average efficiency of 0.99, is achieved by 30 regencies and 18 cities. Cluster 2 consists of 43 regencies and 3 cities with an average efficiency of 0.97. The last cluster, cluster 3, is reached by 8 regencies and 1 city with an average efficiency of 0.95. The efficiency distribution of government expenditure on education in Java after decentralization can be seen in Appendix B. Scatterplots in clusters 1 and 2 are not too tight and are not too tenuous, which means that the efficiency values of each regency and city have little difference. In contrast, in cluster 3 there are scatterplots which are pretty far apart from the others, meaning that the value is far enough from other regencies and cities.

After decentralization, there are new regencies and cities in the Island of Java, precisely in the provinces of Banten, namely Tangerang City, Lebak Regency, Pandeglang Regency, Serang City, and Tangerang Regency. The regencies and cities included in clusters 1, 2, and 3.

Cities and regency that manage to achieve efficiency 1 are Jakarta city, Bandung city, Mojokerto city, Yogyakarta city, and Kulon Progo Regency, while 80 regencies and 18 cities are still not efficient, with an efficiency range of 0.93-0.99.

Regencies and cities have been reached the highest range because Jakarta city and Bandung City are the centres of government in Jakarta and West Java, respectively, which have complete education facilities and competent teachers (Erlando Doni, 2016). In addition, if there are problems in education, it will be in the spotlight of the local government so that it can be quickly improved. Besides that regencies and cities that have achieved efficiency score 1 (efficiency) because mean years of schooling, literacy rate, teacher and student ratio, and enrollment rate have highest scores compared another regencies and cities.

Sumatera Before Decentralization

There are 71 regencies and cities on the island of Sumatera and its surroundings, which are divided into three clusters. Cluster 1 with an efficiency value of 0, Anambas Island, which do not exist before the decentralization period. Furthermore, there are 18 regencies and 20 cities that are included in cluster 2 with an average efficiency of 0.99. Finally, there are 30 regencies and 2 cities classified in cluster 3 with an average efficiency of 0.96. There is little difference in the efficiency values of each regency and cities. The government expenditure on education in the island of Sumatera and its surroundings has not yet fully achieved efficiency. There is one region that has not yet been formed prior to decentralization, namely the Anambas Island so that there is no data, and the efficiency value is 0. Areas that have achieved efficiency 1 include 4 regencies and 14 cities. Regencies and cities have achieved efficiency 1 are in Nanggroe Aceh Darussalam (NAD), Bengkulu Province, North Sumatera Province, West Sumatera Province, dan Riau Province. Then, 44 regencies and 8 cities have efficiency in the range of 0.94-0.99. These results show that the efficiency of the education expenditure on the island of Sumatera is relatively good. The location of the island is still close to the central government of the country so the quality of education is still easy to monitor.

Due to their close proximity to the central government and pre-existing infrastructure, Sumatera's government spending on education was very efficient prior to decentralization, with only slight regional variations. While the remaining cities varied from 0.94 to 0.99, four regencies and fourteen cities attained full efficiency (1).

Sumatera After Decentralization

The efficiency of the government expenditure on education in Sumatera island and its

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

surroundings after decentralization is divided into 3 clusters. Cluster 1 consists of 1 city with an efficiency of 0.88. Cluster 2, with an average efficiency of 0.99, is achieved by 32 regencies and 22 cities. Then, cluster 3 consists of 16 regencies with an average efficiency of 0.97. The difference in efficiency values of each regency and cities is quite large. After the decentralization period, there is one additional area on the island of Sumatera and its surroundings, namely the Anambas Island. The efficiency of the government expenditure on education that has reached value 1 is achieved by 2 regencies and 9 cities. Regencies and cities that have achieved efficiency 1 are in Nanggroe Aceh Darussalam (NAD), West Sumatera Province, Riau Province, and North Sumatera Province. Then, 47 regencies and 13 cities have efficiency in the range of 0.96-0.99. However, Anambas Island is one region that has the lowest efficiency value of 0.88. Anambas Island is a new regency in the Riau Province. The number of educational facilities on this island from elementary, middle and high school is the least compared to other regencies and cities in the Riau Province based on statistics of Indonesia's data of 2013. Jung and Thorbecke (2003) stated that to maximize benefits from education expenditure, a sufficiently high level of physical investment is needed as measures that improve the match between the pattern of educational output.

Efficiency gaps widened during decentralization, with Anambas Island exhibiting the lowest efficiency (0.88), and fewer regions reaching 100% efficiency (2 regencies and 9 cities). Decentralization gave local governments more authority, which led to unequal resource distribution and problems for underdeveloped areas, like poor educational infrastructure in new areas.

