Institutional and Economic Determinants of Ecological Fiscal Transfers in Indonesia

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ABSTRACT

This study investigates the determinants of ecological fiscal transfer (EFT) allocation by examining three key factors: local government size, biodiversity program diversity, and revenue sharing from natural resources. A purposive sampling method was employed, and the data were analyzed using multiple regression analysis. The research population comprises local governments in Indonesia that planned and implemented EFT initiatives, as recorded by the Directorate General of Fiscal Balance (DJPK) of the Ministry of Finance between 2021 and 2023. A total of 32 observations from eligible local governments were included in the final analysis. The empirical findings indicate that both local government size and revenue sharing from natural resources are positively associated with EFT allocations. Conversely, biodiversity program diversity exhibits a negative relationship with EFT allocation, suggesting potential inefficiencies or misalignments between program variety and fiscal transfer incentives.

Keywords: Ecological Fiscal Transfer; Size of Local Government; Biodiversity; Natural Resource Revenue Sharing

Faktor Determinan Ecological Fiscal Transfer di Indonesia

ABSTRAK

Penelitian ini bertujuan untuk mengetahui faktor determinan yang mempengaruhi pengalokasian ecological fiscal transfer antara lain ukuran pemerintah daerah, keragaman program biodiversitas dan pendapatan bagi hasil sumber daya alam. Metode pengambilan sampel menggunakan teknik purposive sampling dengan pengujian melalui analisis regresi berganda. Populasi penelitian ini adalah pemerintah daerah yang merencanakan dan melaksanakan ecological tramsfer fiscal yang tercatat pada DJPK Kemenkeu tahun 2021 – 2023 dengan sampel analisis sebanyak 32 data yang menerapkan dan merencanakan ecological fiscal transfer. Hasil dari penelitian ini yaitu ukuran pemerintah daerah dan pendapatan bagi hasil sumber daya alam berpengaruh positif terhadap ecological fiscal transfer, sedangkan keragaman program biodiversitas berpengaruh negatif terhadap ecological fiscal transfer

Kata Kunci: *Ecological Fiscal Transfer*; Ukuran Pemerintah Daerah; Biodiversitas; Pendapatan Bagi Hasil

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INTRODUCTION

Climate change has led to a marked deterioration in environmental quality globally (Desdiani et al., 2021). In 2023, Indonesia recorded its highest-ever surface temperature at 38°C (Herlambang, 2025). Over the past three years, the frequency of natural disasters in Indonesia has increased significantly—from 3,402 incidents in 2021 to 14,346 in 2023—with floods, hurricanes, landslides, and forest fires among the most common (PDSI et al., 2024).

Among these, forest fires have emerged as a critical environmental issue requiring concerted government and public intervention. These fires are driven by prolonged dry seasons and intentional deforestation practices (Iqbal, 2022). In 2023, global forest fire coverage reached 399.9 million hectares (Samborska & Hannah, 2024), with Indonesia contributing approximately 0.29%—equivalent to 1.16 million hectares. This marks a substantial increase from 204,894 hectares recorded in 2022 (Sipongi, 2024).

The ecological consequences of forest fires are severe, including biodiversity loss and ecosystem degradation, particularly through air and water pollution (National Geographic Indonesia). In response, the Indonesian government enacted Law PMK No. 216/PMK.07/2021 concerning the Use, Monitoring, and Evaluation of Funds from Forest Natural Resource Revenue Sharing and Reforestation Funds (JDIH Kemenkeu). This regulation reflects a broader commitment to climate change mitigation and adaptation.

In 2019, the national budget for climate-related mitigation and adaptation reached IDR 4.52 trillion. Of this, 66% was sourced from private and international contributions, while the remaining 34% came from the ecological fiscal transfer (EFT) budget (Desdiani et al., 2021). The EFT policy is designed to strengthen fiscal relations and environmental governance between the central and local governments, particularly in managing biodiversity and ecosystem services (Halimatussadiah et al., 2021).

