Efficiency of local government expenditure in health sector

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Abstract
This study evaluates the efficiency of local government expenditures in the health sector, crucial for growth and productivity. Using Data Envelopment Analysis, it examines pre- and post-decentralization periods. Before decentralization, only Makassar (Sulawesi) and Gianyar (Bali and Nusa Tenggara) achieved full efficiency. Post-decentralization, Bengkalis, Kota Pematang Siantar, and Simalungun (Sumatera) reached efficiency. Findings reveal that Papua's regions have the lowest efficiency scores, while Sulawesi's are the highest. Papua averages 0.80, below the national average of 0.90, whereas Sulawesi scores 0.93. Overall, efficiency improved post-decentralization. The study highlights the need for government efforts to enhance health expenditure efficiency both before and after fiscal decentralization to achieve optimal results.

Keywords: Decentralization, Efficiency, Government Expenditure, Health

Abstrak
Studi ini mengevaluasi efisiensi pengeluaran pemerintah daerah di sektor kesehatan yang sangat penting bagi pertumbuhan dan produktivitas. Dengan menggunakan Data Envelopment Analysis, studi ini meneliti periode sebelum dan sesudah desentralisasi. Sebelum desentralisasi, hanya Makassar (Sulawesi) dan Gianyar (Bali dan Nusa Tenggara) yang mencapai efisiensi penuh. Setelah desentralisasi, Bengkalis, Kota Pematang Siantar, dan Simalungun (Sumatera) mencapai efisiensi. Temuan-temuan menunjukkan bahwa daerah-daerah di Papua memiliki nilai efisiensi terendah, sementara Sulawesi adalah yang tertinggi. Papua memiliki nilai rata-rata 0,80, di bawah rata-rata nasional 0,90, sedangkan Sulawesi memiliki nilai 0,93. Secara keseluruhan, efisiensi meningkat setelah desentralisasi. Studi ini menyoroti perlunya upaya pemerintah untuk meningkatkan efisiensi belanja kesehatan sebelum dan sesudah desentralisasi fiskal untuk mencapai hasil yang optimal.

Kata kunci: Desentralisasi, Efisiensi, Pengeluaran Pemerintah, Kesehatan

1. Introduction

Decentralization is the transfer of power and responsibility from the central government to the local government and the empowerment of the community for economic development by the local government. Decentralization in a country includes the delegation of authority. Yao (2007) describe this delegation of authority is implemented in order to provide services to the public, from government officials or agencies at the central level to government officials or agencies closer to the communities served. Decentralization emerging in most countries in the world is trigerred by political and economic reasons. Ford (1999) and Javier (2000) describe decentralization from a political perspective. In their view, the drive for decentralization in many countries, especially in developing countries, is influenced by various factors, such as the

background or experience of a country, the role of the country in globalization, the decline of economic development, the demand for changes of public service level, and disintegration in some countries.

The Indonesian local governance system adheres to the principles of decentralization, deconcentration, and co-administration carried out collaboratively. To realize the principles, autonomous regions are established consisting of regencies and cities. The law (UU) regulating local governments (regional autonomy) has been revised, from Law no. 22 of 1999 to Law no. 32 of 2004. With the enactment of this law, the responsibilityof the local governments for developing regions become bigger. The local governments are more aware of the needs and conditions of their own regions and the will of their people than the central government. The local governments can also spend their budget based on their prioritized needs and conditions. The expenditure of the local governments is in accordance with performance-based budget.

The performance-based budget is an important measure of the efficiency of local governments' expenditures indicating the governments' performance in running public services. The public services addressed in this research are in the field of health. Health are important components of growth and development in aggregate production functions. Health is a prerequisite to subtain higher level of productivity.

Measurement of government expenditure performance in previous studies is more common in general, namely public expenditure (Afonso, Schuknecht, & Tanzi, 2010; Carosi, D'Inverno, & Ravagli, 2014; Feeny & Rogers, 2008; Fonchamnyo & Sama, 2016; Bose, Haque, & Osborn, 2007; Herrera & Pang, 2005). This research will only focus on government spending in the health sector (Han & Miao, 2010; Hsu, 2013). Health is one of the main focuses of the government which is always being improved. Especially in Indonesia, which is a tropical region and a vast archipelago and with difficult terrain in remote areas making it difficult for people to get health facilities. Every year the government continues to improve health facilities throughout Indonesia, especially remote areas. This can be seen by the increasing number of public health services and other health facilities which continues to increase (BPS, 2018).

This paper aims to measure the level of efficiency of regencies and cities government expenditures on health prior to fiscal decentralization (1994-2000) and after fiscal decentralization (2001-2014). The data used is old because there is a lot of data to get because it covers all regencies and cities in Indonesia, but the data can still describe the efficiency of regencies and city government spending in the health sector. This research contributes to the government to improve the efficiency of government spending in health.

The government's involvement in the economy will increase as the country's income level rises. Goedhart (1982) states that government expenditures constantly increase as the income level rises. Increasing community income indicates the higher level of community prosperity that will increase the demand of services provided by the government. This ultimately increases government spending.

2. Literature Review

Government expenditure is the cost which must be spent for implementing government policies (Mangkoesubroto, 1991). Government expenditure represents the government's activities in an economy reflected in national or regional revenue and expenditure budgets. The expenditure is realized so that the government can play its role to improve the welfare of its people.

Pertiwi (2007) conducted research on the efficiency of local governments' spending in Central Java. Based on the results of data processing using Data Envelopment Analysis (DEA) on the level of efficiency of education and health expenditures at 35 regencies and cities in 1999 and 2002, she stated that there is a difference in efficiency level of local government expenditures both in education and health in 1999 and 2002. The level of efficiency in 2002 tended to increase from 1999. This means that the local government in each area has made improvements in terms of their government performance but these improvements are not optimal. The differences between Pertiwi's study and the present study are: i) the subject of the present study includes regencies and cities in Indonesia, ii) The public sectors employed in the present study consist of educational and health sectors in regencies and cities in Indonesia with more varied variables, iii) the present study examines before and after fiscal decentralization was implemented in Indonesia.

Research conducted by Rayp and Sijpe (2007) addressed the measurement of government expenditure efficiency in education and health in 52 developing countries and compared the efficiency of the developing countries. Data Envelopment Analysis (DEA) method to estimate inefficiency. DEA is a non parametric linear programming-based technique designed to calculate relative efficiency. A Banker, Charnes, and Cooper (BCC) model allowing variable returns to scale is amployed (Banker, Charnes, & Cooper, 1984). This is in close accordance with the theoretical fiscal policy models where the positive effects of productive government expenditure weaken as the government or the expenditure ratios become bigger. In small samples (of a 50 observations) and little is known concerning a production function relating public expenditure to outputs for health, education, and government effectiveness, there is a considerable risk of misspecification. DEA's relative performance vis-à-vis stochastic methods even improves when more noise is introduced, even under the presence of heteroscedasticity, DEA based estimators give the best result.

Merini (2013) conducted a study about the efficiency of government expenditure for public sectors including health, educational, and infrastructure sectors in Southeast Asian. The analysis used was Data Envelopment Analysis (DEA) with the model of Constant Return to Scale (CRS). Results of the study indicated that there were variations in the level of efficiency of government expenditure for public sectors in Southeast Asian. The highest level of efficiency in the three sectors was Singapore; whereas, Malaysia had the lowest efficiency level of government expenditure in the three sectors. The differences between Merini's study and the present study are: i) the subject of the present study includes regencies and cities in Indonesia, ii) the method of the present study used beside DEA is Tobit, iii) there are only two public sectors

used; those are education and health, but variables used for the two sectors are more varied, iv) the present study examines before and after fiscal decentralization was implemented in Indonesia.

Grigoli and Kapsoli (2017) on his research on the efficiency of health expenditure in emerging and developing economies using DEA and SFA to measure efficiency of health expenditure. Efficiency values are obtained by using one input (public health expenditure) and one output (healthy life expectancy). In particular, less than half of the economies stay in the same quartile in terms of their ranking on spending efficiency. Furthermore, while 10% of the economies are in the most (least) efficient DEA quartile end up in the least (most) efficient one when SFA is used to compute the efficiency scores.

Research by Aron (2019) regarding healthcare expenditure efficiency analysis in 34 provinces in Indonesia using DEA. The results of the study found that provinces with the highest efficiency were North Sumatra, DKI Jakarta, West Java, East Java, and South Sulawesi. While the provinces with the lowest efficiency are Bangka Belitung Island, Gorontalo, and Maluku. Furthermore, Aron (2019) explains that efficiency differences in each region can be due to technological advances, forms of financing, coverage levels, and administrative systems. Furthermore, similar research conducted by Prasetyo, Mulyono, and Nugroho (2018) on local governments' expenditure efficiencies and determinants in 34 provinces in Indonesia using two stages, namely the first DEA method and then tobit regression. The results show that DKI Jakarta, DI Yogyakarta and West Java have the highest efficiency values. While Papua and West Papua are the provinces with the lowest efficiency. Nevertheless, Papua, East Kalimantan, and South Sumatra are provinces that have positive efficiency growth during the analysis period based on the Malmquist Index. The results of tobit regression analysis show that population, government accountability, democratic index, number of universities, and local investment have a significant positive effect on the value of efficiency.

3. Research Method
The method used is Data Envelopment Analysis (DEA). Data Envelopment Analysis (DEA), originating from Farrell's (1957) and popularized by Charnes, Cooper, and Rhodes (1978), assumes the existence of a convex production frontier. The production frontier in the DEA approach is constructed using linear programming methods. The terminology 'envelopment' stems out from the fact that the production frontier envelops the set of observations.

