Climate Change and Fiscal Response: Analysis of Regional Expenditure in Java Island

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ABSTRACT

This study investigates the impact of climate change on regional fiscal policy in Java, Indonesia, focusing on how temperature and rainfall changes influence fiscal spending. Using secondary data from the ERA5 Satellite (2008–2020) and fiscal data from the Directorate General of Fiscal Balance (Direktorat Jenderal Perimbangan Keuangan/DJPK), this research examines 113 districts/cities on Java Island. Climate change indicators—average temperature and rainfall—serve as independent variables, while regional fiscal spending on climate-related initiatives is the dependent variable. Panel data analysis is conducted using three regression models: common effect (OLS), fixed effect, and random effect models, with the Chow and Hausmann tests to identify the most appropriate model. Results indicate a positive relationship between climate change (temperature and rainfall) and increased fiscal spending for climate adaptation and mitigation. The findings support the hypothesis that regions with higher temperatures and increased rainfall experience greater climate-related fiscal spending, highlighting the urgency for such measures in areas farther from the equator.

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***Keywords**: Climate Change, Panel Data, Public Spending, Regional Fiscal*

ABSTRAK

Studi ini mengkaji dampak perubahan iklim terhadap kebijakan fiskal daerah di Jawa, Indonesia, dengan fokus pada bagaimana perubahan suhu dan curah hujan memengaruhi belanja fiskal. Dengan menggunakan data sekunder dari Satelit ERA5 (2008–2020) dan data fiskal dari Direktorat Jenderal Perimbangan Keuangan (DJPK), penelitian ini mengkaji 113 kabupaten/kota di Pulau Jawa. Indikator perubahan iklim—suhu dan curah hujan rata-rata berfungsi sebagai variabel independen, sedangkan belanja fiskal daerah untuk inisiatif terkait iklim merupakan variabel dependen. Analisis data panel dilakukan dengan menggunakan tiga model regresi: model efek umum (OLS), efek tetap, dan efek acak, dengan uji Chow dan Hausmann untuk mengidentifikasi model yang paling tepat. Hasilnya menunjukkan hubungan positif antara perubahan iklim (suhu dan curah hujan) dan peningkatan belanja fiskal untuk adaptasi dan mitigasi iklim. Temuan tersebut mendukung hipotesis bahwa daerah dengan suhu yang lebih tinggi dan peningkatan curah hujan mengalami belanja fiskal terkait iklim yang lebih besar, yang menyoroti urgensi untuk langkah-langkah tersebut di daerah yang lebih jauh dari khatulistiwa.

***Kata kunci**: Belanja Publik, Data Panel, Fiskal Daerah, Perubahan Iklim*

INTRODUCTION

Climate change has become one of the most pressing global issues in recent decades. Its impacts are not only limited to the environment but also extend to various economic, social, and social welfare sectors. According to the World Bank (2021), climate change is a 'silent killer' for a country's economic growth and sustainable development. Meanwhile, Zivin et al. (2018) stated that climate change can affect a country's GDP and economic growth. Furthermore, in the fiscal context, climate change also puts pressure on state revenues and income (Perry & Ciscar, 2014; Aaheim et al., 2012). The World Meteorological Organization (WMO) in 2020 conceptualized climate change as a climate

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phenomenon caused by global warming due to increasing concentrations of greenhouse gases in the atmosphere. Climate change causes the start of the rainy season to be delayed, while the end of the rainy season will be earlier, and the dry season will be longer. Changes in the season period have implications for increasing extreme weather which results in an increase in the frequency and intensity of disasters, especially hydrometeorological disasters such as floods, landslides, abrasion and others.

The context of Indonesia, climate change has significant implications, given the country's geographic vulnerability to various natural disasters such as floods, droughts, and extreme weather. Hydrometeorological disasters such as land and forest fires, floods that can be accompanied by landslides, rising sea levels that increase high tides and abrasion, and extreme sea waves in all districts in Indonesia from 2010 to 2018 have increased and dominated and may increase in frequency due to the influence of climate change. The Asian Development Bank (ADB) estimates that by 2021, the impact of climate change could cost 2.5 - 7% of the country's gross domestic product (GDP), with the poorest and most marginalized communities likely to experience significant losses and damage due to the impacts of climate change (World Bank, 2021). In these conditions, climate change will put pressure on the economic conditions, especially the fiscal conditions of a region.

