

CLIMATE-RELATED DISASTERS AND PROVINCIAL CONTINGENCY BUDGET ADAPTATION IN INDONESIA

Alif Muhammad Fadli¹⁾, Anwar Sidiq²⁾

¹⁾Development Economics Study Program, Universitas Terbuka, Indonesia

²⁾Development Economics Study Program, Universitas Terbuka, Indonesia

Corresponding author: 049656976@ecampus.ut.ac.id

Abstract

This study examines whether Indonesian regional contingency budgets adapt to realised climate-related disaster experience, treating budget responsiveness as one dimension of fiscal resilience. A balanced province-year panel covering 32 provinces is estimated using fixed effects with standard errors clustered by province. The dependent variable is the budgeted share of contingency expenditure (Belanja Tidak Terduga/BTT) in total regional expenditure. The model relates the current BTT share to its one-year lag and to lagged frequencies of landslides, floods, droughts, forest fires, extreme-weather events, and coastal abrasion per 100,000 population. The results indicate that the model is statistically significant and explains a meaningful share of within-province variation in contingency budgeting. The lagged BTT share is positive and significant, showing that provincial allocations are strongly influenced by previous-year budgets. Flood and landslide frequencies also significantly increase the following year's contingency-budget share, while drought, forest fire, extreme weather, and coastal abrasion are not statistically significant. These findings suggest that provincial contingency budgeting is both incremental and selectively responsive to recurrent and visible hazards. However, event counts do not fully reflect hazard duration, affected area, casualties, infrastructure damage, or economic losses, and the dynamic fixed-effects estimates should therefore be interpreted as associations. Risk-informed BTT guidelines should combine prior allocations with hazard-specific severity indicators and systematic post-event fiscal evaluation.

Keyword: fiscal resilience, regional contingency budget, climate-related disasters, fixed effects, Indonesia

Introduction

Natural disasters create contingent fiscal liabilities because emergency response, social protection, rehabilitation, and reconstruction can raise expenditure at the same time that disrupted economic activity weakens public revenue. Fiscal resilience therefore concerns a government's capacity to anticipate, absorb, adapt to, and recover from shocks without undermining fiscal sustainability, essential services, or medium-term development priorities (OECD & World Bank, 2019). This capacity includes budgetary reserves, revenue stability, expenditure flexibility, access to financing, and the ability to mobilize funds rapidly. Indonesia's Disaster Risk Financing and Insurance Strategy similarly treats disaster financing as part of fiscal-risk management rather than as an ad hoc humanitarian response (Ministry of Finance of the Republic of Indonesia, 2018). The multidimensional character of local financial condition identified by Ritonga (2014) also implies that resilience cannot be inferred from a single annual balance alone.

The issue is particularly important in Indonesia. The WorldRiskReport 2025 ranks Indonesia third among 193 countries in the WorldRiskIndex, reflecting high exposure combined with social and institutional vulnerability (Bündnis Entwicklung Hilft & IFHV, 2025). In addition to geophysical hazards, provinces repeatedly face floods, landslides, droughts, forest fires, extreme weather, and coastal abrasion. Under decentralized governance, regional governments must finance disaster response while continuing to provide education, health, infrastructure, and administrative services. Law No. 24 of 2007 assigns disaster-management responsibilities to central and regional governments across pre-disaster, emergency, and post-disaster stages (Republic of Indonesia, 2007), while Law No. 23 of 2014 establishes the broader distribution of governmental functions under decentralization (Republic of Indonesia, 2014). BTT, or contingency expenditure, is one of the regional instruments available for urgent and unforeseen needs, although it is not equivalent to the full set of prevention, mitigation, and preparedness expenditures.

Indonesian evidence confirms that disasters affect regional budgeting through multiple channels. Wiyanti and Halimatussadiah (2021) found that disaster victims and physical damage could weaken regional fiscal balances through lower own-source revenue and higher social-assistance, consumption,

capital, and unexpected expenditure, with some effects appearing after the disaster year. Haris et al. (2023) showed that disaster risk influenced emergency-response allocations across Indonesian local governments, although budgeting remained more oriented toward response than prevention. Anggriani et al. (2024) further reported that disaster risk was associated with weaker fiscal autonomy, financial flexibility, and service solvency. Together, these studies establish the fiscal relevance of disasters but leave open how annual realized hazard experience is translated into subsequent provincial contingency allocations.