DEA allows the calculation of technical efficiency measures that can be either input or output oriented. The purpose of an input-oriented study is to evaluate by how much input quantity can be proportionally reduced without changing the output quantities. Alternatively, and by computing output-oriented measures, one could also try to assess how much output quantities can be proportionally increased without changing the input quantities used. The two measures provide the same results under constant returns to scale but give different values under variable returns to scale. Nevertheless, both

output and input oriented models will identify the same set of efficient or inefficient decision-making units (DMU) (Afonso & Aubyn, 2005).

DEA is a non parametric linear programming-based technique designed to calculate relative efficiency. A model allowing variable returns to scale is employed (Banker, Charnes, and Cooper, 1984). This is in close accordance with the theoretical fiscal policy models, where the positive effects of productive government expenditure weaken as the government or the expenditure ratios become bigger.

DEA method answering the research objective, that is, measuring level of efficiency of regencies and cities government expenditure on education and health prior to fiscal decentralization (1994-2000) and after fiscal decentralization (2001-2014). Data processing is conducted to measure technical efficiency rate annually. The technical efficiency rate will use an efficiency measurement based on output orientation, measurement scale assumption of Variable Return to Scale (VRS). Data processing using this method is essential to see annual technical efficiency rate. The result of technical efficiency measurement will generate two conditions: efficient and inefficient, thus, DMU efficiency score can be determined.

The data used in this study are secondary data from regencies and cities in Indonesia (cross section) from 1994 until 2014. Data from 1994 to 2014 is divided into two sections according to the period before decentralization (1994-2000) and after decentralization (2001-2014). This separation is to see whether there are differences in the value of efficiency before or after. The difference is not for comparison, but to know how improvement is achieved after decentralization.

The time period used is from 1994 to 2014 and the covered areas for health sector are 193 regencies and cities and after decentralization are 203 regencies and cities. The data of input variables include regional government expenditures on health which are obtained from date base, annual report the Directorate General of Financial Balance (DJPK). Meanwhile, the output variable is life expectancy. Life expectancy was obtained from Central Bureau of Statistics (BPS, 1994-2014).

The Government of Indonesia, through decentralization, aims to improve public service planning and provision taking into account local needs and conditions, meeting regional and national socio-economic development goals. The government must benefit from decentralization because of increased cost effectiveness and public services due to better allocation of limited resources. Variables used in this study are explained to provide clear descriptions and to avoid misinterpretations of the variables studied and the process of analysis carried out. The variables of this research are:

Input variables
Development expenditure in the health sector is the realization of government expenditure on health: social welfare and the roles of women, children and adolescents reflected in the realization of Regional Revenue and Expenditure Budget (APBD) of regencies or cities in Indonesia. The realization of this expenditure is equal to the direct spending of the local governments per capita on health sector which is calculated from

the total direct expenditure of the health sector divided by the number of people in a certain period expressed in rupiah at a constant price of 2000.

Output variables

Life expectancy is an estimate of the average length of life from birth

$$e^0 = T_o/I_o$$

Where:

e^0 : life expectancy;

T_o : the total number of years of life after zero year;

I_o : the number of people living

The input variable used in this study is government expenditures on the health sector and the output used, namely life expectancy following the input and output of research conducted by Hsu (2013), Jafarov and Gunnarsson (2008), Afonso and Aubyn (2004).

4. Results and Discussion

This section will explain the results of an analysis of the efficiency of government expenditure in health. To facilitate interpretation, the grouping of regions is divided into 6 major islands in Indonesia: Java, Sumatera, Kalimantan, Sulawesi, Bali dan Nusa Tenggara, Maluku dan Papua. In addition, efficiency is also grouped into 3 groups of low, medium and high using the K-means method. K-means clustering is used for describing an algorithm that assigns each item to the cluster that has the nearest centroid (mean) (Johnson & Wichern, 2007). Each cluster may have different values depending on the data analyzed.

This section discusses the efficiency of government expenditure on health in Indonesia. The method used is Data Envelopment Analysis (DEA). DEA aims to identify the efficiency level from 1994-2014 and the average efficiency achieved by each DMU during that period. Not all studied DMUs can maintain their optimal efficiency; however, in general many regencies and cities achieved their optimal efficiency after fiscal decentralization. For example, Maros and Minahasa regencies achieve optimal efficiency for some periods after decentralization. Meanwhile, Bengkalis regency is the only regency which can maintain its optimal efficiency from 2002 to 2014. This is a good indicator as many regional governments are able to optimize their health expenditure.

Table 1. Cluster Information of Average Efficiency Government Expenditure in Health Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.70	0.82	0.87
Number of Islands in Each Cluster	1	1	4

The graph of the efficiency of government spending in health can be seen in Figure 1. The grouping is clearly visible in low, medium and high order. The islands included in cluster 1 category are Maluku and Papua. Then Sumatera in cluster 2. Cluster 3 consisted of Java, Sulawesi, Kalimantan, Bali and Nusa Tenggara.
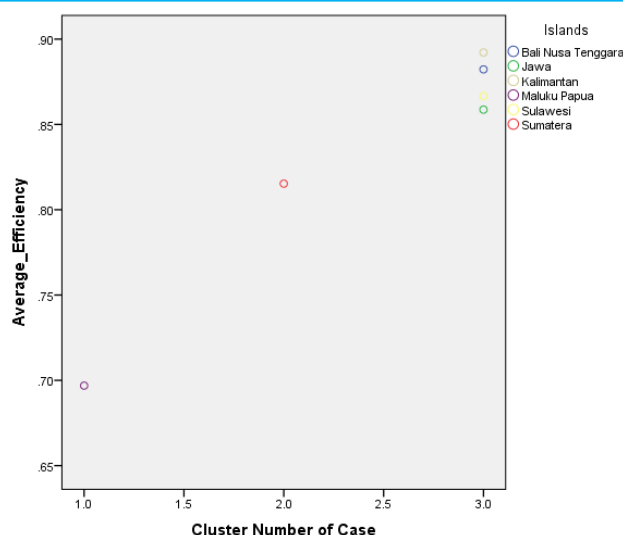
Figure 1. Scatterplot of Classification for Average Efficiency of Government Expenditure on Health Before Decentralization

Furthermore, is the grouping of average efficiency of government spending in health after decentralization based on the islands can be seen in Table 2. The average value of efficiency after decentralization is better than before decentralization. The result of cluster of K-means divides into three cluster namely 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.

Table 2. Cluster Information of Average Efficiency Government Expenditure in Health After Decentralization

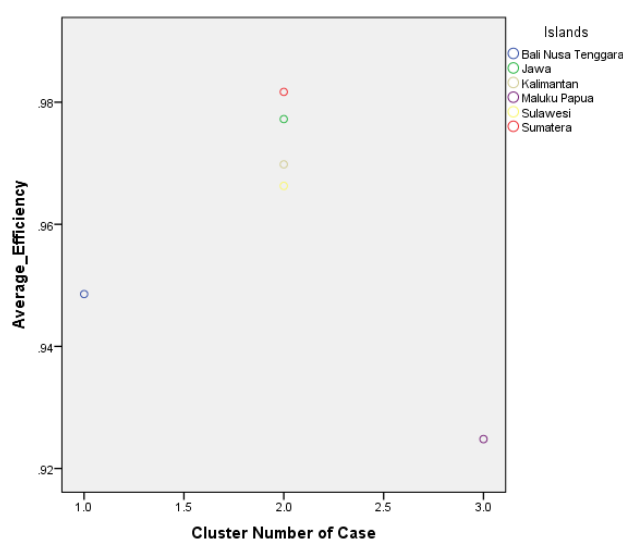|	Cluster		
	1	2	3
Average Efficiency	0.88	0.93	0.91
Number of Islands in Each Cluster	1	1	4

Figure 2. Scatterplot of Classification for Average Efficiency of Government Expenditure on Health After Decentralization

The graph of the efficiency of government spending in health can be seen in Figure 2. Cluster is divided into three namely cluster one consisting of Maluku Papua. The second cluster consists of one island, Sulawesi. Finally, cluster three consists of four islands namely Jawa, Sumatera, Kalimantan, and Bali Nusa Tenggara. Although the average value of efficiency is good and almost close to 1, it still needs improvement to be efficient.

Java Before Decentralization

The efficiency of government expenditure on health in Java before decentralization is divided into 3 clusters, as shown in Table 3. Cluster 1 consists of 24 regencies and 1 city with an average efficiency of 0.83, cluster 2 consists of 17 cities and 36 regencies with an average efficiency of 0.92. Then, cluster 3 with an efficiency average of 0 comprises of 2 cities and 1 regency that have not been formed before decentralization, so that there is no data.

Table 3. Cluster Information of Java Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.83	0.92	0.00
Number of Regencies and Cities in Each Cluster	25	53	3

The cluster distribution in the form ascatterplot can be seen in Appendix M. It shows that the density is denser in the cluster 2, which means the value of efficiency is not too far away. Cluster 1 shows that there is one area in the scatterplot that is separate from the group because it has an efficiency value with a gap that is quite different from the other regions.