Table 1. Application EFT in the World

Country	Year Implementation	Indicator	Source of Funds
Portugal	2007	Protected Areas	Government Budget
France	2007	Land areas that are strictly protected	Government Budget
China	2012	Water quality	Government and Regional Budget
India	2015	Dense forest area	State Tax
Indonesia (Kalimantan Utara)	2019	Forest fires, water quality, air quality, waste management and open space index	Government Budget (DAU)
Brasil (Alagoas)	2020	Biodiversity Diversity	Tax State

Source: Busch et al., (2021); Droste et al., (2016)

Table 1 highlights the critical role of government in facilitating the distribution of ecological fiscal transfers at the regional level. The timely implementation of these transfers enhances the effectiveness of environmental quality management, particularly when aligned with relevant ecological indicators (Busch et al., 2021). In Indonesia, the allocation of ecological fiscal transfers has shown annual variation, with a discernible upward trend in distribution over recent years (Desdiani et al., 2021). This increase is illustrated in Table 2 below.

Tabel 2. Implementation EFT in Indonesia

Year	Budget (Thousand rupiah)
2021	14,051,100,000
2022	14,109,200,000
2023	14,100,000,000

Source: Kementrian Keuangan, 2023

Table 1 illustrates the pivotal role of government in distributing environmental fiscal transfers at the regional level. The more rapidly these transfers are implemented, the greater their impact on optimizing environmental quality management, particularly when aligned with appropriate ecological indicators (Busch et al., 2021). To ensure the success of this mechanism, collaboration between central and regional governments is essential—not only to guarantee an equitable allocation of ecological fiscal transfers, but also to mitigate potential misuse or fraud that could undermine stakeholder trust (Nevi Costari & Putri Ariella Belinda, 2021). This aligns with the theory of budget rationality, which emphasizes mutual interests and cooperation in pursuit of shared objectives (Coleman, 1990).

Despite the growing relevance of ecological fiscal transfers, previous research has left certain gaps, particularly in understanding their determining factors. Ecological fiscal transfer policies are designed to enhance both biodiversity conservation and environmental governance (Halimatussadiah et al., 2021). Among the critical determinants influencing allocation is the size of local governments.

Local government size, often measured by geographical extent and administrative scope, plays a significant role in determining fiscal needs. Larger regions with extensive protected areas typically require more substantial budgets for environmental management (Droste et al., 2016). Consequently, the size of a local government correlates positively with the allocation of ecological fiscal transfers (Martinez-Vazquez & Timofeev, 2009). Wang (2022) also emphasizes that larger jurisdictions tend to utilize such transfers to support environmental protection more extensively.

International best practices support this notion. Jurisdictions with higher proportions of protected areas relative to critical land zones tend to receive greater ecological fiscal allocations. This policy approach not only incentivizes regional efforts in forest and biodiversity conservation (Haryanto, 2015), but also supports

broader objectives of interregional fiscal equity (Aditiya & Dirgantari, 2017). Thus, the larger the protected area, the greater the ecological fiscal transfer received (Haryanto, 2015; Busch et al., 2021).

These observations align with the theory of fiscal rationality, which posits that larger protected areas necessitate more strategic budget allocation to ensure environmental quality improvements (Canavire-bacarreza et al., 2019). Empirical studies by Desdiani et al., (2021) and Eisenack, (2024) have further confirmed a positive association between local government size and ecological fiscal transfer. Based on this, the first hypothesis is formulated as follows:

H_1: The size of local government has a positive effect on ecological fiscal transfer.

In addition to size, biodiversity program diversity also emerges as a critical determinant. Ecological fiscal transfers encourage local governments to implement a range of biodiversity programs to attract external funding and investment. Such partnerships not only finance conservation initiatives, but also increase central government revenues through expanded tax bases (Haryanto, 2016); (Kusbandiyah et al., 2022).

Diversity in biodiversity programs is often used as a criterion for ecological fiscal transfer eligibility at both national and international levels. It reflects the extent of local commitment to conservation efforts, including initiatives such as reforestation and coral reef restoration (Busch et al., 2021; Köllner et al., 2002; Lima de Paulo & Camões, 2019). According to the budgetary rationality framework, greater program diversity demands stronger resource allocation and efficient management from governments to maximize ecological and financial outcomes (Gu et al., 2022).

However, the relationship is complex. While several studies (Busch et al., 2021; Gu et al., 2022; Desdiani et al., 2021) confirm a positive impact of biodiversity program diversity on fiscal allocations, others present contrasting findings. Köllner et al., (2002) noted a positive association in Switzerland, where greater program diversity facilitated more targeted fiscal allocation. Conversely, Santos Rui et al., (2012), in their study of Portugal, and Busch & Mukherjee, (2018) in Brazil, reported negative impacts due to poor biodiversity identification and increased transaction costs. These discrepancies highlight the need for effective program evaluation and clear implementation standards. Based on this, the second hypothesis is proposed:

H_2: Biodiversity program diversity has a positive effect on ecological fiscal transfer.