International research likewise shows that fiscal responses vary across institutions, hazard types, and levels of government. Miao et al. (2020) found that disasters increased provincial expenditure and intergovernmental transfers in China, whereas Lodi et al. (2023) documented heterogeneous local-government responses to floods in Italy. Capuno et al. (2024) showed that external assistance helped stabilize average local finances after Typhoon Haiyan, although poorer Philippine municipalities subsequently generated less revenue. Suresh et al. (2024) linked floods and cyclones to fiscal volatility and liabilities across Indian states, and de Mello and Jalles (2025) found that disasters can reshape subnational expenditure and revenue shares. Broader cross-country evidence also demonstrates that disaster responses can involve pro- or counter-cyclical fiscal adjustment (Noy & Nualsri, 2011), short-term deficit financing (Ouattara & Strobl, 2013), and responses conditioned by financial development and insurance capacity (Melecky & Raddatz, 2015). Deryugina (2017) further shows that fiscal costs can extend well beyond direct disaster aid through ordinary social-insurance programs.

A central measurement issue is the distinction between structural risk and realized events. An aggregate disaster-risk index combines exposure, vulnerability, and capacity and is useful for long-term planning, but it may change slowly and need not represent the hazards that actually occurred in a particular year. Hazard-specific event frequencies can identify whether provincial budgets respond to recent experience, although counts alone cannot capture duration, affected area, casualties, infrastructure loss, or economic damage. Moreover, different hazards may enter the budget through different channels: floods and landslides often produce visible and localized emergency demands, while drought, fire, extreme weather, and abrasion may require severity measures or may be financed through sectoral programs outside BTT.

This study therefore examines whether the provincial BTT share adjusts after realized climate-related hazard experience. It uses a balanced fixed-effects panel of 32 provinces and relates the current contingency-budget share to its own one-year lag and to lagged hazard-specific event rates per 100,000 population. The design contributes by separating six climate-related hazards, explicitly modeling budget persistence, and focusing on the temporal adjustment from prior-year events to the current budget. The study interprets this responsiveness as an adaptive component of fiscal resilience, not as a complete measure of regional fiscal resilience or as event-level attribution of individual disasters to anthropogenic climate change.

Methods

This study employs a quantitative explanatory design using annual province-level panel data for 2015–2024. The unit of analysis is an Indonesian provincial government. After applying one-year lags, the estimation sample contains 288 observations from 32 provinces, with nine usable observations for each province. The balanced structure enables the analysis to identify changes within the same province while controlling for time-invariant characteristics such as geography, long-standing institutions, and persistent differences in exposure.

Regional budget data are obtained from the portal data maintained by the Directorate General of Fiscal Balance (DJPK), Ministry of Finance. The portal reports budget and realization components, including total regional expenditure and BTT. Disaster-event data are compiled from the BNPB disaster-data portal and Statistics Indonesia (BPS), which provide annual event counts by hazard and province. Population data used to express event frequency per 100,000 residents are obtained from Statistics Indonesia's provincial population tables. The sources are merged using standardized province and year identifiers. Contingency-budget share is calculated as budgeted BTT divided by total budgeted regional expenditure. BTT can finance disaster response. Each hazard variable is measured as the annual number of events divided by provincial population and multiplied by 100,000.

Table 1. Variable Definitions, Operationalization, and Expected Signs

Variable	Operationalization	Source	Expected Sign
Contingency-budget share	Budgeted BTT divided by total budgeted regional expenditure in year t.	DJPk	
Lagged contingency-budget share	Budgeted BTT divided by total budgeted regional expenditure in year t-1.	DJPk	+
Lagged landslide events	Landslide events per 100,000 population in year t-1.	BNPB; BPS	+
Lagged flood events	Flood events per 100,000 population in year t-1.	BNPB; BPS	+
Lagged drought events	Drought events per 100,000 population in year t-1.	BNPB; BPS	+
Lagged forest-fire events	Forest and land-fire events per 100,000 population in year t-1.	BNPB; BPS	+
Lagged extreme-weather events	Extreme-weather events per 100,000 population in year t-1.	BNPB; BPS	+
Lagged coastal-abrasion events	Coastal-abrasion events per 100,000 population in year t-1.	BNPB; BPS	+