Table 4 (Appendix) shows cities and regencies in clusters 1, 2, and 3. Tangerang city, Pandeglang, and Serang city have not yet been formed before decentralization so the value is 0. Then, Magelang is the regency with the lowest efficiency with efficiency value of 0.73, followed by Sampang with 0.77. Yet, there is no regency and city that has efficiency score of 1. The highest efficiency is 0.98, which is achieved by Sleman and Tulungagung. Sampang is a regency located in Madura Island and included in East Java Province. Infant mortality rates in Sampang, Probolinggo, Bondowoso and Jember are among the highest in East Java (BPS, 2018). This is congruent with Verhoeven et. al. (2007) indicators of performance in health services; one of which is infant-, child-, and maternal mortality rates.

Java After Decentralization

After decentralization, the efficiency of government expenditure on health in Java is divided into 3 clusters, which can be seen in Table 5. Cluster 1 is achieved by 2 cities and 9 regencies with an average efficiency of 0.82. Cluster 2 is reached by 8 cities and 28 regencies with an average efficiency of 0.90. Cluster 3 consists of 9 cities and 25 regencies with an average efficiency of 0.95.

Table 5. Cluster Information of Java After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.82	0.90	0.95
Number of Regencies and Cities in Each Cluster	11	36	34

The distribution of the efficiency of each cluster can be seen in Appendix N. The scatterploton each cluster appears to have distance and not too tight. This is because the efficiency values of each regency and cities vary and only few are equal in value.

Regencies and cities with the efficiency of government expenditure on health in Java after decentralization can be seen in Table 6 (Appendix). There are no efficient regencies and cities in managing government expenditure on health in Java. The highest efficiency is 0.99 achieved by Pacitan and Sleman, while the lowest efficiency is Magelang, with 0.79. Pacitan is a regency in East Java which has a declining infant mortality rate every year and a high life expectancy (BPS 2019). These two factors are one of indicators of health service performance as stated in Verhoeven et al. (2007), namely maternal mortality rates and healthy average life expectancy as defined by the WHO.

Sumatera Before Decentralization
The efficiency of government expenditure on health in Sumatera before decentralization can be seen in Table 7 cluster 1 with an average of 0.94 is achieved by 2 cities and 9 regencies. Cluster 2 consists of 5 cities and 20 regencies with an average efficiency of 0.86, while cluster 3 consists of 1 city and 1 regency whose territory has not yet been fored so that there is no data and its efficiency value is 0.

Table 7. Cluster Information of Sumatera Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.94	0.86	0.00
Number of Regencies and Cities in Each Cluster	11	25	2

Appendix O shows the scatterplot value of the efficiency of government expenditure on health achieved by regencies Sumatera before decentralization. The scatterplot seems quite tight and not too tenuous, which means that the efficiency value obtained has a slight difference in each regency.

Before the decentralization of Sumatera Island, there is no regency that reaches health efficiently (Appendix Table 8). The highest efficiency is 0.97 achieved by 1 regency and 2 cities, namely West Aceh, Pematang Siantar City, and Tebing Tinggi City. A regency that has the lowest efficiency is South Tapanuli with the efficiency score of 0.79. Meanwhile, the other 5 cities and 27 regencies have efficiency in the range of 0.82-0.95. Then, there are 1 regency and 1 city with efficiency of 0, namely Bangka and Batam city (regency and city that have not been formed before decentralization). Pematang Siantar and Tebing Tinggi are cities in North Sumatera Province which have a high life expectancy compared to other cities in North Sumatera Province (BPS, 2018). This life expectancy is related to people's lifestyles. As stated in the research of

Gunnarson and Jafarov (2008), lifestyle factors and exogenous factors have a correlation with efficiency.

Sumatera After Decentralization

The efficiency value of Sumatera Island after decentralization in managing government expenditure on health is divided into 3 clusters. Cluster 1 with an average efficiency value of 0.97 is achieved by 6 cities and 10 regencies. Cluster 2 consists of 1 city and 20 regencies with an average efficiency of 0.91, and cluster 3 with an average efficiency of 0.65 consists of 1 regency.

Table 9. Cluster Information of Sumatera After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.97	0.91	0.65
Number of Regencies and Cities in Each Cluster	16	21	1

Appendix P shows the scatterplot efficiency of health expenditure in cities and regencies in Sumatera. The Scatterplot is not too tight in each Cluster. This means that the value of efficiency in each city and regency varies and has a slight difference.

There are 1 city and 2 regencies on the island of Sumatera after decentralization that achieves efficiency, namely Pematang Siantar city, Bengkalis, and Simalungun (Appendix Table 10). The three regions have not reached efficient before decentralization. Pematang Siantar city and Simalungun located in North Sumatera province whereas Bengkalis is in Riau Provence. The cities with the lowest efficiency are Batam and Riau Islands which are newly formed regions after decentralization. Pematang Siantar was one of the cities that achieved the highest efficiency before decentralization and after decentralization it becomes efficient with efficiency value of 1 along with Simalungun which is also a regency in North Sumatera Province.

In addition, both city and regency have a high life expectancy around 70-year-old in North Sumatera (BPS, 2018) and have a high percentage of children under five years old who are immunized, compared to other cities and regencies in North Sumatera Province (BPS, 2018). Life expectancy and number of immunization vaccine are two of the performance indicators in health care (Verhoeven, 2007; Gunnarsson & Jafarov, 2008). Batam and Riau Islands are new areas in the Kepulauan Riau Province formed in 2002. The location of the province borders the sea with Vietnam and Cambodia. Batam and Kepulauan Riau become cities in the Sumatera Island and surrounding areas that have the lowest efficiency. This is because the location of the region is quite separate from the large islands in Indonesia. As stated by Gupta and Verhoeven (2001), differences in regional location based on regional factors including health status make a difference in efficiency.

Kalimantan Before Decentralization

The distribution of the results of the efficiency of government expenditure on health in Kalimantan Island before decentralization can be seen in Table 11. The efficiency is divided into 3 clusters. Cluster 1 with an average efficiency of 0.88 is achieved by 3

cities and 10 regencies. Cluster 2 consists of 2 cities and 3 regencies with an average efficiency of 0.95 and cluster 3 consists of 2 regencies with an average efficiency of 0.79.

Table 11. Cluster Information of Kalimantan Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.88	0.95	0.79
Number of Regencies and Cities in Each Cluster	13	5	2

Distribution of scatterplots per cluster on the island of Kalimantan before decentralization can be seen in Appendix Q Scatterplots look quite tenuous, which means that the difference in efficiency values of each regency and cities is quite large especially in Cluster 2.

The city that achieves the highest efficiency value is Palangkaraya with 0.99, while the lowest are Tanah Laut and Sambas with efficiency of 0.77 and 0.81 respectively (Appendix Table 12). The other 4 cities and 13 regencies have efficiency in the range of 0.86-0.96. Palangkaraya is the capital city of the Central Government of Central Kalimantan Province, so it is not surprising that it has high efficiency even though it does not reach efficiency value of 1. Palangkaraya's access to government makes the city easy to monitor health facilities and their performance so that if there are problems they can be repaired quickly. As Carosi (2014) stated, the greater the city, the greater the level of efficiency.

Kalimantan After Decentralization

The efficiency in managing government expenditure on health in Kalimantan Island after Decentralization is divided into 3 clusters. Cluster 1 consists of 4 cities and 12 regencies with an average efficiency of 0.93. Cluster 2 with an average efficiency of 0.87 is achieved by 1 city and 2 regencies. Cluster 3 with an efficiency of 0.78 is achieved by 1 regency.

Table 13. Cluster Information of Kalimantan After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.93	0.87	0.78
Number of Cities in Each Cluster	16	3	1

Distribution of scatterplots per cluster on the island of Kalimantan after decentralization can be seen in Appendix R. Scatterplots look quite tenuous, which means that the difference in efficiency values of each regency and cities is quite large. But there are some areas with scatterplots that coincide, which means that the efficiency value is close together.

The efficiency of government expenditure on health in Kalimantan Island after decentralization has not yet reached efficiency score of 1 (Appendix Table 14). The highest efficiency value that can be achieved is 0.98, obtained by Palangkaraya city, while the lowest efficiency value is Tanah Laut with 0.78. Other 4 cities and 14 regencies are in the efficiency range of 0.83-0.97. Tanah Laut is a regency in South

Kalimantan Province that only has one hospital in 2012 (BPS, 2018) and 17 health centers in 2010 (BPS, 2018). Health facilities such as hospitals and health centers are key in health services (Verhoeven, et al., 2007; Gunnarsson & Jafarov, 2008; Lavado, Lagrada, & Gozun, 2010).

Sulawesi Before Decentralization

The efficiency of government expenditure on health in Sulawesi Island before decentralization is divided into 3 clusters, which can be seen in Table 15. Cluster 1 consists of 6 regencies with an average efficiency of 0.85. Cluster 2 with an average efficiency of 0.94 is achieved by 4 cities and 21 regencies. Cluster 3 consists of 1 city and 1 regency that have not been formed before decentralization so that the efficiency value is 0.

Table 15. Cluster Information of Sulawesi Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.85	0.94	0.00
Number of Regencies and Cities in Each Cluster	6	25	2

The distribution of scatterplots on the island of Sulawesi before decentralization shows on Appendix S. The cluster 2 scatterplot looks denser than cluster 1. This shows that the efficiency value gap in cluster 2 is smaller than cluster 1.

A city that has achieved efficiency before decentralization is Makassar with a value of 1. Makassar city is the center of government in South Sulawesi (Appendix Table 16). Other 27 regencies and 3 cities have efficiency in the range of 0.81-0.97. Additionally, there are 1 city and 1 regency that have not been formed before decentralization, namely Majene and Mamuju city. The lowest efficiency is acquired by Donggala and Poso which are part of the Central Sulawesi Province. Before decentralization there were riots in Poso between 1998-2001 as a result of religious conflict (Alganih, 2016). This riot affects the socio-economic conditions of the community and damages infrastructure in Poso.