Beyond programmatic efforts, revenue sharing from natural resources also significantly affects ecological fiscal transfer. In many regions, particularly those with expansive land areas and limited private investment, fiscal support from resource revenues becomes crucial for funding environmental management (Tianawati, 2022; Mumbunan et al., 2012). However, regions with high natural resource income may simultaneously experience environmental degradation due to insufficient safeguards. As such, these regions may require additional ecological fiscal transfers to offset environmental costs (Mumbunan et al., 2012).

Within the framework of fiscal rationality, revenue sharing serves to align ecological fiscal transfer allocations with environmental performance, ensuring that resource-rich regions also invest in protection measures Droste et al., (2016).

This is supported by empirical evidence from Dougherty & Montes, (2023) and Tianawati, (2022), who found a positive relationship between natural resource revenue sharing and ecological fiscal transfers. Accordingly, the third hypothesis is formulated as follows:

H_3: Revenue sharing from natural resources has a positive effect on ecological fiscal transfer.

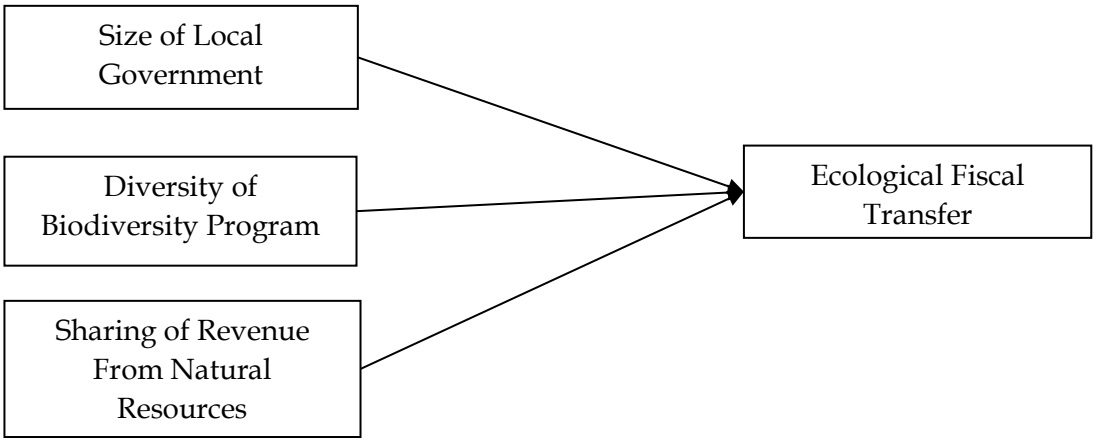

Figure 1. Research Model

RESEARCH METHOD

This study employs a quantitative research design, using secondary data sourced from official local government reports. Multiple regression analysis was applied as the primary analytical technique to investigate the relationship between key independent variables and ecological fiscal transfer. The focus of the analysis is on regional governments that have implemented ecological fiscal transfer mechanisms during the period of study.

Purposive sampling was used to identify relevant cases, based on two key criteria. First, the sample includes regional governments that received ecological fiscal transfers between 2021 and 2023, as documented by the Directorate-General of Fiscal Balance (Direktorat Jenderal Perimbangan Keuangan – DJPK). Second, it includes regional governments that implemented or had plans to implement ecological fiscal transfer initiatives during the same period, as recorded by The Asia Foundation (TAF). This sampling strategy ensures that the selected regions reflect actual engagement with ecological fiscal policies.

In measuring ecological fiscal transfer, this study uses forestry-sector revenue-sharing funds as a proxy. These revenue-sharing mechanisms represent a form of fiscal decentralization aimed at supporting local environmental management efforts. The allocation of such funds reflects the central government's commitment to enabling regional governments to undertake environmental protection and conservation activities. Previous research indicates that these transfers play a strategic role in promoting ecological outcomes by providing fiscal incentives at the subnational level (Ridwan & Fitriyani, 2022).