The literature on the impact of climate change on government budgets and its fiscal implications is relatively new. The impact of climate change on fiscal varies from country to country. Bachner & Bednar-Friedl (2019) study found that the more developed a country is, the less the increase in temperature and extreme weather affects the country's fiscal. Furthermore, Unterberger (2018) found that climate change causes a decrease in revenue and an increase in government spending in developing countries. On the revenue side, the impact of climate change depends on a country's main revenue sector and human resources. Climate change will greatly affect the revenue of developing countries whose main sources of revenue come from the agriculture, fisheries, and tourism sectors (Cinner et al., 2022). Countries with advanced economies generally have human resources that are responsive to climate change so that the number of victims affected will be fewer than the number of victims in developing countries (Lis & Nickel, 2010). Meanwhile, on the spending side, the impact of climate change depends on the climate change adaptation technology used and the climate change impact funding system. Countries with advanced disaster and climate change response technology such as the United States, the increase in spending is only significant for program spending types such as social assistance spending and is not significant for capital spending types (Miao et al., 2018). Developed countries generally have good climate change funding systems such as disaster insurance or Catastrophic Bonds (CAT bonds) in America (Lehtonen et al., 2019). Both of these play an important role in reducing the impact of climate change on fiscal in developed countries.

Java Island, as the center of the economy and the largest population in Indonesia, faces more complex challenges related to the impact of climate change on the socio-economic and fiscal dynamics of the government. In addition to functioning as the center of the Indonesian government in Jakarta, Java Island also has a very large population and is a significant economic area (Hidayat et al., 2016). This island is the center of most industrial, agricultural, and trade activities in Indonesia. In addition, as the center of government, more advanced infrastructure, and high population concentration, Java has a fairly large fiscal burden, both in terms of expenditure allocation and disaster risk management. With the development of the industrial sector and population growth, this condition has the potential to have an impact on the environment, both directly and indirectly, including the risk of climate change in Java. According to Marjuki et al. (2016), in this context, climate variability such as air temperature related to rainfall is an important factor to explore, because it can affect economic growth and agricultural production, especially in Java. The increasingly complex environmental problems have implications for the role of understanding how climate change affects fiscal in Java Island becoming increasingly important to formulate into effective and sustainable policies.

The study of the impact of climate change on the economy at the disaggregated level (region) has become an important issue of mainstream research, by conducting climate research in Indonesia using weather station data to elaborate on the impact of temperature changes on GRDP in 5 provinces (Priyanto, 2021). However, in-depth research on the impact of climate change on fiscal is still lacking. The use of fiscal parameters will be more specific in providing direction based on which sectors are affected (Akram, 2013; Sangkhaphan & Shu, 2019). Therefore, more in-depth research is needed on climate change as portrayed through changes in temperature and rainfall. Based on the urgency and relevance above, this study will examine the impact of climate change on regional fiscal in Java.

LITERATURE REVIEW

Research related to the impact of climate change on fiscal conditions has been conducted with various types of data and study loci. Lis & Nickel (2010) and Acevedo et al. (2020) conducted studies using aggregate data in various developed and developing countries. The results of the two studies are difficult to compare because Acevedo et al. (2020), used the dependent variable of GDP per capita policy. While Lis & Nickel (2010) used the dependent variable of the debt to GDP ratio. However, both concluded that the negative impacts of climate change will be felt more by developing countries due to poor macroeconomic conditions and poverty and higher levels of income inequality. Yang & Tang (2022) and Qi et al. (2024) have conducted research with disaggregated data. Both studies aim to see the impact of climate change on the fiscal conditions of local governments in China and use temperature as an independent variable. The results of both studies show that climate change can increase local government spending in the social and health sectors and reduce income, especially in the agricultural sector.

Climate change can also affect central government policies in terms of regional transfer spending. Qi et al. (2024) found that there is a significant relationship between temperature increases and increases in regional transfer spending in the health and social security sectors. The authors used the average daily temperature as an independent variable and captured its impact on fiscal pressure. The unit of analysis was 1,828 counties/cities in China in the period 1995 to 2019. The results of this study are in line with the study conducted by Miao et al. (2018), although the area level and methods used in the two studies are different. This is justified by Yang & Tang (2022), with a wider area and both using the fixed effect method.