Source: Authors' own analysis, 2026

The empirical model estimates the current contingency-budget share as a function of the previous year's share and lagged hazard-specific event rates. The specification is written as follows:

$$CB_{it} = \alpha_i + \rho CB_{it-1} + \beta_1 LS_{it-1} + \beta_2 FL_{it-1} + \beta_3 DR_{it-1} + \beta_4 FF_{it-1} + \beta_5 EW_{it-1} + \beta_6 CA_{it-1} + \varepsilon_{it} \quad (1)$$

In the equation (1), CB denotes the contingency-budget share; LS, FL, DR, FF, EW, and CA denote landslide, flood, drought, forest-fire, extreme-weather, and coastal-abrasion events per 100,000 population; α_i is the province fixed effect; and ε_{it} is the idiosyncratic error. Province fixed effects remove time-invariant unobserved characteristics that may be correlated with hazard occurrence and budgeting behavior (Wooldridge, 2010). Standard errors are clustered by province to allow heteroskedasticity and within-province serial correlation (Cameron & Miller, 2015). Consistent with the study design, the main specification includes province fixed effects without year fixed effects.

The inclusion of CB_{it-1} gives the model a dynamic interpretation. The coefficient ρ measures short-run budget persistence, whereas the hazard coefficients measure the immediate adjustment associated with prior-year events. When $|\rho| < 1$, the long-run multiplier for a hazard is $\beta/(1-\rho)$. Because fixed-effects estimators with a lagged dependent variable can be biased when the time dimension is short (Nickell, 1981), the results are interpreted as within-province associations.

Results and Discussion

Table 2. Summary Statistics

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
Contingency-budget share	0.004916	0.003167	0.000798	0.035613	0.004793
Flood events per 100,000 population	0.641108	0.429136	0.000000	3.176809	0.598880
Landslide events per 100,000 population	0.205740	0.107064	0.000000	4.484305	0.366031
Drought events per 100,000 population	0.021456	0.000000	0.000000	1.730959	0.106018
Forest-fire events per 100,000 population	0.432741	0.034804	0.000000	10.349809	1.129506
Extreme-weather events per 100,000 population	0.364610	0.234046	0.000000	2.366615	0.385233
Coastal-abrasion events per 100,000 population	0.025966	0.000000	0.000000	0.417595	0.062002

Source: Data Processing Result, 2026

Across the 320 province-year observations, the average contingency-budget share was approximately 0.492% of total budgeted expenditure, while the median was lower at approximately 0.317%, indicating that a relatively small number of high-allocation observations raised the overall mean. Floods were the most frequently recorded climate-related hazard, averaging 0.641 events per 100,000 population, followed by forest fires and extreme-weather events. Forest fires displayed the greatest variation, with a standard deviation of 1.130 and a maximum of 10.350 events per 100,000 population, suggesting that fire occurrence was concentrated in a limited number of highly affected province-years. Landslides were less frequent on

average but also exhibited a pronounced upper tail. Drought and coastal-abrasion events had median values of zero, indicating that they were absent in at least half of the province-year observations. Overall, the means exceeding the medians and the relatively large maximum values indicate right-skewed and heterogeneous hazard distributions across Indonesian provinces.