Kalimantan Before Decentralization

The efficiency of the government expenditure on education in the island of Kalimantan before decentralization is divided into 3 clusters. Cluster 1 consists of 5 regencies and 1 city with an average efficiency of 0.94, while cluster 2, with an average efficiency of 0.99, is obtained by 30 regencies and 7 cities. Finally, cluster 3 with an efficiency of 0.9 is obtained by 10 regencies and 1 city. The island of Borneo has a more diverse efficiency than the other islands.

The scatterplot looks not tight and has a fairly long range from the smallest value to the largest value. This means that there are slight differences in the efficiency values of each regencies and cities and not many regencies and cities have the same efficiency value. The efficiency of the government expenditure on education in the island of Kalimantan after decentralization. There are 9 regencies and 6 cities that have achieved efficiency 1. Regencies

and cities that have achieved efficiency 1 are in East Kalimantan province, North Kalimantan province, South Kalimantan province, Central Kalimantan province. Then 33 regencies and 3 cities have efficiency values in the range of 0.9-0.99. Meanwhile, the lowest range is 0.88-0.89 achieved by 3 regencies namely Kayong Utara, Kubu Raya, and Ketapang. These three regencies are in the province of Kalimantan Barat which is the province with the highest number of poor people on the island of Kalimantan based statistics of Indonesia's data of 2019. School enrollment rates at the high school level in the Kayong Utara, Kubu Raya, and Ketapang are also below 50%. This is in line with the statement by (Verhoeven, Gunnarsson and Carcillo, 2007) which states that one of performance indicators of expenditure on education is rates progression to secondary education.

The cluster distribution of the government expenditure on education efficiency value of the Kalimantan island after decentralization can be seen in Table 15 (appendix). Clusters are divided into 3. Cluster 1 consists of 23 regencies and 7 cities with an average efficiency of 0.99; Cluster 2, with an average efficiency of 0.97, is achieved by 11 regencies and Cluster 3, with an average efficiency of 0.93, consists of 11 regencies and 2 cities. The differences in efficiency values of each regency and city are quite large. Regencies and cities on Kalimantan Island that get an efficiency score of 1 are 5 regencies and 2 cities. Then, the remaining 40 regencies and 7 cities reached efficiency between 0.91-0.99. After decentralization, the number of regencies and cities that achieve efficiency 1 in managing education expenditure is less than before decentralization. Some regencies and cities have been efficient where 6 of them are in Central Kalimantan Province, namely Barito Timur, Gunung Mas, Katingan, Lamandau, Murung Raya, and Palangkaraya City, while one other city is Bontang, which is located in East Kalimantan Province. All of these cities have almost 100% school enrollment rates at the elementary and junior high school levels based. Furthermore, Kayong Utara's lowest efficiency has increased after decentralization. This is the effect of a free education program from the Kayong Utara government that has succeeded in increasing net enrollment rates and the number of schools (Suherda et.al., 2019). In addition, the school enrollment rate is one of the reasons that determine public sector efficiency (Feeny and Rogers, 2008).

Before decentralization, efficiency was more diverse, with some regions achieving high efficiency (up to 0.99) while others were less efficient. Inefficiency stemmed from uneven distribution of resources and varying school enrollment rates across regions. The wide range in efficiency values reflects disparities in local governance and economic conditions.

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

Kalimantan After Decentralization

Cluster 1 consists of 23 regencies and 7 cities with an average efficiency of 0.99; Cluster 2, with an average efficiency of 0.97, is achieved by 11 regencies and Cluster 3, with an average efficiency of 0.93, consists of 11 regencies and 2 cities. Scatterplots have a tenuous distance, which means that the differences in efficiency values of each regency and city are quite large. Regencies and cities in the Kalimantan island that get an efficiency score of 1 are 5 regencies and 2 cities. Then, the remaining 40 regencies and 7 cities reached efficiency between 0.91-0.99. After decentralization, the number of regencies and cities that achieve efficiency 1 in managing education expenditure is less than before decentralization. Some regencies and cities have been efficient where 6 of them are in Central Kalimantan Province, namely Barito Timur, Gunung Mas, Katingan, Lamandau, Murung Raya, and Palangkaraya City, while one other city is Bontang, which is located in East Kalimantan Province. These cities have almost 100% school enrollment rates at the elementary and junior high levels. Furthermore, Kayong Utara's lowest efficiency has increased after decentralization. This is the effect of a free education program from the Kayong Utara government that has succeeded in increasing net enrollment rates, as well as increasing the number of schools (Suherda et.al., 2019). In addition, the school enrollment rate is one of the reasons that determine public sector efficiency (Feeny and Rogers, 2008).

Kalimantan's education spending efficiency was rather high and equally distributed prior to decentralization; six cities and nine regencies achieved complete efficiency (1). With fewer regions (two cities and five regencies) attaining efficiency following decentralization, inequities increased. Free education initiatives brought about improvements in certain areas, such as Kayong Utara, while inefficient areas with high rates of poverty and poor school enrollment, especially in West Kalimantan, persisted. The necessity for focused strategies to alleviate regional inequities and raise the standard of education was highlighted by decentralization.