To operationalize the ecological fiscal transfer variable, the study relies on official data from the DJPK, which specifies the total amount of forestry-based revenue-sharing received by each local government annually. This metric captures

the financial capacity allocated to local governments specifically for environmental governance purposes and serves as a robust indicator of ecological fiscal transfer implementation during the observed period, as follows:

$$\text{Ecological Fiscal Transfer} = 80\% \times \text{Regional Section} \times \left(\frac{\text{PNBP SDA Certain Area}}{\text{Total PNBP National}}\right) \quad \text{.....(1)}$$

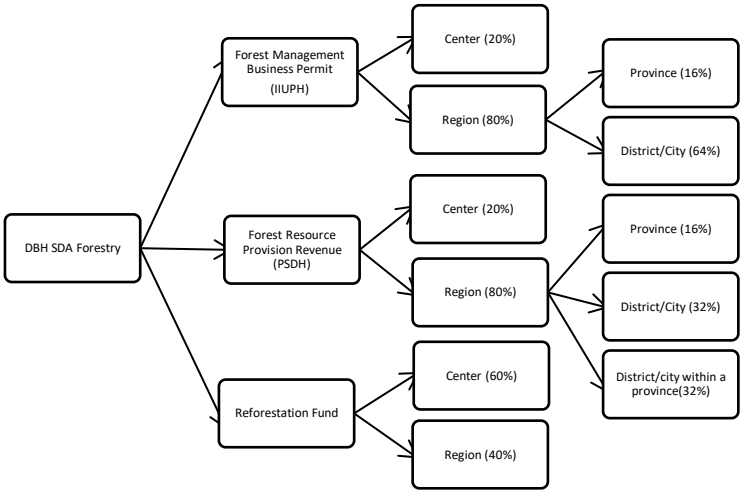

Figure 2. DBH Natural Resources Forestry Sector Mechanism

Source: (Manurung, 2019)

Figure 2 presents the allocation mechanism for the Revenue Sharing Fund for Natural Resources (Dana Bagi Hasil Sumber Daya Alam – DBH-SDA) in the forestry sector. The DBH-SDA comprises three principal components: business permits for forest utilization (Izin Usaha Pemanfaatan Hasil Hutan – IIUPH), resource provision revenue (Provisi Sumber Daya Hutan – PSDH), and reforestation funds. These components are derived from non-tax state revenues (Penerimaan Negara Bukan Pajak – PNBP) associated with forestry activities (Manurung, 2019). The IIUPH serves a regulatory function, determining regional forestry contributions in line with existing legal frameworks, particularly those related to forest conservation and protection (Aronggear & Ungirwalu, 2021). The PSDH contributes directly to regional revenue through the redistribution of non-tax proceeds from the exploitation of forest resources (Palapessy et al., 2024). Meanwhile, reforestation funds are earmarked specifically for the rehabilitation of degraded forest areas. These components are governed under Law No. 33 of 2004 concerning Fiscal Balance between the Central and Regional Governments, Law No. 9 of 2018 on Non-Tax State Revenues, and Government Regulation No. 55 of 2005 regarding Fiscal Equalization (Manurung, 2019).

In this study, the size of the local government is proxied by the extent of protected areas under its jurisdiction. Protected area coverage is regarded as a reliable indicator of a region's environmental management responsibility, and by extension, its fiscal needs. Furthermore, the proportion of protected land is often used as a correction factor for unreported or underreported conservation efforts due to data limitations (Visconti et al., 2013). The size of the protected area is

measured using the method proposed by Visconti et al., (2013), which allows for a consistent evaluation of spatial environmental governance across jurisdictions.

$$\text{Conservation Area} = \frac{\text{Protected Land Area} + \text{Total Land Area of OECM}}{\text{Total Land Area}} \quad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The conservation area refers to the total extent of land and water formally protected by the government for the purpose of biodiversity conservation, measured in hectares (Pemerintah Indonesia, 1990). These areas are critical for maintaining ecological integrity and supporting conservation initiatives.

The protected land area comprises all terrestrial regions designated as scientific reserves or protected zones by national authorities. These designations are based on ecological importance and are recognized in national-level conservation planning (WCMC, 2024).

The total land area under Other Effective Area-Based Conservation Measures (OECMs) includes geographically defined spaces that, while not legally protected, are recognized for delivering conservation outcomes. These areas often encompass coastal zones, small islands, offshore waters, and deep-sea environments and function as complementary spaces to formal protected areas (Kehutanan, 2023).

The total land area of a region refers to its full territorial expanse, expressed in hectares or square kilometers, and excludes inland water bodies, continental shelves, and exclusive economic zones (Badan Informasi Geospasial, 2021). This measurement provides a baseline for assessing environmental and spatial policy interventions across jurisdictions.