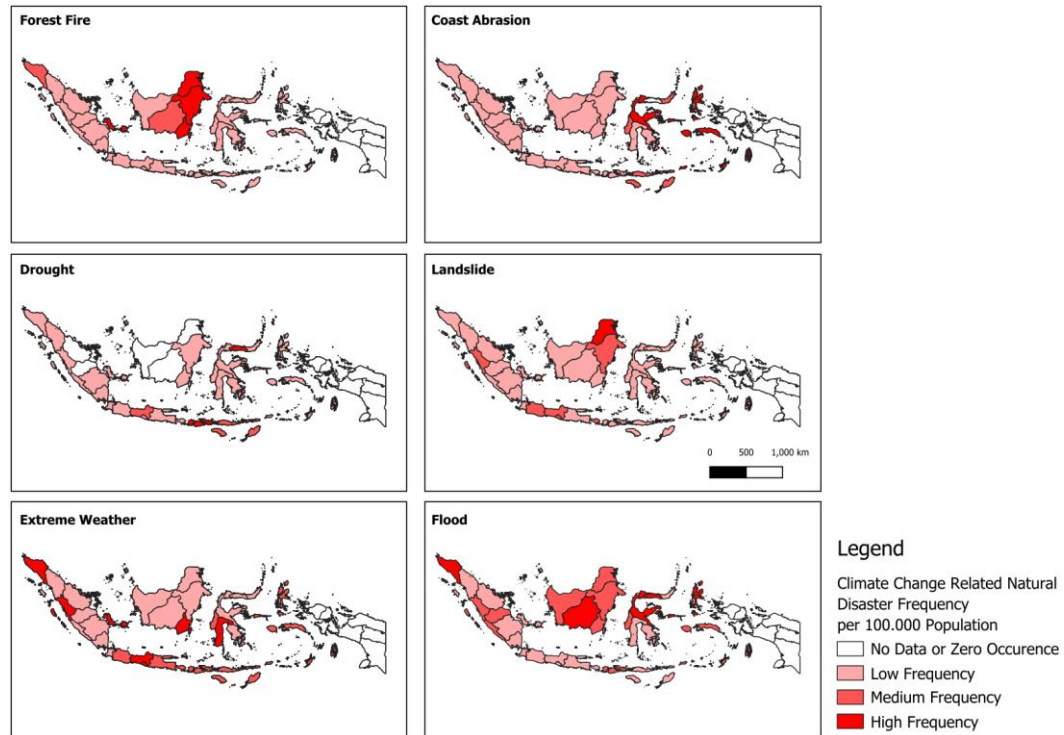


Figure 1. Spatial Distribution of Disaster Frequency 2015—2024

The spatial distribution in the maps as illustrated in Figure 1 shows that climate-related hazards are highly uneven across Indonesian provinces. Floods appear to be the most geographically widespread hazard, with medium-to-high frequencies across parts of Sumatra, Kalimantan, Sulawesi, and several eastern provinces, consistent with their highest mean frequency of 0.641 events per 100,000 population. Forest fires are more spatially concentrated, particularly in Kalimantan and parts of Sumatra, which helps explain their low median but exceptionally high maximum and standard deviation. Landslides are concentrated mainly along Java, Sumatra, and parts of Sulawesi and Kalimantan, while extreme-weather events are distributed relatively broadly across the western and central regions. In contrast, drought and coastal abrasion show more limited and fragmented occurrence, with many provinces classified as having zero or low frequency, consistent with their median values of zero.

Table 3. Panel Regression Results

Variable	Random Effect	Fixed Effect
Lagged contingency-budget share	0,542883*** (0,032890)	0,391959*** (0,021901)
Lagged landslide events per 100,000	0,001519*** (0,000472)	0,001639** (0,000706)
Lagged flood events per 100,000	0,000739** (0,000355)	0,002176*** (0,000520)
Lagged drought events per 100,000	−0,000624 (0,001323)	−0,000022 (0,001626)
Lagged forest-fire events per 100,000	0,000111 (0,000144)	0,000032 (0,000177)
Lagged extreme-weather events per 100,000	0,000112 (0,000516)	0,000921 (0,000842)
Lagged coastal-abrasion events per 100,000	−0,000510 (0,003233)	−0,001873 (0,003539)
Province fixed effect	No	Yes

Variable	Random Effect	Fixed Effect
Year fixed effect	No	No
Cluster-robust SE	Yes	Yes
Observation	288	288
R-squared within	0,2865	0,3143
F-statistic/Wald chi-squared	1.298,63***	79,94***

Note: Province-clustered robust standard errors are in parentheses. * $p < 0.1$. ** $p < 0.05$. *** $p < 0.001$.