Sulawesi Before Decentralization

The efficiency of the government expenditure on education in the island of Sulawesi and its surroundings. The cluster is divided into 3, namely cluster 1 with an efficiency value of 0 because the regencies and cities that have not been formed before decentralization. Cluster 2 consists of 41 regencies and 8 cities with an average efficiency value of 0.96. While Cluster 3 with an average efficiency value of 0.82 consists of 2 regencies. Scatterplots are not stacked and have a fairly tight range, this means that the efficiency values of each regency and cities

have little difference. The efficiency of regencies and cities including clusters 1, 2 and 3 on the island of Sulawesi and its surroundings before decentralization. In cluster 1 are regencies and cities that had not been formed before decentralization so there is no data and the efficiency value is 0. Then there are 7 regencies and 4 cities that have achieved efficiency 1. Regencies and cities that have achieved 1 are in North Sulawesi province, South Sulawesi Province, and Central Sulawesi. While the other 37 regencies and 4 cities have efficiency in the range of 0.85-0.99. A regency with the lowest efficiency, 0.78, is Jeneponto, which is a regency with the lowest education index and development index in Sulawesi Selatan Province.

Before decentralization, most regencies and cities in Sulawesi showed efficiency levels ranging from 0.85 to 0.99, with a few regions achieving full efficiency (1.0), primarily in North, South, and Central Sulawesi provinces. Before decentralization, inefficiencies stemmed from underdeveloped education systems in areas with low HDI, as seen in Jeneponto. Limited resources and governance capacity further contributed to disparities. Jeneponto faced challenges related to low education and development indices.

Sulawesi After Decentralization

Cluster 1 with an average efficiency of 0.95 is achieved by 24 regencies and 2 cities. Cluster 2 is achieved by 26 regencies and 8 cities with an average efficiency of 0.98 and cluster 3 with an average of 0.89 is achieved by 2 regencies. The scatterplot distribution of each cluster on the island of Sulawesi after decentralization, scatterplots appear to have a considerable distance. This means that the efficiency values of each regencies and cities are quite different.

There are 11 new 9 regencies and 2 cities added in Sulawesi Island and surrounding areas after decentralization which can be seen in Table 11 (appendix). The regency with the lowest efficiency value of 0.87 is Jeneponto. Other 49 regencies and 8 cities have efficiency in the range of 0.9-0.99. Then areas that achieved efficiency score 1 are 2 regencies and 2 cities, namely Manado city, South Minahasa, North Minahasa, and Tomohon City. Cities and regencies that have achieved efficiency 1 are all in North Sulawesi Province. North Sulawesi Province is a province with the highest Human Development Index among all provincies in Sulawesi Island. This is as in the Kirkcaldy et.al., (2004) study which states that the Human Development Index has a significant relationship with 3 literacy score which includes educational performance in reading, mathematical, and scientific literacy.

After decentralization, regions with stronger HDI, like North Sulawesi, leveraged better educational performance in literacy and scientific domains to achieve high efficiency. However,

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

in areas with low HDI, the structural challenges of poverty and resource allocation limited improvements, emphasizing the need for targeted development programs and equitable policies to reduce inefficiencies.

Bali and Nusa Tenggara Before Decentralization

The islands of Bali and Nusa Tenggara are two different but adjacent islands and are in the east of the island of Java. The efficiency of government expenditure on education on these two islands is divided into 3 clusters. Cluster 1, with an average efficiency of 0.97, is achieved by 12 regencies and 2 cities. Cluster 2 consists of 1 city and 11 regencies with an average efficiency of 0.91. Cluster 3, with an average efficiency of 0.81, is achieved by 2 regencies. Appendix I shows the efficient distribution of government expenditure on education in the islands of Bali and Nusa Tenggara before decentralization. Scatterplots in clusters 1 and 2 look not too tight and not too tenuous, which means that the efficiency values of each regency and cities have little difference. In contrast, in cluster 3, there are scatterplots which are quite far apart from the others, meaning that they have values far enough from regencies and other cities.

There are two areas that achieve efficiency 1, namely Kota Denpasar and Tabanan. Denpasar and Tabanan are in Bali Province. There is 1 regency with the lowest efficiency value of 0.79, Sumba Barat. Then, 23 regencies and 2 cities in Bali and Nusa Tenggara islands have efficiency in the range of 0.84-0.99. The time before decentralization Sumba Barat Regency became one of the cities with the highest percentage of residents 10 years and over who were illiterate. This is in line with the study which states that the Illiteracy rate has an influence on the efficiency of public spending (Honjo et.al., 1997).