Regional governments in Indonesia, including the Java region, are mainstreaming budgeting to address climate change with the concept of Climate Budget Tagging (CBT), namely budget tagging at the central and regional levels related to climate change mitigation and adaptation efforts. The reference for implementing CBT in the regions is the regional budget tagging guideline book for climate change issued by the Ministry of Finance in 2019 (PK DPR, 2022). CBT uses spending parameters according to function to align and integrate regional government affairs and other elements with state spending, the classification of which is carried out according to function. This policy has been implemented relatively recently so that the understanding of the apparatus varies both between OPDs and between regions in carrying out tagging, understanding climate change, and even accepting new nomenclature.

In order to represent empirical conditions and theoretical frameworks, this study will use spending parameters by function with justification from previous literature related to the impact of climate change on related sectors (Musfitria et al., 2023; Alkatiri et al., 2023; Mukti & Isa, 2024). A study conducted by Yang & Tang (2022) used spending variables based on function to determine the effect of climate change on fiscal. The study also showed that rising temperatures had an effect on increasing local government spending on infrastructure, health, and environmental sectors. In their research, Qi et al. (2024) also found that climate change proxied by temperature fluctuations increased government spending in the health and social sectors. This is also justified by the findings of the DPR PK (2022) which showed that regions implementing the CBT program such as the

Surabaya City Government, Gorontalo Regency, Cirebon Regency, Gunung Kidul Regency, and Sumedang Regency marked spending based on environmental functions, health, social protection, and infrastructure as spending on climate change adaptation and mitigation. In these conditions, this study will use spending based on functions related to climate change, namely the environment, health, social protection, and infrastructure as fiscal parameters.

The geographical reality of a region also affects state/regional revenues and expenditures. According to Giovanis & Ozdamar (2022), regions located near the equator and with warm climates will experience a greater impact of climate change compared to Northern European and North American countries, resulting in an even greater destructive impact on fiscal. Qi et al. (2024) also found that areas located near the coast and in the lowlands will significantly affect the magnitude of the impact of climate change on fiscal conditions. This also shows that the area and latitude and longitude positions also affect temperature and rainfall. So this study will also use when these variables represent geographic indicators as control variables.

Demographic conditions also affect the impact of climate change on government revenue and spending. Giovanis & Ozdamar (2022) used population and population density as control variables in their estimation model. The study showed that both variables gave significant results. Leppänen et al. (2017) used the dependency ratio indicator through the number of non-productive population (under 20 years and over 65 years) as a control variable. The results of the study showed that there was a significant positive relationship between population density and government revenue. However, the dependency ratio variable showed insignificant results. This study was then designed to examine the impact of climate change as depicted through temperature and rainfall on regional fiscal spending in Java. This study uses disaggregated data at the district/city level and applies a fixed effect model to capture unobserved variations between units of analysis (districts/cities). The main variables in this study are temperature and rainfall, while the dependent variable is regional fiscal spending which includes infrastructure, environmental, social, and health spending. The control variables used in this study are GRDP, HDI, population density, area, latitude, longitude, and city dummy.

METHOD

This study is a quantitative study using secondary data from the ERA5 Satellite to capture climate change, as it has been proven to have high accuracy in various regions, including China, Africa, and Indonesia (Jiao et al., 2021; Steinkopf, 2022; Sitepu et al., 2023). The satellite data in this study covers the period 2008 to 2020 in 113 districts/cities in Java Island. The source of fiscal data comes from the Directorate General of Fiscal Balance (*Direktorat Jenderal Perimbangan Keuangan*/DJPK), Ministry of Finance, with the limitations of the law governing regional taxes and levies stipulated in 2009. To reduce bias in the types of taxes, the data starts from 2008. Due to the expansion of regions during the study period, the data used is unbalanced, but in the form of a panel, which is expected to provide more comprehensive information regarding the dynamics between regions and time. This study aims to examine the effect of climate change on regional fiscal in Java Island. The main independent variables are average temperature and rainfall that reflect climate change. The dependent variable analyzed is climate spending, with several additional control variables also taken into account. Based on the literature study, the relationship between climate change and fiscal is developed into two models based on the fiscal indicators used. This model shows that climate change as measured by temperature and rainfall can cause positive externalities in the form of increased climate-related fiscal spending in the regions. Panel data analysis uses three regression models: common effect (OLS), fixed effect, and random effect models, with the Chow and Hausmann test (Gujarati, 2009) to determine the best model. Classical assumptions, such as normality, multicollinearity, heteroscedasticity, and autocorrelation tests, are tested to ensure BLUE (Best Linear Unbiased Estimates) estimation results. Based on this test, it was found that both regression models did not have multicollinearity problems, but experienced

heteroscedasticity. Therefore, the regression model uses the robust standard error option. The research hypothesis states that temperature and rainfall have a positive relationship with regional fiscal spending, where an increase in both is assumed to increase climate-related fiscal spending.