Source: Data Processing Result, 2026

Across all three estimators, the lagged contingency-budget share is positive and statistically significant, indicating strong persistence in provincial BTT allocation. Flood and landslide frequencies are also positively and significantly associated with the following year's contingency-budget share. By contrast, drought, forest fire, extreme weather, and coastal abrasion are not statistically significant in any specification. Nevertheless, the Hausman specification indicates that the unobserved province-specific effects are correlated with the explanatory variables, violating the key assumption of the random-effects estimator. Accordingly, the fixed-effects model is preferred because it provides consistent estimates after controlling for time-invariant provincial characteristics.

In fixed effect model, the lagged contingency-budget share is positive and statistically significant. Because both variables are proportions, a one-percentage-point increase in the previous year's BTT share is associated with an approximately 0.392-percentage-point increase in the current share, holding prior hazard experience constant. This indicates substantial incrementalism, meaning provincial governments appear to treat the previous allocation as a baseline rather than reconstructing the contingency budget independently each year. Haris et al. (2023) found that disaster risk influences emergency-response budgeting in Indonesia and the present result shows that budget history itself is an equally important part of the adjustment process.

Lagged flood frequency has a positive and statistically significant coefficient. One additional flood event per 100,000 residents in the previous year is associated with an increase of approximately 0.218 percentage points in the current contingency-budget share. Given the persistence coefficient, the implied long-run multiplier is 0.00358, or approximately 0.358 percentage points. Floods are recurrent, geographically visible, and frequently generate immediate requirements for evacuation, logistics, temporary shelter, infrastructure repair, and social protection. The result therefore supports an experiential-learning mechanism in which repeated flood exposure becomes incorporated into subsequent budget baselines.

Lagged landslide frequency is also positive and statistically significant. Its coefficient means that one additional landslide event per 100,000 residents is associated with an increase of approximately 0.164 percentage points in the following year's BTT share. The implied long-run multiplier is 0.00269, or approximately 0.269 percentage points. Landslides often create concentrated damage to roads, settlements, and public facilities and can therefore produce clear and localized demands on emergency financing. The smaller coefficient relative to floods may reflect differences in event frequency, spatial coverage, and the administrative functions through which recovery is financed.

The positive flood and landslide effects are consistent with Wiyanti and Halimatussadiah (2021), who found that Indonesian disasters can raise unexpected expenditure and that some fiscal effects materialize after the disaster year. They also accord with evidence that disasters increase subnational spending or transfers in China (Miao et al., 2020), influence local capital expenditure and transfer patterns after Italian floods (Lodi et al., 2023), and can prompt short-term deficit financing following severe hurricanes (Ouattara & Strobl, 2013). Noy and Nualsri (2011) show that post-disaster fiscal behavior depends on development conditions, while Melecky and Raddatz (2015) demonstrate that the ability to finance a response depends on financial and insurance capacity. These studies reinforce the interpretation that observed budget adjustment reflects both the shock and the government's financing environment.

Drought, forest-fire, extreme-weather, and coastal-abrasion frequencies are not statistically significant. This finding should not be interpreted as evidence that these hazards lack fiscal consequences. A simple event count assigns the same weight to minor and severe episodes. Drought expenditure is more likely to depend on duration, crop losses, reservoir and water-supply conditions, and the population affected. Forest-fire costs depend on burned area, suppression intensity, health effects, and whether financing is borne by provincial, central, or sectoral agencies. Coastal abrasion is generally slow-moving and may be addressed through infrastructure or coastal-management programs rather than BTT. Extreme-weather events are heterogeneous and may overlap with floods or landslides in administrative records. Wiyanti and

Halimatussadiyah (2021), for example, found fiscal effects for damaged forest area, a severity measure that is conceptually richer than the number of fire events.

The broader literature cautions that recorded disaster appropriations capture only part of the fiscal response. Deryugina (2017) shows that hurricane-related fiscal costs can extend into ordinary unemployment and medical transfers for many years, while Capuno et al. (2024) demonstrate that aggregate fiscal stability can conceal weaker revenue performance among poorer jurisdictions. Suresh et al. (2024) similarly emphasize fiscal volatility and funding inadequacy in disaster-prone Indian states, and de Mello and Jalles (2025) show that disasters can alter the distribution of fiscal responsibilities across government levels. Accordingly, a higher BTT share should be interpreted as adaptive contingency-budget responsiveness - one dimension of fiscal resilience - rather than proof that the entire fiscal system is resilient.