Before decentralization, inefficiency in areas like Sumba Barat was driven by high illiteracy rates, which negatively impacted the effectiveness of government spending on education. Regions with better education outcomes, such as Denpasar and Tabanan, had higher efficiency due to higher literacy rates, aligning with studies showing that education levels influence public sector efficiency.

Bali and Nusa Tenggara After Decentralization

Cluster 1, with an average efficiency of 0.97, is achieved by 10 regencies and 2 cities. Cluster 2 consists of 13 regencies and 1 city with an average efficiency of 0.94. Cluster 3, with an average efficiency of 0.88, consists of 2 regencies. Scatterplots in clusters 1 and 2 look quite tenuous. It has a value far enough from other regencies and cities. There is a decrease in

efficiency where no regencies and cities achieve efficiency 1. The highest efficiency, with a value of 0.99, is achieved by 2 regencies and 1 city namely Badung, Denpasar City, and Tabanan. Then the lowest efficiency is still like before decentralization, namely Sumba Barat, with an efficiency of 0.86, whereas the other 21 regencies and 3 cities have an efficiency with a range of 0.89-0.98. The Kota Denpasar, Badung, and Tabanan have high literacy rates in the province of Bali. High literacy rates influence the efficiency of public spending (Feeny and Rogers 2008; Honjo, et.al., 1997).

After decentralization, regions with established educational infrastructure, particularly those in Bali, continued to perform well. However, inefficiencies persisted in areas with lower literacy rates, such as Sumba Barat, highlighting that decentralization alone could not overcome foundational challenges in education, especially in disadvantaged regions.

Maluku and Papua Before Decentralization

The next distribution of the efficiency of the government expenditure on education in Maluku and Papua Island. The cluster information before decentralization, there are 12 regencies and 3 cities that have not yet been formed, so that the efficiency value is zero. The clustering of education fund efficiency is divided into 3 clusters. Cluster 1, with an efficiency average of 0.94, consists of 24 regencies and 4 cities. Cluster 2 is filled by 12 regencies and 3 cities with 0 efficiency, where the regencies and cities has not been established before decentralization. Then, cluster 3 consists of 8 regencies with an average efficiency of 0.79.

The distribution of the efficiency of government expenditure on education in Maluku and Papua Islands before decentralization. Scatterplots in clusters 1 and 3 look quite dense, meaning that the efficiency values of each regency and cities have little difference. There is 1 regency and 2 cities that have achieved efficiency 1 in Maluku and Papua Islands, namely Ambon City, Morotai Island, and Ternate City. Regency and cities that have achieved 1 are in Maluku province and North Maluku. Then 4 regencies have an efficiency below 0.8, namely Jayawijaya, Yalimo, Intan Jaya, and Merauke, while the other 31 regencies and 2 cities have an efficiency with a range of 0.8-0.98. The regions that are already efficient in government expenditure on education are Kota Ambon, which is in the Maluku province, and Morotai Island, and Kota Ternate City, which is in the northern Maluku Province. The inefficient area with the lowest efficiency value is Jayawijaya in the Papua Province. Ambon is the provincial capital with the highest HDI score in Maluku Province. Then, the city of Ternate, the capital of the North Maluku Province, also has the highest HDI in its province. The municipal region has a real effect

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

on the efficiency of public spending. This means that the bigger the city, the greater the efficiency value (Carosi et.al., 2014).

Before decentralization, most regions had moderate efficiency, with a few achieving full efficiency (1.0), such as Ambon, Morotai Island, and Ternate City. However, areas like Jayawijaya, Yalimo, and Intan Jaya had very low efficiency, often linked to high illiteracy rates and poor school enrollment. In contrast, regions like Ambon, Ternate, and Morotai Island performed well due to their larger city status and higher human development indices (HDI).

Maluku and Papua After Decentralization

Cluster 1 consists of 22 regencies and 6 cities with an average efficiency of 0.97. Cluster 2, with an efficiency average of 0.73, consists of 4 regencies. Finally, cluster 3 is reached by 18 regencies and 1 city with an average efficiency of 0.89. The distribution of the efficiency of government expenditure on education in Maluku and Papua Island after decentralization. Scatterplots in clusters 1, 2 and 3 have gaps, which means that the efficiency values of each regencies and cities have differences, although not too large. There are 2 regencies and 2 cities in Maluku Island and Papua that have achieved efficiency 1, namely Ambon city, Maybrat, Morotai Island, and Ternate city, while there are 4 regencies with the lowest efficiency below 0.8, namely Jayawijaya, Yalimo, Intan Jaya, and Puncak. Then other 38 regencies and 5 cities have efficiency in the range of 0.82-0.99. After decentralization, cities that achieved 1 efficiency increased to 4 cities, namely Ambon City, Maybrat, Morotai Island and Ternate City. While the regency which has the lowest efficiency is Jayawijaya. This region located in eastern Indonesia and has a topography in the form of a plateau. In this city, there is the Jayawijaya Mountains, which is one of the highest areas in Indonesia. The trip to Jayawijaya from Jayapura, the capital of Papua province, can only be reached by airplane. Carosi et.al., (2014) which states that the bigger the city, the higher the efficiency, the smaller the city, the lower its efficiency.