The diversity of biodiversity programs is measured using the area of forests and water bodies (in hectares) within a region that are identified as supporting high biodiversity value. This assessment is based on program performance indicators (Indikator Kinerja Program – IKP) established by the Directorate General of Natural Resources and Ecosystem Conservation (Direktorat Jenderal KSDAE). Biodiversity program diversity is categorized into two major domains: terrestrial and aquatic ecosystems. These domains interact dynamically to influence ecological balance, habitat quality, and environmental productivity within a region (Matatula, 2024).

The level of biodiversity program diversity is calculated using the formula provided by the relevant regulatory commission (Commision, 2024). This metric serves as a proxy to assess regional commitment to biodiversity conservation and is incorporated as an explanatory variable in the ecological fiscal transfer analysis.

$$\text{Biodiversity Program Diversity} = \frac{\text{Forest and Water Area (Ha)}}{\text{IKP Achievement}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

The variable measuring revenue sharing from natural resources is operationalized using the total amount of natural resource revenue sharing funds (Dana Bagi Hasil Sumber Daya Alam – DBH SDA) received by a region. This approach is adopted because DBH SDA reflects the financial contributions derived from a region's natural resource base, which are allocated to support regional development. Effective monitoring of these funds is crucial to minimizing risks of misuse or fraud, particularly in resource-rich regions where the stakes are high (Olivia, 2020). The measurement is expressed using the following formula, as adapted from Saputra et al., (2021):

Sharing of Revenue From Natural Resources = Total Region DBH SDA

To examine the relationship between the independent variables and the dependent variable—ecological fiscal transfer—this study employs multiple linear regression analysis. This method is chosen for its ability to model the simultaneous influence of several explanatory variables on a single outcome variable.

Hypothesis testing includes the coefficient of determination test (R^2), which evaluates the proportion of variance in the dependent variable explained by the independent variables, and the F-test, which assesses the overall significance and goodness-of-fit of the regression model. The general form of the regression equation used in this study is as follows:

$Y = \alpha + \beta 1UPD + \beta_2 KPB + \beta_3 PBHSDA + e$……(4)

Where:

Y = Ecological Fiscal Transfer
X_1 = Size of Local Government
X_2 = Biodiversity Program Diversity
X_3 = Sharing of Revenue From Natural Resources
α = Constant
β_1 β_2 β_3 = Coefficient

RESULTS AND DISCUSSION

This study focused on local governments that both planned and implemented ecological fiscal transfers, as documented by The Asia Foundation (TAF) during the 2021–2023 period. The initial sample consisted of 32 local governments, yielding a total of 96 observations. However, 35 data points were identified as outliers, characterized by extreme values significantly higher or lower than the remainder of the dataset. The presence of such outliers posed a risk of distorting the distribution and compromising the reliability of the statistical analysis. After excluding these observations, the final sample comprised 61 valid data points for use in the regression analysis.

Table 3. Descriptive Test Results

	N	Minimum	Maximum	Mean	Std. Deviation
Ecological Fiscal Transfer	61	0.02	447.20	32.42	78.85
Size of Local Government	61	0.01	45.33	12.76	12.52
Biodiversity Program Diversity	61	0.00	3.45	0.73	0.97
Sharing of Revenue From Natural Resources	61	14.65	19.53	16.62	1.40
Valid N (*listwise)*	61				

Source: Research Data, 2024

Based on the descriptive statistics presented above, the ecological fiscal transfer and biodiversity program diversity variables exhibit standard deviation values that exceed their respective means. This suggests a high degree of variability in the data, indicating significant differences in these variables across the observed local governments. In contrast, the variables representing the size of the local government and natural resource revenue sharing display standard deviations lower than their respective mean values. This indicates a more concentrated distribution, suggesting less variation among the observations for these two variables.

Table 4. Classical Assumption Test Results

	Criteria	Results	Conclusion
Normalitas (One Sample K-S Test)	Value sig > 0.05	Asymp. Sig (2-tailed) .176	The data is normally distributed.
Multikolinearitas	Value VIF ≤ 10 and ≥ 0.10	Size of Local Government = VIF 1.226 Biodiversity Program Diversity = VIF 1.147 Sharing of Revenue From Natural Resources = VIF 1.377	In this research. multicollinearity did not occur.
Heteroskedastisitas (Uji Park)	Value Sig. > 0.05	Size of Local Government Sig .758 Biodiversit Program Diversity Sig .558 Sharing of Revenue From Natural Resources Sig .606	In this research. heteroscedasticity did not occur.
Autokorelasi (Durbin-Watson)	du < dw < 4-du	du =1.6904 dw = 2.267 4-1.6904 = 2.3096 1.6904 < 2.267 < 2.3096	In this research. there was no positive or negative autocorrelation.