RESULT

The data used in this study are 113 districts/cities in Java Island during the period 2008 to 2020. However, there are differences in the number of observations due to the expansion of several new districts/cities during the observed period, so that several variables derived from DJPK data are only available after the district/city is officially formed. Table 1 shows a descriptive summary of all variables used in this study, consisting of fiscal variables for each district/city in Java Island which are dependent variables, changes in temperature and rainfall as the main independent variables and several other variables used as controls.

Table 1. Descriptive Analysis

Variable	Mean	Std. Dev.	Min	Max
Temperature	24.897	1.745	18.91	27.843
Rainfall	2682.374	731.561	1361.977	5718.204
Accumulated Shopping	26.803	.739	20.714	29.281
IPM	69.929	5.431	54.49	86.65
PDRB (Million)	30.657	.89	28.252	33.649
Population density	2579.663	3320.819	268.958	15306.825
An area	1146.928	986.638	16.06	5782.4
longitude	110.136	2.225	105.75	114.333
latitude	-7.254	.546	-8.333	-6.017

the average temperature value of all regencies/cities in Java Island for the period 2008-2020 was 24.89 °C, where the lowest value was in Batu City at 18.91 in 2008, while the highest value was in Surabaya City at 27.84 °C in 2020. These values indicate a significant difference in temperature conditions between regencies/cities in Java Island. This is because Batu City is located around Malang, East Java Province as part of the highest plains area on Java Island, while Surabaya City from East Java Province is in an area with much lower plains and is an urban area. The average annual rainfall value is 2682.374 mm with the lowest value of 1361.977 mm owned by Sumenep Regency in 2009 and the highest of 5718.2039 mm owned by Banjarnegara Regency, Central Java Province in 2010. The variability of rainfall variable values indicates a significant difference related to the average rainfall that falls each year. So that differences also influence the difference in temperature and rainfall of regencies in Java Island in regional topography.

Accumulation of regional spending for sectors affected by climate change, namely the environment, protection, health, and infrastructure, is a parameter in measuring regional fiscal conditions. The nominal value uses the natural logarithm function so that data variation can be minimized and facilitate data analysis. The average nominal value of spending from all regencies/cities in Central Java for the period 2008-2020 if the logarithm value in the table above is converted to the original scale is 436,913,031,652 where the lowest value is owned by Subang City of 990,776,959 in 2016, while the highest value is owned by Surabaya City of 5,207,248,216,178 in 2020. These values show a significant difference in climate change spending in regencies/cities in Java.

To overcome the large variation between districts/cities in control variables such as GRDP value, the natural logarithm function is used. The lowest GRDP value was held by Banjar City in 2013 at 1,860,748,607,812 while the highest GRDP was held by Surabaya City, East Java Province in 2019 at 580,488,529,010,000. In addition, the population density variable which is measured based on the comparison between the population and the area per square kilometer of the district/city also shows significant variation. The lowest population density was held by Banyuwangi Regency in 2019 at

268,958, while the highest number was held by Cimahi City, West Java Province in 2017 at 15,306.9. This shows a significant difference in population density between regions. Furthermore, the HDI variable with the lowest value of 54.49 was owned by Sampang Regency in 2010, while the highest value was owned by Yogyakarta City in 2019 at 86.65. The low HDI value indicates the limitations of the community in compiling life decision-making options because the quality of life and cognitive level are still low in the area. In the context of climate change, it is important to ensure equal access to education, health, and the economy for the development of a better quality of life in the face of climate change.

Regression analysis was conducted to see the effect of climate change as proxy by temperature and rainfall on fiscal indicators by adding control variables in the form of HDI value, ln GRDP, Population Density, Area, latitude, longitude, and urban area. Testing of this panel data model uses two tests, namely the Chow test (Likelihood test ratio) to select the best model between FEM or Common Effect Model and the Hausman test to select the most appropriate FE or RE model for panel data estimation.