Based on the analysis of the efficiency of education expenditures, several conclusions can be obtained. Regencies and cities that have low efficiency scores have similar characteristics, namely the first high illiteracy rate as happened in Sampang, Bangkalan, Jember, West Sumba. The second is low school enrollments rates at the high scholl level such as North Kayong, Kubu Raya, and Ketapang. In contrast, regencies and cities with high efficiency have characteristics similar to high literacy rates, high human development indexes, and big cities.

After decentralization, areas with better infrastructure, larger populations, and higher literacy rates continued to improve in efficiency, while more remote regions with tough terrain,

like Jayawijaya, faced persistent inefficiencies. The findings suggest that decentralization did not automatically resolve geographic or educational disparities, highlighting the importance of targeted policies in improving education efficiency.

Results of Tobit Panel Regression Estimation in Education

The Tobit panel regression results for education are presented in Table 3. The joint significance test shows a Chi-Square Probability of 0.0287, indicating that all independent variables (per capita income, population, student-teacher ratio, and region dummy) significantly affect education efficiency before fiscal decentralization. Table 3 shows the estimation results in the technical efficiency component model of education before and after fiscal decentralization. There are 2.177 observations consisting of regencies and cities in Indonesia during the period of 1994-2000. A partial analysis reveals that, out of the four variables, only the student-teacher ratio (Mg) is significant, with a probability of 0.003 (α = 0.01). The other variables—per capita income (Lngdp), population size (Lnpop), and region dummy—are insignificant. The negative coefficient for the student-teacher ratio suggests that a higher ratio leads to lower educational efficiency, as greater student numbers reduce teacher supervision and attention, lowering teaching quality.

Therefore, a smaller student-teacher ratio improves education efficiency, holding other factors constant. Unlike the first model (before decentralization), the second model (after decentralization) has more variables that are statistically significant. The number of observations used in the second model is bigger than the first model due to the longer time span (2001-2019) and larger number of individuals (regencies and cities) because of the regional expansion. However, the number and types of variables used remain the same in order to compare whether the factors affecting technical efficiency are similar or different between before and after decentralization samples. The results of the joint-significance test show that all the independent variables significantly affect the technical efficiency of education. This condition is indicated by the number of Probability Chi-Square, which is smaller than α = 0.01.

Furthermore, results of the partial statistical test using the Wald test show that only the per capita income variable (Lngdp) is not statistically significant because it has a probability number 0.140, which is above α = 0.01. Meanwhile, the variables of the number of population (Lnpop) and student-teacher ratio (Mg) are significant at the α level of 0.01, and the dummy region variable is significant at α = 0.05. The positive coefficient for the population variable (Lnpop) means that with the increasing population in a region, the level of education efficiency

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

becomes higher. Meanwhile, the negative coefficient on the student-teacher ratio variable (Mg) means that with the lower student-teacher ratio, the educational efficiency of a region becomes higher. The lower student-teacher ratio means that teachers' burdens in teaching are smaller, so the teachers' control over students becomes easier. The dummy variable region (Reg), where number 1 is a city, and 0 is regency, has a significant positive coefficient. This figure means that the level of education efficiency in cities is higher than in the regencies because access to facilities and information sources in the cities is much easier than in the regencies.

Table 3. Estimation Results of Technical Efficiency Component Model in Education before and after Fiscal Decentralization

Variable		Before Decentralization	After Decentralization
	Coefficient	-0.00076	0.00206
Lngdp	Std. Error	0.00315	0.00140
	Probability	0.809	0.140
	dy/dx	-0.00036	0.00139
	Coefficient	-0.00096	0.00501
Lnpop	Std. Error	0.00197	0.00147
	Probability	0.626	0.001
	dy/dx	-0.00046	0.00338
	Coefficient	-0.00076	-0.00044
Mg	Std. Error	0.00025	0.00015
	Probability	0.003*	0.003*
	dy/dx	-0.00036	-0.0003
	Coefficient	0.01509	0.01739
Region	Std. Error	0.0115	0.00799
	Probability	0.189	0.030**
	dy/dx	0.00688	0.01087
	Coefficient	0.99948	0.90154
Constant	Std. Error	0.03487	0.02275
	Probability	0.000*	0.000*
Number of Observation		2177	4271
Prob > Chi Square		0.0287	0.0000
Log Likelihood		2602.81	5249.28

Notes: *Significant at α = 0.01; **Significant α = 0.05

Source: Secondary data output after processing, 2024; (Widya, 2024).

