

PAYING FOR DISASTERS BEFORE THEY HAPPEN: RISK FINANCING AND THE SUBNATIONAL FISCAL GAP

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ABSTRACT

Subnational governments bear disasters first and finance them last, using instruments designed for response rather than for anticipation. This study examines what the evidence establishes about the fiscal cost of disasters, the instruments available to meet it, and where the subnational gap lies. The method is a structured review of research published between 2017 and 2024. Four findings follow. The visible fiscal bill understates the real one: the present value of the increase in non-disaster transfers following hurricanes, sustained for a decade in affected areas, significantly exceeds that of direct disaster aid, so the true cost is carried by routine social spending rather than by disaster budgets. Higher-tier transfers absorb the shock, with a panel of 50 states over 1970 to 2013 finding disaster-induced spending largely financed by federal transfers and total tax revenues little affected though their components fluctuate more. Subnational budgeting for disasters is systematically thin, with a study of 13 regional budgets finding that authorities do not systematically plan funds for crisis situations and that implementation phases are most underfunded. And adaptation finance does not reach the tier that bears the risk, being allocated primarily to multilateral entities and national governments. The study also reports an absence: no verified benefit-cost estimate for prevention was located within the window, despite that claim underpinning most policy argument.

ABSTRAK

Pemerintah daerah menanggung bencana lebih dulu dan membiayainya paling akhir, dengan instrumen yang dirancang untuk penanganan alih-alih untuk antisipasi. Penelitian ini menelaah apa yang dibuktikan riset mengenai biaya fiskal bencana, instrumen yang tersedia untuk memenuhinya, dan di mana letak kesenjangan di tingkat daerah. Metodenya adalah telaah terstruktur riset terbitan 2017 hingga 2024. Empat temuan mengikutinya. Tagihan fiskal yang terlihat lebih kecil daripada yang sebenarnya: nilai kini dari kenaikan transfer nonbencana setelah badai, yang bertahan satu dasawarsa di wilayah terdampak, secara bermakna melampaui nilai kini bantuan bencana langsung, sehingga biaya sesungguhnya ditanggung oleh belanja sosial rutin, bukan oleh anggaran bencana. Transfer dari tingkat yang lebih tinggi menyerap guncangan itu: panel 50 negara bagian sepanjang 1970 hingga 2013 menemukan belanja akibat bencana sebagian besar dibiayai transfer pusat, dan penerimaan pajak total tidak banyak terpengaruh meski komponennya berfluktuasi lebih besar. Penganggaran bencana di daerah secara sistematis tipis: studi atas 13 anggaran daerah menemukan bahwa otoritas tidak merencanakan dana penanganan krisis secara sistematis dan tahap pelaksanaan paling kekurangan dana. Pembiayaan adaptasi pun tidak sampai ke tingkat yang menanggung risikonya, karena dialokasikan terutama kepada lembaga multilateral dan pemerintah pusat. Penelitian ini juga melaporkan satu ketiadaan: tidak ditemukan estimasi manfaat-biaya pencegahan yang terverifikasi dalam rentang

	telaah, padahal klaim itulah yang menopang sebagian besar argumen kebijakan. Kata kunci: pembiayaan risiko bencana; anggaran daerah; pembiayaan adaptasi iklim; pengalihan risiko; ketahanan fiskal
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I. INTRODUCTION

When a disaster occurs, a local government does three things in quick succession: it responds, it reallocates, and it waits for higher-tier assistance. Only the first is what it planned for. The second is taken from programmes that were funded for other purposes, and the third arrives on a timetable the local government does not control.

This is not a description of poor management. It is the predictable result of financing arrangements built around response, in which money is committed after an event whose timing is unknown, rather than around anticipation, in which capacity is established before it. The distinction is usually framed as prevention versus response and argued on cost-effectiveness grounds. This study proceeds differently, because that cost-effectiveness claim turns out to be harder to substantiate than its ubiquity suggests.