Sulawesi After Decentralization

The efficiency of Sulawesi Island in managing government expenditure on health after decentralization is divided into 3 clusters. Cluster 1 consists of 6 regencies with an average efficiency of 0.89. Cluster 2 with an average efficiency of 0.96 is achieved by 4 cities and 21 regencies. Then cluster 3 with an average efficiency of 0.71 is achieved by 1 city and 1 regency.

Table 17. Cluster Information of Sulawesi After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.89	0.96	0.71
Number of Regencies and Cities in Each Cluster	6	25	2

The distribution of efficiency values in Sulawesi Island after decentralization can be seen in Appendix T. In cluster 2, the scatterplot looks a little overlapping, which means it has a small value of efficiency at each regency and cities. Whereas in cluster 1 there

is a scatterplot that is far apart from the others which means that the efficiency value has a considerable distance from other regions.

After decentralization in the island of Sulawesi, there are additional two new regions, Majene regency and Mamuju city (Appendix Table 18). However, the Mamuju city and Majene have the lowest efficiency value; Majene with 0.68 and Mamuju with 0.75. Then after decentralization there is no city that is efficient in managing health expenditure. Majene regency and Mamuju city are in West Sulawesi Province. The corruption case of the Sulawesi Public Hospital health equipment funds in Mamuju has harmed the government and society (Indonesia Supreme Court, 2017). Corruption affects the government spending efficiency (Wang & Eskander, 2011; Hauner & Kyobe, 2010). Corrupt communities are more likely to mismanage financial and material resources that can negatively affect the allocation of public resources in various economic sectors (Fonchamnyo & Sama, 2016).

Bali and Nusa Tenggara Before Decentralization
Table 19 shows the grouping of efficiency in managing government expenditure on health in the islands of Bali and Nusa Tenggara before decentralization. Cluster 1 consists of 4 regencies with an average efficiency of 0.78. Cluster 2 with an average efficiency of 0.96 is achieved by 7 regencies and 1 city. The last is cluster 3 with an average efficiency of 0.86 achieved by 8 regencies.

Table 19. Cluster Information of Bali and Nusa Tenggara Island Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.78	0.96	0.86
Number of Regencies and Cities in Each Cluster	4	8	8

The scatterplot distribution of each cluster on the Bali and Nusa Tenggara Island before decentralization can be seen in Appendix U. Scatterplots have a tenuous distance, this means that the differences in efficiency values of each regency and cities are quite large. The scatterplot looks not too tight because there is an efficiency gap in each city.

Regencies and Cities that have achieved efficiency in managing health expenditures in the islands of Bali and Nusa Tenggara can be seen in Table 20 (Appendix). Gianyar is the only regency that has achieved efficiency 1. Health facilities in Gianyar are excellent compared to other regencies and cities in the Province of Bali with adequate mattresses in hospitals (BPS, 2018). This is in line with the research of Hsu (2013) which states that hospital beds have an influence on increasing efficiency. Moreover, there are 3 regencies with low efficiency in the range 0.75-0.79. Apart from these are 15 regencies and 1 city with an efficiency range of 0.83-0.99. The regencies with the lowest efficiency are East Lombok, Bima, and Sumbawa, all of which are in the West Nusa Tenggara Province. The three regencies have a lower percentage of children under five years old who have received immunizations compared to other cities in West

Nusa Tenggara Province (BPS, 2017). Immunization is one of the key indicators of performance in health services from the government (Verhoeven, 2007).

Bali and Nusa Tenggara After Decentralization

The efficiency of government expenditure on health in the islands of Bali and Nusa Tenggara after decentralization is divided into 3 clusters. Cluster 1 consists of 1 city and 9 regencies with an average efficiency of 0.95. Cluster 2 with an average efficiency of 0.83 comprises of 4 regencies, and cluster 3 consists of 6 regencies with an average efficiency of 0.90.

Table 21. Cluster Information of Bali and Nusa Tenggara After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.95	0.83	0.90
Number of Regencies and Cities in Each Cluster	10	4	6

The scatterplot distribution of each Cluster on the Bali and Nusa Tenggara Island after decentralization can be seen in Appendix V. Scatterplots have a tenuous distance, this means that the differences in efficiency values of each regency and cities are quite large.

Regencies and cities in Bali and Nusa Tenggara after decentralization have not been efficient in managing health expenditure (Appendix Table 22). The highest efficiency value is 0.97 achieved by Denpasar city and Jembrana. Then 5 regencies with the lowest efficiency in the range 0.82-0.89 are East Lombok, Sumbawa, Bima, East Sumba, and Ende, which are located in Nusa Tenggara Island. Denpasar city and Jembrana regency are in Bali Province, and Denpasar city is the provincial capital. As explained earlier, the health facilities in the central government certainly have good quality because the greater the city, the greater the efficiency (Carosi, 2014). Then Denpasar city and Jembrana have a population ratio with a sufficient number of hospital beds compared to other cities in Bali Province. The number of hospital mattresses is used to determine the health quality status of a region. The better the health status, the higher the efficiency value (Macintyre, Maciver, & Sooman, 1993).

Maluku and Papua Before Decentralization

Table 23 shows that the efficiency of government expenditure on health in the islands of Maluku and Papua is divided into 3 clusters. Cluster 1 with an average efficiency of 0.93 is achieved by 1 city and 2 regencies. Cluster 2 consists of 2 cities that have not been formed before decentralization so that the efficiency value is 0. Cluster 3 consists of 5 regencies with an average efficiency of 0.84. This efficiency can be improved by maximizing the use of inputs so that the output becomes better (Hadad, et al., 2013).

Table 23. Cluster Information of Maluku and Papua Before Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.93	0.00	0.84
Number of Regencies and Cities in Each Cluster	3	2	5

The scatterplot of expenditure efficiency in Maluku and Papua before decentralization can be seen on Appendix W. In all clusters, it can be seen that the scatterplot is not too tight and has a distance that is not too far, which means that the efficiency value in each regency and cities in Maluku and Papua is not much different.

The efficiency of government expenditure on health in Maluku and Papua Islands is not yet efficient and therefore it must be improved. The highest efficiency is 0.95 achieved by Central Halmahera and followed by Ambon city with 0.93. Other 6 regencies have efficiencies in the range of 0.8-0.89. This efficiency can still be increased by maximizing existing inputs so that the output obtained is better (Hadad, et al., 2013). Ambon city and Central Halmahera have quite high efficiency even though they have not acquired efficiency value of 1. This means that existing inputs in Central Ambon and Halmahera have high life expectancy as output. Life expectancy is one of the variables that includes long-term result of the health system. Poor access to health facilities, low quality of health facilities and doctors, and low expenditure in medicines, in general, can make a low average life expectancy (Retzlaff-Roberts et al. 2004; Afonso & Aubyn, 2005; Räty & Luoma, 2005).

Table 24. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Maluku and Papua Before Decentralization

No.	Regencies and Cities	Average Efficiency	Cluster
1	Maluku Tengah	0.89	1
2	Kota Ambon	0.93	1
3	Halmahera Tengah	0.95	1
4	Kota Ternate	0	2
5	Kota Tidore Kepulauan	0	2
6	Merauke	0.8	3
7	Halmahera Selatan	0.84	3
8	Kepulauan Sula	0.84	3
9	Maluku Tenggara	0.84	3
10	Halmahera Barat	0.87	3

Maluku and Papua After Decentralization

The efficiency of government expenditure on health in Maluku and Papua after decentralization is divided into 3 clusters. Cluster 1 consists of 1 city and 3 regencies with an average efficiency of 0.96. Cluster 2 consists of 3 regencies with an average efficiency of 0.87, while cluster 3 with an average of 0.78 is achieved by 2 regencies and 1 city. This efficiency can still be improved through the use of existing inputs so that it can get maximum output (Hadad, et al., 2013).

Table 25. Cluster Information of Maluku and Papua After Decentralization

	Cluster		
	1	2	3
Average Efficiency	0.96	0.87	0.78
Number of Regencies and Cities in Each Cluster	4	3	3

The efficiency distribution of government expenditure on health in Maluku and Papua after decentralization is presented in Appendix X. Scatterplots on each cluster

have a considerable distance. This means that efficiency in each regency and cities in Maluku and Papua has quite a different value.

Table 26. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Maluku and Papua After Decentralization

No.	Regencies and Cities	Average Efficiency	Cluster
1	Halmahera Tengah	0.93	1
2	Maluku Tengah	0.95	1
3	Maluku Tenggara	0.98	1
4	Kota Ambon	0.99	1
5	Halmahera Selatan	0.86	2
6	Halmahera Barat	0.87	2
7	Kepulauan Sula	0.87	2
8	Kota Tidore Kepulauan	0.75	3
9	Kota Ternate	0.78	3
10	Merauke	0.81	3

Table 26 shows the efficiency value of each city in Maluku and Papua. There is no city in Maluku and Papua that has achieved efficiency value of 1. The highest efficiency achieved by Ambon city is 0.99, while the lowest efficiency value is achieved by Ternate city and Tidore Islands city. Other 7 regencies and 1 city have efficiency in the range of 0.81-0.98. Ternate city and Tidore Islands city in North Maluku Province. Although Ternate is the capital of North Maluku province, the efficiency of its health expenditure management has not been good. Population density in Ternate city, which is the most densely populated in North Maluku, is not balanced with adequate health facilities. Recorded in 2012 with a population density of 1773.64 people / km2, there were only 8 health facilities (BPS, 2018). This affects the efficiency of health services as health facilities are one indicator of the efficiency of health services in a region (Retzlaff-Roberts et al. 2004; Alfonso & Aubyn, 2005; Räty & Luoma, 2005).