The Tobit panel regression estimation results can only be used to see which variables are statistically significant in influencing educational efficiency. However, they cannot be used to identify the most crucial variable. Therefore, the output of the marginal effect is used to see changes in the efficiency of education (TE) due to changes in each independent variable. The results of the marginal effect estimation on the actual variable for the model before decentralization (model 1) and after decentralization (model 2). The significance of each variable does not need to be re-examined as it follows the output of Tobit regression estimation. For the model before decentralization, only the student-teacher ratio (Mg) is statistically significant. Meanwhile, after decentralization, there are three significant variables: population (Lnpop), student-teacher ratio (Mg) and region dummy (Reg).

Table 4. Tobit Marginal Effect Before and After Decentralization in Education

Variable	Before Decentralization	After Decentralization
	-0.0005	0.0014
	(0.0022)	0.0010
Lngdp	[0.809]	[0.141]
	-0.0007	0.0034
	(0.0014)	(0.001)
Lnpop	[0.626]	[0.001]
	-0.0005*	-0.0003
	(0.0002)	(0.0001)
mg	[0.003]	(0.003)
	0.0098	0.0109
	(0.0071)	(0.0046)
region	[0.164]	[0.018]

Notes: *Significant at α = 0.01; **Significant α = 0.05

Source: Secondary data output after processing, 2024; (Widya, 2024).

Based on the coefficient number of student-teacher ratio (Mg), the number after decentralization is smaller. This means the influence of this variable decreases. This condition occurs due to the increase of the number of teachers in Indonesia, especially part-time teachers. Thus, the teaching load of teachers also decreases.

The success of reducing the impact of the student-teacher ratio on the level of efficiency in the post-decentralization period should be appreciated. However, a new problem emerges, that is the efficiency disparity between cities and regencies. This is shown by the region's

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

marginal effect number of 0.0108, which means the efficiency level in cities is higher by 1.08 percent than that in the regencies. Meanwhile, the population variable has an efficiency number of 0.0034. This means the higher the number of population of a region, the higher the level of efficiency increases. This shows that human capital in each region has increased positively.

The student-teacher ratio had the biggest influence on efficiency prior to decentralization; greater ratios resulted in lower efficiency because of the increased teaching burden. Efficiency during this period was not greatly impacted by other factors, such as population size, per capita income, or geographic location. Though it remained substantial after decentralization, the impact of the student-teacher ratio diminished as the number of instructors rose. Another important consideration was population size, with larger populations potentially translating into greater efficiency through increased resources and better human capital. Additionally, the efficiency disparity between regencies and cities became apparent, with the former enjoying greater access to resources and infrastructure. These modifications show how decentralization made it possible for more intricate elements to affect the effectiveness of education, such as population size and regional access.

Table 5. Results of Tobit Regression of All Observations in Education

TE	Coefficient	dy/dx	Standard Error	z	p>|z|
Lngdp	-0.00113	-0.00077	0.00110	-1.03	0.305
Lnpop	0.00010	0.00007	0.00117	0.09	0.930
		-0.00020			
Mg	-0.00029		0.00013	-2.27	0.023**
Reg	0.01605	0.01025	0.00833	1.92	0.054*
Dtime	0.00951	0.00658	0.00116	8.20	0.000***
Constant	0.97814	-	0.01795	54.48	0.000***
Number of observations : 6448					
Prob > chi2 : 0.000					

Note: * significant at α =0.1, ** significant at α = 0.05, and *** significant at α = 0.01

Source: Secondary data output after processing, 2024; (Widya, 2024).

To compare the impacts of fiscal decentralization on the level of educational efficiency, the researcher constructed a new model by including all the observations for both before and after decentralization was implemented. The time dummy variables (Dtime) is incorporated into

the model to capture the effect of time of decentralization on the efficiency of expenditure. A dummy variable of 1 represents the post-decentralization period (2001–2019), while 0 represents the pre-decentralization period (1994–2000). The analysis includes 6,448 observations across all cities and regencies as DMUs, with an unbalanced panel due to regional expansion. The researcher designed a new model to compare the impacts of fiscal decentralization on educational efficiency by incorporating all observations from both before and after decentralization. This setup allows for evaluating the specific impact of decentralization on educational efficiency over time, accounting for changes in both the structure of the regions and the efficiency of their educational expenditures.

Table 6. Tobit Marginal Effect of All Observations in Education

TE	Coefficient	Error Standard	Z	p>|z|
Lngdp	-0.0008	0.0008	-1.03	0.305
Lnpop	0.00007	0.0008	0.09	0.930
Mg	-0.0002	0.00009	-2.26	0.024**
Reg	0.0103	0.0050	2.07	0.039*
Dtime	0.0066	0.0008	7.98	0.000***
Number of observations : 6448				
Prob > chi2 : 0.000				

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

Source: Secondary data output after processing, 2024; (Widya, 2024).