Source: Research Data, 2024

Table 5. Multiple Linear Regression Results

Model	Unstandardized Coefficients B	t	Sig.
(Constant)	-741.839	-7.071	0.000
Size of Local Government	1.427	2.188	0.033
Biodiversity Program Diversity	-17.774	-2.199	0.032
Sharing of Revenue From Natural Resources	46.256	7.487	0.000
Adjusted R Square	0.474		
Sig. F	0.000		

Source: Research Data, 2024

The regression equation is as follows:

Y = -741,839 + 1,427X1 – 17,774X2 + 46,256X3 + e……(5)

When all independent variables (local government size, biodiversity program diversity, and natural resource revenue sharing) are held at zero, the base level of ecological fiscal transfer is estimated at IDR 741,839. A one-hectare increase in local government size corresponds to an IDR 1,427 rise in ecological fiscal transfer. In contrast, each additional hectare of high-category biodiversity program diversity is associated with a decrease of IDR 17,774 in ecological fiscal transfer. Meanwhile, a one-rupiah increment in natural resource revenue sharing results in an increase of IDR 46,256 in ecological fiscal transfer.

Based on the regression results presented in Table 5, the coefficient for local government size is statistically significant (p = 0.033), confirming a positive effect on ecological fiscal transfer and supporting the first hypothesis (H1). This is consistent with prior studies suggesting that larger jurisdictions tend to receive greater ecological fiscal allocations, as they carry correspondingly higher

environmental management responsibilities (Droste et al., 2016; Schröter-Schlaack et al., 2014), aligning with the theory of budget rationality (Canavire-bacarreza et al., 2019).

Conversely, biodiversity program diversity exhibits a negative and significant coefficient ($p = 0.032$), indicating a negative effect on ecological fiscal transfer and leading to the rejection of the second hypothesis (H2). While ecosystem diversity typically enhances environmental quality through improved air and water cycles and habitat integrity (Soeprobowati et al., 2020), it may paradoxically reduce fiscal allocations when program diversity is not reflected in budget design or reporting. This issue is exacerbated by inconsistent measurement and limited infrastructure for biodiversity assessment, particularly in regions with complex geography, undermining the allocation system's responsiveness (Saputra et al., 2021). Supporting literature highlights how poorly aligned biodiversity assessments can result in cost overruns and inequitable fiscal distribution (de Paulo & Camões, 2020; Pramono et al., 2022).

Finally, the positive and highly significant coefficient on natural resource revenue sharing ($p < 0.001$) confirms a robust positive effect on ecological fiscal transfer, validating the third hypothesis (H3). This finding underscores the importance of compensatory mechanisms: regions endowed with abundant resources often experience greater ecological strain and therefore benefit from additional environmental funding (Siregar et al., 2021; Mumbunan et al., 2012). These allocations align well with the principles of budget rationality, supporting equitable and sustainable resource management (Droste et al., 2016).

Overall, the results indicate that local government size and natural resource revenue sharing increase the allocation of ecological fiscal transfers, while biodiversity program diversity, surprisingly, may reduce them. This paradox suggests the need for more targeted policy design that aligns fiscal transfers with ecological performance metrics to more accurately reflect environmental stewardship.

CONCLUSION

The findings of this study indicate that both the size of local government and the sharing of revenue from natural resources have a positive and significant influence on the allocation of ecological fiscal transfers. In contrast, biodiversity program diversity exhibits a negative effect on ecological fiscal transfer. A key limitation of this study lies in the restricted availability of data, as ecological fiscal transfer has not been uniformly implemented or planned across all regions in Indonesia. Consequently, the measurement approach for biodiversity program diversity may require refinement. Future research is encouraged to adopt alternative measurement frameworks that are more contextually relevant to Indonesia. Moreover, the inclusion of political will as a moderating variable may offer deeper insights by capturing institutional and governance dynamics that potentially mediate the relationship between ecological policy variables and fiscal outcomes.

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