Table 2. Chow Test and Hausman Test Results

Test	Hypothesis	Prob.
Chow Test	$H0$: Common Effect	0.0000
	$H1$: Fixed Effect	
Hausman test	$H0$: Random Effect	0.0000
	$H1$: Fixed Effect	

In determining the best model between the two methods in the Chow Test, the F-restricted value found in the Fixed Effect estimation output is seen. F-restricted which shows a P-value (prob > F) smaller than alpha 0.05 will cause rejection of H0 for the common effect model and accept H1 for the Fixed Effect model. Meanwhile, to determine the best model between Fixed Effect and Random Effect, it can be seen based on the chi2 value in the Hausman test output. P-value (prob > chi2) smaller than alpha 0.05 will cause rejection of H0 for the Random Effect model and accept H1 for the Fixed Effect model. Based on the tests that have been carried out on the three regression models, it was obtained that the best model for this study is the Fixed Effect model. Another reason why the Fixed Effect model is considered the best model is because of the unique characteristics of each district/city that are different from other districts/cities, but tend to remain the same or do not change from year to year. Therefore, the Fixed Effect method has the advantage of overcoming the potential for unobserved variable bias by eliminating the influence of variables that do not change between years.

Regression analysis on the Model was conducted to see the effect of climate change measured by temperature and rainfall on government spending related to climate change. The results of the Model 1 estimation in the study are presented in Table 3 with a coefficient of determination (R2) value of 0.689. This can be interpreted that the use of independent variables in Model 1 is able to explain the variation of the dependent variable by 68.9%, while the rest is explained by other variables not included in the model. In addition, the results of the Model 1 estimation show that all variables, both the main independent variables and control variables other than urban areas, have a significant effect. The significance level of the Temperature variable is α <10% and rainfall is α <10%.

Table 3. Estimation Results of the Climate Change Impact Model on Fiscal

Variable	Results
Temperature	0.245***
	(0.0710)
Rainfall	-0.000133***
	(2.67e-05)
Population density	0.000136**
	(5.60e-05)
IPM	0.0379***
	(0.00642)
Ln PDRB	1.496***
	(0.0711)
An area	-5.04e-05
	(0.000257)
Latitude	0.261***
	(0.0564)
Longitude	0.0296**
	(0.0128)
Dummy City	-0.433**
	(0.189)
Constant	15.63***
	(1.785)
Observations	1460
R-squared	0.689
Robust standard errors in parentheses : p<0.01 (***), p<0.05 (**), p<0.1 (*)	

The positive coefficient value of temperature as the main independent variable indicates a positive relationship between changes in temperature and rainfall with fiscal spending on climate change. So, an increase of 1 point/degree of temperature will contribute to increasing government spending on climate, such as the environment, health, social protection, and infrastructure. A 1-degree increase in temperature will increase the nominal climate change spending by 24.5%. These results support the author's hypothesis that climate change has a positive relationship with fiscal spending. This shows that temperature has negative externalities in various sectors, thus contributing to increasing the number and severity of sick people, damaging the environment and infrastructure, and affecting people's consumption and income, which in turn will contribute to increasing fiscal spending on climate change. This is also in accordance with the results of research by Yang & Tang (2022) and Qi et al. (2024) that increasing temperature has a strong impact on increasing government spending on social, health, and environmental spending.

An interesting finding occurred in the rainfall component which actually contributed negatively to climate change-related spending. A 1 mm increase in rainfall will reduce the nominal climate change-related spending by 0.0133%. This is because rainfall fluctuations affect the environmental, health, social, and infrastructure sectors only in the short term. Increased rainfall will hamper agriculture in the short term but in the long term it will support agricultural production. In addition, the health and infrastructure sectors will only be significantly affected if the rainfall causes flooding. This is justified by research by Acevedo et al. (2020) which found that temperature fluctuations put pressure on the government's fiscal in the short and long term, while rainfall reduces fiscal pressure due to its limited influence.

The IPM variables for, Population Density, and GRDP used to see demographic and development conditions in Java Island also show a positive and significant relationship with fiscal spending, which means that achieving community welfare and quality of life also increases government spending related to climate change. This is based on the idea that limitations in education, economy, and health can hinder the community's ability to

participate in development and enjoy its benefits. The community is increasingly active in voicing demands to increase fiscal spending because the impacts of climate change are increasingly felt. Proactive climate change mitigation and adaptation strategies are more easily accelerated in areas with adequate human resources (Zivin et al., 2018). Low levels of education, health, and economy will reduce the community's capacity to adapt to climate change, thereby reducing the absorption of government spending. The positive relationship between the variables of community welfare and quality of life with fiscal spending related to climate change is also in accordance with previous research. As conducted by Miao et al. (2018) and Lehtonen et al. (2019) who found that the climate change funding system in developed countries is better than in developing countries, because the adaptive and responsive societies to climate change that developed countries have significantly influence the formulation of fiscal spending.