The five independent variables, two—income per capita (Lngdp) and population (Lnpop)—are statistically insignificant (probability > α = 0.1). The student-teacher ratio (Mg) is significant at α = 0.05 and negatively correlated with education efficiency, indicating that smaller class sizes enhance efficiency by enabling better student management by teachers. The dummy region variable (Reg) is significant at α = 0.1 with a positive coefficient, showing that cities exhibit higher educational efficiency than regencies. Similarly, the dummy time variable (Dtime), significant at α = 0.01, demonstrates that average efficiency post-decentralization is higher than pre-decentralization. The joint significance test confirms that all independent variables significantly influence technical education efficiency, with a Probability Chi-Square < 0.000. The marginal effect of the time variable is 0.00658, indicating that education efficiency post-decentralization (2001–2019) is 0.658% higher than pre-decentralization, highlighting the positive impact of decentralization on education outcomes.

The marginal effect of the time variable was 0.00658, which means that education

EcceS:
Economics, Social, and Development Studies
Fakultas Ekonomi dan Bisnis Islam, UIN Alauddin Makassar
Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

efficiency in the post-decentralization period is 0.658% higher compared to the pre-decentralization period. This finding highlights the positive impact of decentralization on educational outcomes, suggesting that decentralization led to improvements in the efficiency of education spending in Indonesia.

CONCLUSION

By contrasting the years 1994–2000 and 2001–2019, this study examines how fiscal decentralization affects the effectiveness of government spending in the education sector across Indonesian regencies and cities. The results, which were obtained using DEA and Tobit regression analysis, show that fiscal decentralization has typically increased the effectiveness of education spending, especially in areas with higher efficiency scores like Java, Sumatera, and Kalimantan. Nonetheless, areas such as Sulawesi and Papua still show lower levels of efficiency. The population, regional features, and student-teacher ratio are essential elements that affect efficiency; lower student-teacher ratios are linked to higher technical efficiency. The study emphasises the significance of local governments' roles in maximising resource allocation and enhancing educational results via improved accountability and planning. There are various restrictions on this study.

The first limitation is that it only compares two time periods, 1994–2000 and 2001–2019, which restricts our understanding of the long-term consequences of fiscal decentralization. Additionally, it ignores other areas like infrastructure and health in favor of concentrating just on education. The study may have missed other factors affecting efficiency because it only looks at a limited number of variables, such as population size and the student-teacher ratio. Regional data quality differences exist, especially in places with less developed infrastructure. The effects of COVID-19 and the private sector's involvement in education are not considered. Furthermore, the assumptions made by the DEA and Tobit models might only account for some efficiency drivers. Finally, the study needs to evaluate the quality of education, which is a crucial component, even though it assesses spending efficiency. Policy implications highlight the necessity for national and local governments to supervise the distribution of funds, cut down on red tape, and resolve inequalities in the quality and accessibility of education, particularly in rural areas. Future studies might examine more extended periods, the COVID-19 pandemic, other industries, including health, and the private sector's contribution to education.

REFERENCES

Afonso, A. and Aubyn, M.S. (2005) 'Efficiency of secondary education provision: a semi-parametric analysis with inputs', *European Central Bank*, p. 39.

Afonso, A. and Fernandes, S. (2005) 'Assessing and Explaining the Relative Efficiency of Local Government : Evidence for Portuguese', *The Journal of Socio-Economics*, 37(5), pp. 1946–1979.

Astri, M., Nikensari, S.I. and Kuncara W., H. (2013) 'Pengaruh Pengeluaran Pemerintah Daerah Pada Sektor Pendidikan Dan Kesehata Terhadap Indeks Pembangunan Manusia Di Indonesia', *Jurnal Pendidikan Ekonomi dan Bisnis (JPEB)*, 1(1), p. 77. Available at: https://doi.org/10.21009/jpeb.001.1.5.

Bose, N., Haque, M.E. and Osborn, D.R. (2007) 'Public expenditure and economic growth: A disaggregated analysis for developing countries', *The Manchester School*, 75(5), pp. 533–556.

Buehn, A., Lessmann, C. and Markwardt, G. (2013) 'Decentralization and the shadow economy: Oates meets Allingham–Sandmo', *Applied Economics*, 45(18), pp. 2567–2578.

Carosi, L., D'Inverno, G. and Ravagli, L. (2014) 'Global public spending efficiency in Tuscan municipalities', *Discussion Papers*, 175.

Central Bureau of Statistics Indonesia (2018) *Indonesian Sustainable Development Goals Indicators*.

Chakraborty, K. (2009) 'INEFFICIENCIES IN PUBLIC EDUCATION: A VALUE-ADDED APPROACH.', *Southern Business & Economic Journal*, 32.