Overall, the estimates indicate that provincial contingency budgeting is path-dependent and selectively hazard-responsive. Prior allocations strongly anchor the current budget, while floods and landslides supply additional information that leads to upward adjustment. The results imply that a uniform event-count rule would be inappropriate. BTT guidelines should combine historical allocations with hazard-specific severity indicators, including affected population, duration, damaged infrastructure, burned area, and estimated economic loss. Such a framework would better connect contingency budgeting to actual expected liabilities and to Indonesia's broader disaster-risk financing strategy (Ministry of Finance of the Republic of Indonesia, 2018).

Several limitations remain. The estimates identify within-province associations rather than causal effects. BTT can finance urgent needs unrelated to natural disasters, and the omission of year fixed effects means that national policy changes and common macro-fiscal shocks are not separately removed. Event counts do not measure physical or economic severity, and measurement practices may differ across provinces. Finally, the lagged dependent variable may generate finite-sample bias with nine effective periods (Nickell, 1981). Future analysis should compare the results with bias-corrected fixed effects (Bruno, 2005), a carefully restricted dynamic-panel estimator with the Arellano-Bond specification tests (Arellano & Bond, 1991), and alternative hazard measures based on victims, affected area, and physical losses.

Conclusion

This study evaluates the adjustment of provincial disaster contingency budgets after climate-related hazard experience. Using 288 observations from 32 provinces, the fixed-effects model shows that BTT budgeting is strongly persistent: a one-percentage-point increase in the prior-year share is associated with a 0.392-percentage-point increase in the current share. The result indicates an incremental budgeting process in which historical allocations remain the principal baseline for subsequent decisions.

Beyond persistence, prior-year floods and landslides significantly increase the current contingency-budget share. One additional flood event per 100,000 population is associated with an increase of approximately 0.218 percentage points, and one additional landslide event is associated with an increase of approximately 0.164 percentage points. Drought, forest fire, extreme weather, and coastal abrasion are not statistically significant when measured using event counts. These differences indicate that budget responsiveness is hazard-specific and that event frequency is not an adequate severity measure for every type of climate-related disaster.

The findings contribute to the disaster-finance literature by shifting attention from structural risk scores toward realized hazard experience and dynamic budget adaptation. For policy, the results support strengthening BTT as a transparent contingency instrument while linking allocations to hazard-specific measures of exposure and severity. For research, the next step is to determine whether larger ex-ante BTT allocations reduce subsequent fiscal stress, protect development and public-service expenditure, or accelerate fiscal recovery. This extension would distinguish budget responsiveness from the effectiveness of contingency financing as an instrument of fiscal resilience.

References

- Anggriani, N., Furqan, A. C., Yuniar, L. S., & Sitorus, S. M. (2024). Financial performance of local governments: The effects of disaster risk. *KnE Social Sciences*, 9(20), 399-412. <https://doi.org/10.18502/kss.v9i20.16544>
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277-297. <https://doi.org/10.2307/2297968>
- BPS-Statistics Indonesia. (n.d.). Population, population growth rate, percentage distribution of population, population density, and population sex ratio by province. BPS-Statistics Indonesia.