5. Conclusion

The efficiency of government expenditure in the health before decentralization there were only two regions that had achieved efficiency 1, namely Kota Makassar and Gianyar. Whereas in the post-decentralization period there were 3 regions that were efficient 1 in managing government expenditure in the health sector, namely Bengkalis, Kota Pematang Siantar, and Simalungun.

The efficiency of regional governments' expenditures on health before and after fiscal decentralization found that Merauke, Kota Ternate, and Kota Tidore Kepulauan have the lowest efficiency scores (0.80) below the average national efficiency (0.90), while Bengkalis, Pematang Siantar, and Simalungun have the highest efficiency scores. The efficiency scores of government health expenditure before decentralization is lower than eficiency score after decentralization.

Based on the results of the study, the researcher provides some suggestion for future research because this study distinctively different from previous studies as it contribute to the literature in these aspects. The focus of the research on government expenditures prior to fiscal decentralization (1994-2000) and after fiscal

decentralization (2001-2014). The time period used is from 1994 to 2014. Future researcher can add time period used after decentralization. Sectors in this study on health. Further researcher can add to the sector used, namely per capita income and education because that variable in the human development index.

The variables used in affect the technical efficiency in health sector can be added in addition to the variables used by researchers. Besides that, this study has not included the role of private sector. The role of the private sector that supports public goods, especially in health. This research employs quantitative approach DEA. Further researcher can use research methods like Stochactis Frontier Analysis and Panel Tobit.

References

Afonso A., & Aubyn M.S. (2005). Cross-Country Efficiency of Secondary Education Provision a Semi-Parametric Analysis with Nondiscretionary Inputs. European Central Bank Working Paper Series 2005, 494, 19-20.

Afonso, A., & Aubyn, M. S. (2005). Non-parametric approaches to education and health efficiency in OECD countries. *Journal of applied economics*, *8*(2), 227-246.

Afonso, A., Schuknecht, L., & Tanzi, V. (2010). Public sector efficiency: evidence for new EU member states and emerging markets. Applied economics, 42(17), 2147-2164.

Alganih, I. (2016). Konflik Poso (Kajian Historis Tahun 1998-2001). *Jurnal Pendidikan Sejarah* 5 (10): 166-174.

Aron, J. (2019). *Healthcare Expenditure Efficiency Analysis Regarding to Healthcare Access in 34 Provinces in Indonesia.*

Badan Pusat Statistik Provinsi Jawa Timur. (2019)*. Life Expectancy of East Java Residents, 2010-2018*. https://jatim.bps.go.id/dynamictable/2018/04/16/394/angka-harapan-hidup-ahh-penduduk-jawa-timur-menurut-kabupaten-kota-ipm-metode-baru-2010-2017.html [3 March 2019]

Badan Pusat Statistik. (2018). *Percentage of population aged 10 years and over who are illiterate according to gender and regency / city in East Nusa Tenggara Province, 2001-2017*. https://ntt.bps.go.id/dynamictable/2017/08/23/403/persentase-penduduk-berumur-10-tahun-ke-atas-yang-buta-huruf-menurut-jenis-kelamin-dan-kabupaten-kota-di-provinsi-nusa-tenggara-timur-2001-2017.html

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management science*, *30*(9), 1078-1092.

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

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

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European journal of operational research*, *2*(6), 429-444.

Feeny, S., & Rogers, M. (2008). *Public sector efficiency, foreign aid and small island developing states.* Journal of International Development: The Journal of the Development Studies Association, 20(4), 526-546.

Fonchamnyo, D. C., & Sama, M. C. (2016). *Determinants of public spending efficiency in education and health: evidence from selected CEMAC countries.* Journal of Economics and Finance, 40(1), 199-210.

Ford, J. (1999). Rationale for decentralization. *Decentralization briefing notes*, 6-8.

Goedhart, C. (1982). *Garis-Garis Besar Ilmu Keuangan Negara. Cetakan Ketiga*. Jakarta: Djambatan

Grigoli, F., & Kapsoli, J. (2018). Waste not, want not: the efficiency of health expenditure in emerging and developing economies. *Review of Development Economics*, *22*(1), 384-403.

Gunnarsson, M. V., & Jafarov, M. E. (2008). *Government Spending on Health Care and Education in Croatia: Efficiency and Reform Options* (No. 2008/136). International Monetary Fund.

Gupta, S., & Verhoeven, M. (2001). The efficiency of government expenditure: experiences from Africa. *Journal of policy modeling*, *23*(4), 433-467.

Hadad, S., Hadad, Y., & Simon-Tuval, T. (2013). Determinants of healthcare system's efficiency in OECD countries. *The European journal of health economics*, *14*, 253-265.

Han, H. W., & Miao, Y. Q. (2010). Calculation of local health expenditure efficiencies and empirical study on influencing factors: DEA-Tobit analysis based on panel data of 31 provinces in China. *J. Financ. Econ*, *5*, 4-15.

Hauner, D., & Kyobe, A. (2010). Determinants of government efficiency. *World Development*, *38*(11), 1527-1542.

Herrera, S., & Pang, G. (2005). *Efficiency of public spending in developing countries: an efficiency frontier approach* (Vol. 3645). World Bank Publications.

Hibatulmedina, S., & Rambe, R. A. (2022). The Efficiency Analysis of Government expenditure on education and Health in Sumatra: the DEA Approach. *Jurnal Ekonomi Pembangunan*, *19*(2), 223–232. https://doi.org/10.29259/jep.v19i2.15795

Hibatulmedina, S., & Rambe, R. A. (2022). The Efficiency Analysis of Government expenditure on education and Health in Sumatra: the DEA Approach. *Jurnal Ekonomi Pembangunan*, *19*(2), 223–232. https://doi.org/10.29259/jep.v19i2.15795

Hsu, Y. C. (2013). The efficiency of government spending on health: Evidence from Europe and Central Asia. *The Social Science Journal*, *50*(4), 665-673.

Indonesia Supreme Court. (2017). Decision of PN MAMUJU Number 18/Pid.Sus.TPK/2016/ PN.Mam Year 2017-Special Corruption Crime. https://putusan.mahkamahagung.go.id/putusan/d80e296f001621d02a8ca3a988 05dff1.

Javier, A. B. (2000). *New Politics and Governance in an Era of Decentralized Polity: the Local Government of The Philippines*. In "The Decentralization Training

Program for Trainers of the Indonesian Public Administration Agency" di GSID Nagoya University. 20 September-12 Oktober

Johnson, R. A. & Wichern, D. W. (2007). *Applied Multivariate Statistical Analysis*. Prentice Hall International: New Jersey.

Lavado, R. F., Lagrada, L. P., & Gozun, B. C. (2010). Using DEA to assess the efficiency of public health units in providing health care services. In *Applications in Multicriteria Decision Making, Data Envelopment Analysis, and Finance* (pp. 237-248). Emerald Group Publishing Limited.

Lewis, B. D. (2017). Local government form in Indonesia: tax, expenditure, and efficiency effects. *Studies in Comparative International Development*, *53*(1), 25–46. https://doi.org/10.1007/s12116-017-9236-z

Macintyre, S., Maciver, S., & Sooman, A. (1993). Area, class and health: should we be focusing on places or people?. *Journal of social policy*, *22*(2), 213-234.

Mangkoesubroto, G. (1991). *Ekonomi Publik* edisi Ketiga. Yogyakarta: BPFE.

Merini, D. (2013). *Analisis Efisiensi Pengeluaran pemerintah Sektor Publik: di Kawasan Asia Tenggara*. 1(2). Malang: Fakultas Ekonomi & Bisnis Universitas Brawijaya

Pertiwi, L. D. (2007). *Efisiensi Belanja Pemerintah Daerah di Provinsi Jawa Tengah*. Jurnal Ekonomi Pembangunan, 12(2), 123-139.

Prasetyo, A. D., Mulyono, N. B., & Nugroho, L. I. (2018). Local governments' expenditures efficiencies and determinants: the case of Indonesia. *International Journal of Trade and Global Markets*, *11*(3), 160-177.

Räty T, & Luoma K. (2005). *Nonparametric Country Rankings Using Indicators and OECD Health Data*. Valtion Taloudellinen Tutkimuskeskus, 74

Rayp, G., & Sijpe, N. V. D., (2007). Measuring and explaining government efficiency in developing countries. *The Journal of Development Studies*, *43*(2), 360-381.

Retzlaff-Roberts, D., Chang, C. F., & Rubin, R. M. (2004). Technical efficiency in the use of health care resources: a comparison of OECD countries. *Health policy*, *69*(1), 55-72.

Verhoeven, M., Gunnarsson, V., & Carcillo, S. (2007). Education and health in G7 countries: Achieving better outcomes with less spending. IMF Working Paper 07/263, (Washington: International Monetary Fund).

Wang, E.C, & Eskander, A. (2011). Relative efficiency of government spending and its determinants evidence from East Asian countries. Journal of Economic Literature, 35(3),1320-1346.