Da Cruz, N.F. and Marques, R.C. (2014) 'Revisiting the determinants of local government performance', *Omega*, 44, pp. 91–103.

Doriza, S., Purwanto, D.A. and Maulida, E. (2012) 'Dampak Desentralisasi Fiskal terhadap Disparitas Akses Pendidikan Dasar di Indonesia Fiscal Decentralization Impacts on Primary Education Access Disparities in Indonesia Pendahuluan', *Jurnal Ekonomi dan Pembangunan Indonesia*, 13(1), pp. 31–46. Available at: https://doi.org/10.21002/jepi.v13i1.03.

Ebel, R.D. and Yilmaz, S. (2002) *On the Measurement and Impact of Fiscal Decentralization. Policy Research Working Paper*.

Erlando Doni (2016) '234901-Pengaruh-Minat-Belajar-Terhadap-Prestasi-C06F683C', *Jurnal Formatif*, 6(1), pp. 35–43.

Feeny, S. and Rogers, M. (2008) 'Public sector efficiency, foreign aid and small island developing states', *Journal of International Development: The Journal of the Development*

Volume 11 Number 2 Ed. December 2024 : page: 140-165
p-ISSN: 2407-6635 e-ISSN : 2580-5570

Studies Association, 20(4), pp. 526–546.

Ghafoor, N. (2024) 'Fiscal Decentralization and Educational Outcomes : Empirical Evidence from Pakistan', (July). Available at: https://doi.org/10.62345/jads.2024.13.2.61.

Helwa, I. *et al.* (2017) 'A comparative study of serum exosome isolation using differential ultracentrifugation and three commercial reagents', *PLoS ONE*, 12(1), pp. 1–22. Available at: https://doi.org/10.1371/journal.pone.0170628.

Honjo, M.K., Gupta, M.S. and Verhoeven, M. (1997) *The efficiency of government expenditure: Experiences from Africa*. International Monetary Fund.

Iskarno, P.E., Kuncara W., H. and Irianto, D. (2014) 'Pengaruh Tingkat Pendidikan Dan Infrastruktur Terhadap Pertumbuhan Ekonomi Di Indonesia (Tahun 2008 – 2012)', *Jurnal Pendidikan Ekonomi dan Bisnis (JPEB)*, 2(1), pp. 1–17. Available at: https://doi.org/10.21009/jpeb.002.1.9.

Jayasuriya, R. and Wodon, Q. (2011) 'Explaining Country Efficiency in Improving Health and Education Indicators: The Role of Urbanization'.

Jenzie, L. and Seddon, J. (1999) 'Decentralization Briefing notes World Bank', pp. 2–6.

Johnson, R.A. and Wichern, D.W. (2007) *Applied Multivariate Statistical Analysis.: Pearson Prentice Hall*, *Pearson Prentice Hall*.

Jung, H.-S. and Thorbecke, E. (2003) 'The impact of public education expenditure on human capital, growth, and poverty in Tanzania and Zambia: a general equilibrium approach', *Journal of Policy Modeling*, 25(8), pp. 701–725.

Kirkcaldy, B., Furnham, A. and Siefen, G. (2004) 'The relationship between health efficacy, educational attainment, and well-being among 30 nations', *European Psychologist*, 9(2), pp. 107–119.

Kis-Katos, K. and Sjahrir, B.S. (2017) 'The impact of fiscal and political decentralization on local public investment in Indonesia', *Journal of Comparative Economics*, 45(2), pp. 344–365. Available at: https://doi.org/10.1016/j.jce.2017.03.003.

Natan, J.A. (2019) 'Healthcare Expenditure Efficiency Analysis Regarding to Healthcare Access in 34 Provinces in Indonesia', *Journal of Chemical Information and Modeling*, 53(9), pp. 1689–1699.

Pardo-fern, J.C. (2013) '(I S B a) a Review on Roc Curves'.

Suherda, H., Amin, M. and Fadillah, F. (2019) 'The Evaluation of Free Education Program at North Kayong District in 2016Period', *Journal of Education, Teaching and Learning*, 4(1), pp. 14–30.

Todaro, M.P. and Smith, S.C. (2015) *Todaro_-_Smith__2015_Economic_Development_12th_ed*.

Verhoeven, M., Gunnarsson, V. and Carcillo, S. (2007) 'Education and health in G7 countries: Achieving better outcomes with less spending'.

World Bank (2008) 'Implementing the Agenda of the Namibian Ministry of Environment and Tourism. A Rapid Country Environmental Analysis with a Public Expenditure Review for Aligning Policy, Institutional and Financil Priorities', (42472), p. 69.

Yao, G.A. (2007) 'Fiscal decentralization and poverty reduction outcomes: Theory and evidence'.