- Bruno, G. S. F. (2005). Estimation and inference in dynamic unbalanced panel-data models with a small number of individuals. *The Stata Journal*, 5(4), 473-500. <https://doi.org/10.1177/1536867X0500500401>
- Bündnis Entwicklung Hilft & Institute for International Law of Peace and Armed Conflict. (2025). *WorldRiskReport 2025: Focus: Floods*. Bündnis Entwicklung Hilft.
- Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, 50(2), 317-372. <https://doi.org/10.3368/jhr.50.2.317>
- Capuno, J., Corpuz, J., & Lordemus, S. (2024). Natural disasters and local government finance: Evidence from Typhoon Haiyan. *Journal of Economic Behavior & Organization*, 220, 869-887. <https://doi.org/10.1016/j.jebo.2024.03.007>
- de Mello, L., & Jalles, J. T. (2025). Natural disasters and intergovernmental relations: More or less decentralisation? *Regional Studies*, 59(1), Article 2310116. <https://doi.org/10.1080/00343404.2024.2310116>
- Deryugina, T. (2017). The fiscal cost of hurricanes: Disaster aid versus social insurance. *American Economic Journal: Economic Policy*, 9(3), 168-198. <https://doi.org/10.1257/pol.20140296>
- Directorate General of Fiscal Balance. (n.d.-b). Portal Data SIKD: APBD. Ministry of Finance of the Republic of Indonesia.
- Haris, N., Furqan, A. C., Kahar, A., & Karim, F. (2023). Disaster risk index on disaster management budgeting: Indonesia's national data set. *Jambá: Journal of Disaster Risk Studies*, 15(1), Article a1365. <https://doi.org/10.4102/jamba.v15i1.1365>
- Lodi, C., Marin, G., & Modica, M. (2023). The public finance response to floods of local governments in Italy. *Journal of Environmental Management*, 332, Article 117352. <https://doi.org/10.1016/j.jenvman.2023.117352>
- Melecky, M., & Raddatz, C. (2015). Fiscal responses after catastrophes and the enabling role of financial development. *The World Bank Economic Review*, 29(1), 129-149. <https://doi.org/10.1093/wber/lht041>
- Miao, Q., Chen, C., Lu, Y., & Abrigo, M. R. M. (2020). Natural disasters and financial implications for subnational governments: Evidence from China. *Public Finance Review*, 48(1), 72-101. <https://doi.org/10.1177/1091142119884710>
- Ministry of Finance of the Republic of Indonesia. (2018). Strategi pembiayaan dan asuransi risiko bencana [Disaster risk financing and insurance strategy]. Fiscal Policy Agency.
- National Disaster Management Agency. (n.d.). Data Informasi Bencana Indonesia. BNPB.
- Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49(6), 1417-1426. <https://doi.org/10.2307/1911408>
- Noy, I., & Nualsri, A. (2011). Fiscal storms: Public spending and revenues in the aftermath of natural disasters. *Environment and Development Economics*, 16(1), 113-128. <https://doi.org/10.1017/S1355770X1000046X>
- OECD, & World Bank. (2019). Fiscal resilience to natural disasters: Lessons from country experiences. OECD Publishing. <https://doi.org/10.1787/27a4198a-en>
- Ouattara, B., & Strobl, E. (2013). The fiscal implications of hurricane strikes in the Caribbean. *Ecological Economics*, 85, 105-115. <https://doi.org/10.1016/j.ecolecon.2012.10.002>
- Republic of Indonesia. (2007). Law No. 24 of 2007 concerning disaster management.
- Republic of Indonesia. (2014). Law No. 23 of 2014 concerning regional government.
- Ritonga, I. T. (2014). Developing a measure of local government's financial condition. *Journal of Indonesian Economy and Business*, 29(2), 142-164. <https://doi.org/10.22146/jieb.6206>
- Suresh, N., Mishra, T., & Parthasarathy, D. (2024). The impact of floods and cyclones on fiscal arrangements in India: An empirical investigation at the sub-national level. *International Journal of Disaster Risk Reduction*, 110, Article 104620. <https://doi.org/10.1016/j.ijdr.2024.104620>
- Wiyanti, A., & Halimatussadiah, A. (2021). Are disasters a risk to regional fiscal balance? Evidence from Indonesia. *International Journal of Disaster Risk Science*, 12(6), 839-853. <https://doi.org/10.1007/s13753-021-00374-2>
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.

Author's Bibliography

Alif Muhammad Fadli was born in Rembang, Indonesia on April 13, 1997. He received the applied bachelor degree in asset public management from the Polytechnic of State Finance STAN, South

Tangerang, Indonesia in 2025, and is currently pursuing the bachelor degree in economic development from Universitas Terbuka, South Tangerang, Indonesia. His major research interests include environmental economics and asset management.

Anwar Sidiq was born in Tegal, Indonesia, on October 27, 1998. He received the diploma degree in accounting from the Polytechnic of State Finance STAN, South Tangerang, Indonesia in 2019, and the bachelor of accounting from Universitas Terbuka, South Tangerang, Indonesia in 2024. He is currently pursuing a bachelor degree in economic development at Universitas Terbuka., South Tangerang, Indonesia. His major research interests include public finance, financial analyst, environmental economics and health economics.