Yao, G. A. (2007). Fiscal decentralization and poverty reduction outcomes: Theory and evidence. Economics Dissertations. Department of Economics Georgio State Universityz

Appendix

Table 4. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Java Before Decentralization

No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Magelang	0.73	1	42	Kota Semarang	0.9	2
2	Sampang	0.77	1	43	Ngawi	0.9	2
3	Bondowoso	0.78	1	44	Batang	0.91	2
4	Jember	0.78	1	45	Blora	0.91	2
5	Probolinggo	0.78	1	46	Kota Bandung	0.91	2
6	Indramayu	0.79	1	47	Ponorogo	0.91	2
7	Bangkalan	0.8	1	48	Rembang	0.91	2
8	Pamekasan	0.81	1	49	Sragen	0.91	2
9	Banyuwangi	0.82	1	50	Wonosobo	0.91	2
10	Brebes	0.82	1	51	Grobogan	0.92	2
11	Sumenep	0.83	1	52	Kota Magelang	0.92	2
12	Lumajang	0.84	1	53	Kota Surakarta	0.92	2
13	Ciamis	0.85	1	54	Pekalongan	0.92	2
14	Lamongan	0.85	1	55	Temanggung	0.92	2
15	Situbondo	0.85	1	56	Jepara	0.93	2
16	Tegal	0.85	1	57	Klaten	0.93	2
17	Kota Yogyakarta	0.85	1	58	Kota Pekalongan	0.93	2
18	Bojonegoro	0.86	1	59	Kota Salatiga	0.93	2
19	Madiun	0.86	1	60	Kulon Progo	0.93	2
20	Majalengka	0.86	1	61	Mojokerto	0.93	2
21	Malang	0.86	1	62	Purbalingga	0.93	2
22	Sukabumi	0.86	1	63	Magetan	0.94	2
23	Cilacap	0.87	1	64	Purwakarta	0.94	2
24	Gresik	0.87	1	65	Trenggalek	0.94	2
25	Pemalang	0.87	1	66	Wonogiri	0.94	2
26	Banyumas	0.88	2	67	Kota Probolinggo	0.95	2
27	Kebumen	0.88	2	68	Semarang	0.95	2
28	Kota Malang	0.88	2	69	Kota Blitar	0.96	2
29	Kota Surabaya	0.88	2	70	Kota Bogor	0.96	2
30	Purworejo	0.88	2	71	Pacitan	0.96	2
31	Tuban	0.88	2	72	Pati	0.96	2
32	Demak	0.89	2	73	Kota Kediri	0.97	2
33	Kediri	0.89	2	74	Kota Madiun	0.97	2
34	Kota Sukabumi	0.89	2	75	Kota Tegal	0.97	2
35	Nganjuk	0.89	2	76	Sukoharjo	0.97	2
36	Sidoarjo	0.89	2	77	Sleman	0.98	2
37	Banjarnegara	0.9	2	78	Tulungagung	0.98	2
38	Jombang	0.9	2	79	Kota Tangerang	0	3
39	Karanganyar	0.9	2	80	Pandeglang	0	3
40	Kendal	0.9	2	81	Kota Serang	0	3
41	Kota Cirebon	0.9	2				

Table 6. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Java After Decentralization

No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Magelang	0.79	1	42	42	0.92	2
2	Probolinggo	0.8	1	43	43	0.92	2
3	Sampang	0.8	1	44	44	0.92	2
4	Bangkalan	0.82	1	45	45	0.92	2
5	Bondowoso	0.82	1	46	46	0.92	2
6	Jember	0.83	1	47	47	0.92	2
7	Pamekasan	0.83	1	48	48	0.92	3
8	Situbondo	0.83	1	49	49	0.92	3
9	Kota Bogor	0.84	1	50	50	0.93	3
10	Kota Serang	0.84	1	51	51	0.93	3
11	Sumenep	0.84	1	52	52	0.93	3
12	Kota Bandung	0.86	2	53	53	0.93	3
13	Kota Sukabumi	0.87	2	54	54	0.93	3
14	Lumajang	0.87	2	55	55	0.93	3
15	Banyuwangi	0.88	2	56	56	0.93	3
16	Bojonegoro	0.88	2	57	57	0.93	3
17	Brebes	0.88	2	58	58	0.93	3
18	Ciamis	0.88	2	59	59	0.93	3
19	Kota Cirebon	0.88	2	60	60	0.93	3
20	Sukabumi	0.88	2	61	61	0.94	3
21	Tuban	0.88	2	62	62	0.94	3
22	Indramayu	0.89	2	63	63	0.94	3
23	Kebumen	0.89	2	64	64	0.94	3
24	Lamongan	0.89	2	65	65	0.94	3
25	Majalengka	0.89	2	66	66	0.94	3
26	Malang	0.89	2	67	67	0.94	3
27	Kota Tangerang	0.9	2	68	68	0.94	3
28	Madiun	0.9	2	69	69	0.94	3
29	Nganjuk	0.9	2	70	70	0.95	3
30	Pandeglang	0.9	2	71	71	0.95	3
31	Pemalang	0.9	2	72	72	0.96	3
32	Tegal	0.9	2	73	73	0.96	3
33	Jombang	0.91	2	74	74	0.96	3
34	Kediri	0.91	2	75	75	0.96	3
35	Kota Surabaya	0.91	2	76	76	0.97	3
36	Ngawi	0.91	2	77	77	0.97	3
37	Ponorogo	0.91	2	78	78	0.98	3
38	Banjarnegara	0.92	2	79	79	0.98	3
39	Banyumas	0.92	2	80	80	0.99	3
40	Cilacap	0.92	2	81	81	0.99	3
41	Gresik	0.92	2				

Table 8. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Sumatera Before Decentralization

No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Ogan Komering Ilir	0.9	1	20	Lampung Utara	0.84	2
2	Karo	0.92	1	21	Dairi	0.85	2
3	Muara Enim	0.92	1	22	Kampar	0.85	2
4	Musi Banyuasin	0.92	1	23	Lahat	0.85	2
5	Aceh Tenggara	0.93	1	24	Musi Rawas	0.85	2
6	Bengkalis	0.94	1	25	Tapanuli Tengah	0.86	2
7	Tapanuli Utara	0.94	1	26	Kota Bandar Lampung	0.87	2
8	Simalungun	0.95	1	27	Langkat	0.87	2
9	Aceh Barat	0.97	1	28	Aceh Timur	0.88	2
10	Kota Pematang Siantar	0.97	1	29	Labuhan Batu	0.88	2
11	Kota Tebing Tinggi	0.97	1	30	Kota Palembang	0.88	2
12	Tapanuli Selatan	0.79	2	31	Sarolangun Bangko	0.88	2
13	Ogan Komering Ulu	0.82	2	32	Kota Sibolga	0.88	2
14	Lampung Selatan	0.83	2	33	Aceh Besar	0.89	2
15	Kota Medan	0.83	2	34	Aceh Tengah	0.89	2
16	Aceh Selatan	0.84	2	35	Aceh Utara	0.89	2
17	Asahan	0.84	2	36	Kota Tanjung Balai	0.89	2
18	Lampung Barat	0.84	2	37	Pulau Bangka	0	3
19	Lampung Tengah	0.84	2	38	Kota Batam	0	3

Table 10. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Sumatera After Decentralization

No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies / Cities	Average Efficiency	Cluster
1	Lahat	0.94	1	20	Lampung Tengah	0.89	2
2	Kota Tanjung Balai	0.94	1	21	Lampung Selatan	0.9	2
3	Kota Bandar Lampung	0.95	1	22	Kota Medan	0.9	2
4	Labuhan Batu	0.95	1	23	Aceh Tengah	0.91	2
5	Ogan Komering Ilir	0.95	1	24	Aceh Timur	0.91	2
6	Sarolangun Bangko	0.95	1	25	Aceh Utara	0.91	2
7	Kota Sibolga	0.96	1	26	Asahan	0.91	2
8	Muara Enim	0.97	1	27	Pulau Bangka	0.91	2
9	Kota Palembang	0.97	1	28	Lampung Barat	0.91	2
10	Karo	0.98	1	29	Aceh Besar	0.92	2
11	Musi Rawas	0.98	1	30	Aceh Tenggara	0.92	2
12	Kota Tebing Tinggi	0.98	1	31	Kampar	0.92	2
13	Musi Banyuasin	0.99	1	32	Lampung Utara	0.92	2
14	Bengkalis	1	1	33	Aceh Barat	0.93	2
15	Kota Pematang Siantar	1	1	34	Dairi	0.93	2
16	Simalungun	1	1	35	Langkat	0.93	2
17	Aceh Selatan	0.88	2	36	Tapanuli Tengah	0.93	2
18	Ogan Komering Ulu	0.88	2	37	Tapanuli Utara	0.93	2
19	Tapanuli Selatan	0.88	2	38	Kota Batam	0.64	3

Table 14. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Kalimantan After Decentralization

No.	Regencies / Cities	Average Efficiency	Cluster	No.	Regencies / Cities	Average Efficiency	Cluster
1	Barito Timur	0.91	1	11	Kota Balikpapan	0.95	1
2	Berau	0.91	1	12	Kotawaringin Barat	0.95	1
3	Kotawaringin Timur	0.91	1	13	Kota Samarinda	0.95	1
4	Murung Raya	0.91	1	14	Barito Utara	0.96	1
5	Kota Pontianak	0.91	1	15	Paser	0.97	1
6	Pulang Pisau	0.91	1	16	Kota Palangka Raya	0.98	1
7	Barito Selatan	0.93	1	17	Sambas	0.83	2
8	Kapuas	0.93	1	18	Kutai Kartanegara	0.89	2
9	Kapuas Hulu	0.94	1	19	Kota Banjar Baru	0.9	2
10	Sanggau	0.94	1	20	Tanah Laut	0.78	3