Population density also has a positive effect on climate change-related spending. Areas with dense populations are more vulnerable to climate change impacts, such as flooding, air pollution, and pressure on natural resources. This higher vulnerability encourages governments to invest more funds in mitigation and adaptation measures to protect populations and infrastructure. These results are in accordance with the findings of Karlsson & Ziebarth (2018) who found that high population density will result in increased environmental degradation and potential victims of climate disasters. In turn, this causes the government to have to increase the allocation of fiscal spending related to climate change. In addition, with a dense population, there is pressure from the public for the government to take more significant action on climate change, so that the allocation of spending for this sector increases. Thus, while increasing HDI reduces the need for climate spending due to a more independent society, increasing GRDP and population density encourage the government to increase spending in this sector to manage risks and protect the community (Qi et al., 2024).

Furthermore, increasing Gross Regional Domestic Product (GRDP) has a positive effect on climate change-related spending. Higher GRDP indicates better economic growth in a region. When the economy grows, the government has more resources and revenues that can be allocated to various sectors, including climate change. With more funds, the government can invest more in climate change mitigation and adaptation, such as climate-resilient infrastructure development and greening programs (Lehtonen et al., 2019). In addition, regions with high GRDP usually have a higher awareness of the impacts of climate change and the need to take proactive actions, which encourages greater allocation of funds to this sector.

The geography-related variables that have a significant influence are the positive coefficient for the longitude variable indicating that areas with higher longitude values (or further west) tend to allocate more funds for climate spending. This indicates that areas in western Java tend to allocate more funds for climate spending compared to areas in eastern Java. This is justified by a BMKG study in 2022, which found that in general the trend of increasing surface temperatures was higher in western and central Indonesia. So this increase in temperature causes an increase in fiscal spending to address the increasingly destructive impacts of climate change.

A positive latitude indicator means that areas with higher values (further from the equator) tend to experience hotter climates. This is because geographically the island of Java is located near the equator. Challenges such as extreme temperature increases are significant as in tropical regions in general. This justifies the findings of Giovanis & Ozdamar (2022) which state that areas located near the equator and with warm climates will experience greater impacts of climate change compared to Northern European and North American countries. Therefore, the government allocates less funds for climate change mitigation and adaptation in areas with higher latitudes, because the impacts of climate change that are further from the equator are less urgent or severe.

In other positions, there are insignificant variables, namely area and city dummy. Area does not reflect the actual need for climate change spending. Areas with large areas do not necessarily require greater spending on climate change issues if their populations are

relatively small or economic activities that support climate change are low. Cities and regencies have different spending priorities, but this is not always reflected in spending on climate change. Some cities may have strong environmental initiatives, while others do not, and the same can apply to regencies. This causes the effect of the city dummy variable to be insignificant due to policy heterogeneity. In addition, there are diverse regional characteristics ranging from large metropolitan cities to small cities. While large cities such as Surabaya are more affected by climate change and have special budgets, small cities such as Subang City do not focus too much on climate spending. This makes the effect of the city dummy less significant due to variations in the characteristics of cities in Java.

CONCLUSION

Analysis of climate change at the district/city level in Java Island and its impact on fiscal showed several important findings. Temperature and rainfall fluctuations in each region still vary, with some regions having values above the national average. This climate change has been shown to have a significant impact on regional budgets, especially in areas with high temperatures. Increasing temperature fluctuations tend to encourage greater spending on climate impact management, while increasing rainfall in the long term actually reduces the need for climate budgets because it supports the agriculture and irrigation sectors, allowing funds to be diverted to other priorities. Regional economic, geographic, and demographic factors also determine fiscal spending related to climate change. Regions with high levels of education, welfare, and health tend to have better commitments in climate-related spending. The government needs to pay more attention to areas with high population density, high poverty rates, and locations farther from the equator, because these areas face greater challenges in dealing with climate change. To overcome funding constraints, priority is needed on adaptation and mitigation programs, including special social assistance for lowland and hot climate areas. Disaster-resilient infrastructure development and transmigration-based regional planning are expected to help reduce population pressure in urban areas. Local governments also need to prioritize development that goes beyond economic growth goals to increase commitment to addressing climate change. Further research is recommended to consider additional factors that may influence climate change and fiscal, expand coverage to the village level, and use standard deviation parameters of temperature and rainfall for greater accuracy. In addition, a longer research period will provide deeper insights into the trend of the relationship between climate change and fiscal in Java.

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