Table 12. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Kalimantan Before Decentralization

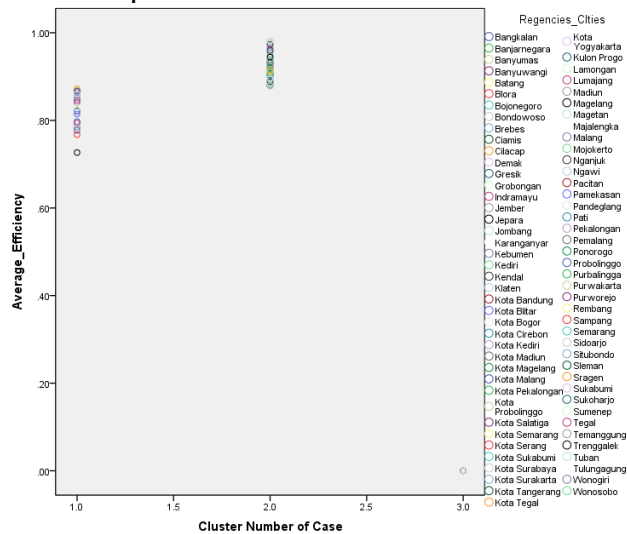| No.	Regencies / Cities	Average Efficiency	Cluster	No.	Regencies / Cities	Average Efficiency	Cluster
1	Sanggau	0.86	1	11	Murung Raya	0.89	1
2	Kota Banjar Baru	0.87	1	12	Kotawaringin Barat	0.91	1
3	Barito Selatan	0.87	1	13	Kota Balikpapan	0.92	1
4	Kota Pontianak	0.87	1	14	Paser	0.93	2
5	Kutai Kartanegara	0.88	1	15	Barito Utara	0.94	2
6	Pulang Pisau	0.88	1	16	Kapuas	0.95	2
7	Barito Timur	0.89	1	17	Kota Samarinda	0.96	2
8	Berau	0.89	1	18	Kota Palangka Raya	0.99	2
9	Kapuas Hulu	0.89	1	19	Tanah Laut	0.77	3
10	Kotawaringin Timur	0.89	1	20	Sambas	0.81	3

Table 16. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Sulawesi Before Decentralization

No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Donggala	0.81	1	18	Bulukumba	0.94	2
2	Poso	0.81	1	19	Gowa	0.94	2
3	Jeneponto	0.83	1	20	Minahasa Selatan	0.94	2
4	Banggai	0.86	1	21	Minahasa Utara	0.94	2
5	Bolaang Mongondow	0.88	1	22	Kota Tomohon	0.94	2
6	Selayar	0.88	1	23	Kepulauan Talaud	0.95	2
7	Minahasa	0.91	2	24	Soppeng	0.95	2
8	Pangkajene Dan Kepulauan	0.91	2	25	Luwu	0.96	2
9	Takalar	0.91	2	26	Luwu Timur	0.96	2
10	Barru	0.92	2	27	Luwu Utara	0.96	2
11	Bone	0.92	2	28	Kota Manado	0.96	2
12	Maros	0.92	2	29	Enrekang	0.97	2
13	Pinrang	0.92	2	30	Tana Toraja	0.97	2
14	Kota Bitung	0.93	2	31	Kota Makassar	1	2
15	Sinjai	0.93	2	32	Majene	0	3
16	Toraja Utara	0.93	2	33	Kota Mamuju	0	3
17	Bantaeng	0.94	2				

Table 18. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Sulawesi After Decentralization

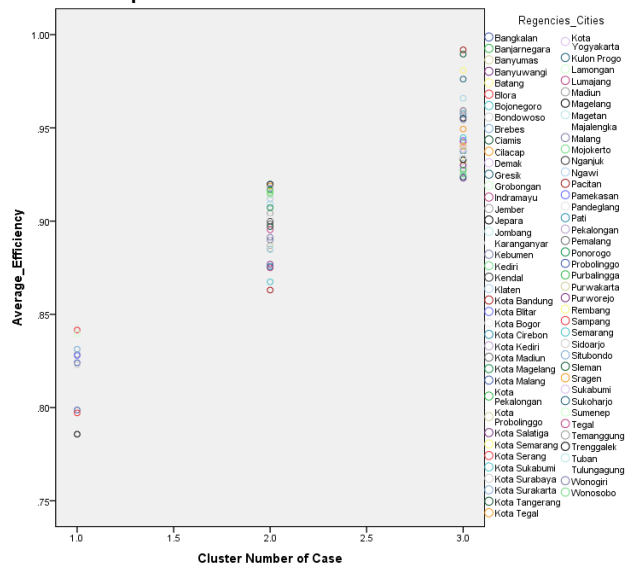| No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Donggala	0.86	1	18	Minahasa	0.96	2
2	Poso	0.86	1	19	Minahasa Utara	0.96	2
3	Banggai	0.9	1	20	Sinjai	0.96	2
4	Jeneponto	0.9	1	21	Soppeng	0.96	2
5	Pangkajene Dan Kepulauan	0.91	1	22	Kota Tomohon	0.96	2
6	Barru	0.92	1	23	Luwu Timur	0.97	2
7	Bone	0.93	2	24	Pinrang	0.97	2
8	Luwu Utara	0.93	2	25	Kepulauan Talaud	0.98	2
9	Kota Bitung	0.94	2	26	Luwu	0.98	2
10	Takalar	0.94	2	27	Kota Makassar	0.98	2
11	Bantaeng	0.95	2	28	Tana Toraja	0.98	2
12	Maros	0.95	2	29	Toraja Utara	0.98	2
13	Minahasa Selatan	0.95	2	30	Enrekang	0.99	2
14	Selayar	0.95	2	31	Gowa	0.99	2
15	Bolaang Mongondow	0.96	2	32	Majene	0.68	3
16	Bulukumba	0.96	2	33	Kota Mamuju	0.75	3
17	Kota Manado	0.96	2				

Table 20. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Bali and Nusa Tenggara Before Decentralization

No.	Regencies/Cities	Average Efficiency	Cluster	No.	Regencies/Cities	Average Efficiency	Cluster
1	Lombok Timur	0.75	1	11	Klungkung	0.99	2
2	Bima	0.78	1	12	Gianyar	1	2
3	Sumbawa	0.79	1	13	Manggarai	0.83	3
4	Sumba Timur	0.8	1	14	Belu	0.84	3
5	Badung	0.92	2	15	Lombok Barat	0.85	3
6	Karangasem	0.94	2	16	Buleleng	0.86	3
7	Bangli	0.95	2	17	Flores Timur	0.86	3
8	Kota Denpasar	0.95	2	18	Sikka	0.86	3
9	Jembrana	0.97	2	19	Ende	0.87	3
10	Tabanan	0.97	2	20	Timor Tengah Utara	0.87	3

Table 22. Classification of Regencies and Cities Based on Average Efficiency of Government Expenditure on Health in Bali and Nusa Tenggara After Decentralization

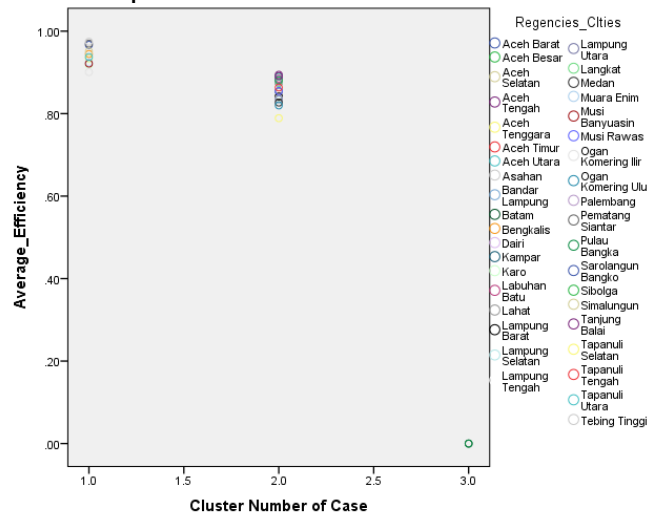| No.	Regencies/ Cities	Average Efficiency	Cluster	No.	Regencies/ Cities	Average Efficiency	Cluster
1	Karangasem	0.93	1	11	Lombok Timur	0.82	2
2	Bangli	0.94	1	12	Sumbawa	0.82	2
3	Sikka	0.94	1	13	Bima	0.83	2
4	Timor Tengah Utara	0.94	1	14	Sumba Timur	0.84	2
5	Badung	0.95	1	15	Ende	0.89	3
6	Flores Timur	0.96	1	16	Belu	0.9	3
7	Gianyar	0.96	1	17	Lombok Barat	0.9	3
8	Tabanan	0.96	1	18	Buleleng	0.91	3
9	Kota Denpasar	0.97	1	19	Klungkung	0.91	3
10	Jembrana	0.97	1	20	Manggarai	0.91	3

Appendix M: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Java Before Decentralization
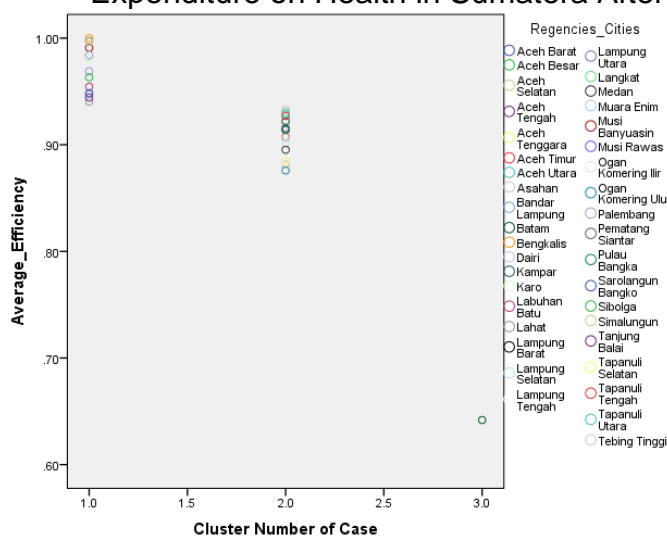

Appendix N: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Java After Decentralization
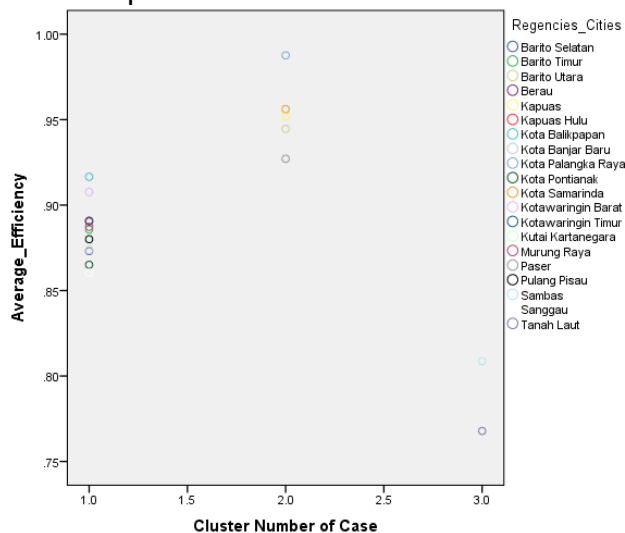

Appendix O: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Sumatera Before Decentralization
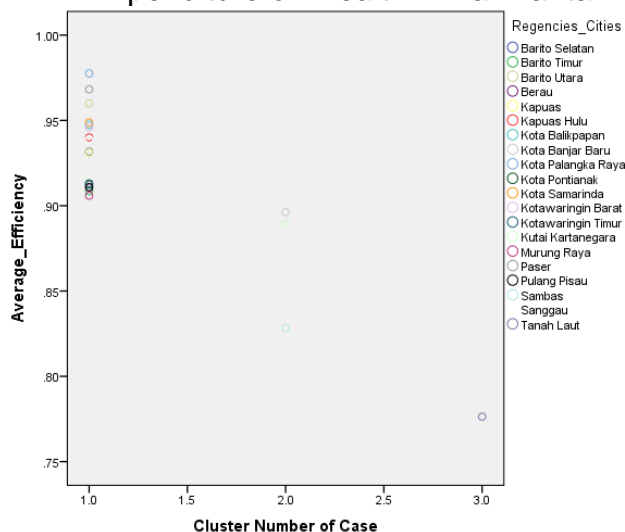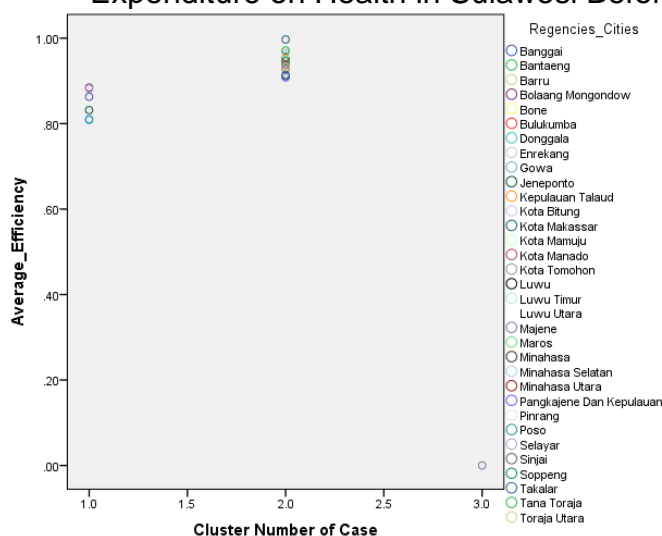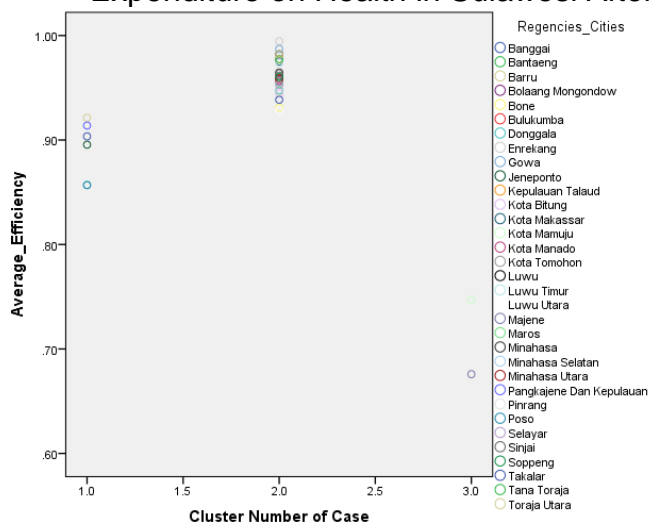
Appendix P: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Sumatera After Decentralization

Appendix Q: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Kalimantan Before Decentralization

Appendix R: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Kalimantan After Decentralization
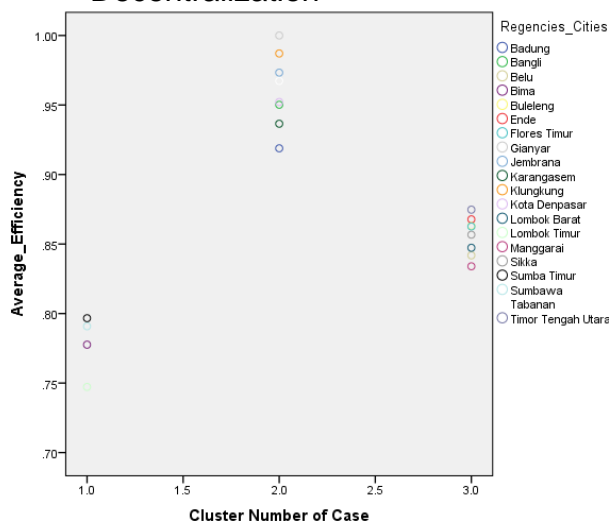
Appendix S: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Sulawesi Before Decentralization
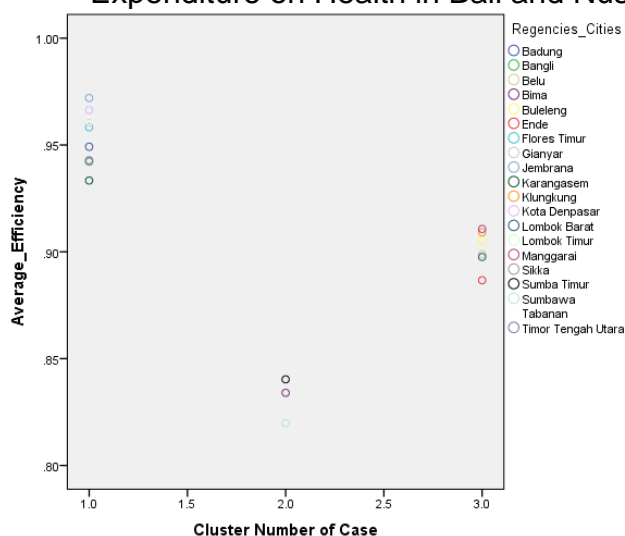

Appendix T: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Sulawesi After Decentralization
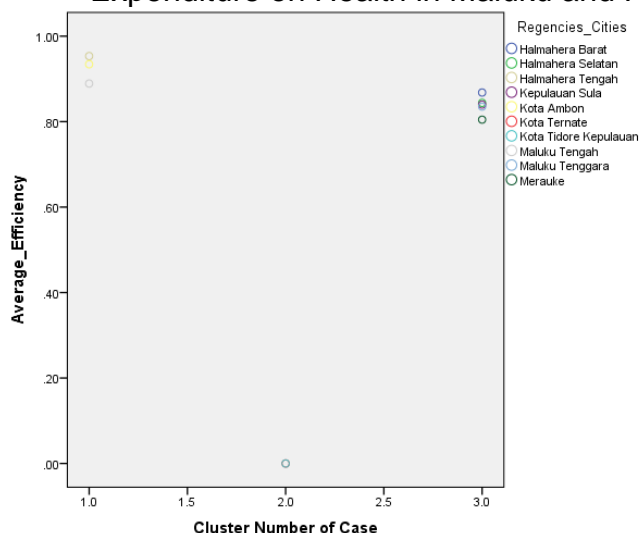

Appendix U: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Bali and Nusa Tenggara Before Decentralization

Appendix V: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Bali and Nusa Tenggara After Decentralization

Appendix W: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Maluku and Papua Before Decentralization

Appendix X: Scatterplot of Classification Average Efficiency of Government Expenditure on Health in Maluku and Papua After Decentralization