The starting point is that the fiscal cost of a disaster is larger and later than the bill anyone counts. Deryugina (2017) finds that hurricanes cause substantial increases in non-disaster government transfers — unemployment insurance and public medical payments — in affected counties for a decade afterwards, and that the present value of this increase significantly exceeds that of direct disaster aid. The implication is that the fiscal cost has been significantly underestimated, and that most of it is not recorded as disaster spending at all.

Where that cost lands depends on the intergovernmental system. Miao et al. (2018), using a panel vector autoregression across 50 states from 1970 to 2013, find that after a disaster states increase programme expenditure and receive more federal transfers, that disasters have limited impact on total tax revenues while amplifying fluctuations in sales, income and property tax revenues, and that disaster-induced additional spending is largely financed through federal transfers, including non-disaster public welfare assistance.

That is a benign result for subnational solvency and an ambiguous one for subnational incentives. A tier whose disaster costs are substantially absorbed by transfers from above has less reason to finance preparation from its own budget, and the evidence on what subnational governments actually budget is consistent with that: Oulehlova et al. (2021), examining 13 regional budgets across 2013 to 2019, find that public authorities do not systematically plan funds for dealing with crisis situations, with implementation phases most underfunded.

Three questions organise the analysis. First, what is the true fiscal cost of a disaster and where does it land? Second, what instruments exist to meet it before the event, and what does the evidence say about their performance? Third, why does financing not reach the subnational tier that bears the risk, and what follows for design?

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

The fiscal cost of disasters

Deryugina (2017) provides the study that reframes the accounting. Examining United States hurricanes, she finds substantial increases in non-disaster government transfers in affected counties persisting for a decade, with a present value significantly exceeding that of direct disaster aid, and concludes both that the fiscal cost of disasters has been significantly underestimated and that victims in developed countries are better insured than previously thought. The second conclusion qualifies the first: the hidden cost is the price of an implicit social insurance that is working.

Miao et al. (2018) trace where the cost lands within a federation. Their panel vector autoregression across 50 states from 1970 to 2013 estimates disaster impacts on revenue, expenditure, debt issuance and intergovernmental transfers, finding that states increase programme expenditure and receive more federal transfers, that total tax revenues are little affected while sales, income and property tax revenue fluctuations are amplified, and that the additional spending is financed largely through transfers including non-disaster welfare assistance.

Botzen et al. (2019) provide the review-level synthesis of models and empirical studies estimating direct property damage and indirect impacts on growth and trade, attributing rising losses mainly to population and economic growth in disaster-prone areas and expecting further increases from continued exposure growth together with climate change. Exposure growth rather than hazard change is, on their account, the dominant driver of the loss trend to date.

Instruments: pooling, transfer and contingent finance

Ciullo et al. (2023) examine sovereign catastrophe risk pooling and argue that existing pools underperform because they were not designed to maximise diversification and pool risk only regionally. Constructing pools by maximising diversification, they find that global pooling always yields higher diversification than regional pooling, distributes countries' shares in pool risk more evenly, and increases the number of countries that profit from participating, with optimal global pooling raising diversification over existing pools by up to 65 per cent.

Hochrainer-Stigler et al. (2017) assess a regional solidarity fund against three aims — solidarity, contribution to proactive risk reduction, and robustness against depletion. Simulating future disasters, they find the reformed fund reasonably robust to more frequent events, with depletion risk reducible through higher member contributions or risk transfer, but conclude that it does not embed needs-based solidarity, since lower-income members received disproportionately less compensation relative to eligible losses even though on average they received more aid than they contributed.

Fernández Lopera et al. (2024) develop a socially inclusive climate risk transfer mechanism built from vulnerable populations' own perspectives on climate impacts and their willingness to adopt insurance, finding national and local risk management policies aligned with those needs and proposing a model that explicitly layers a risk pool, contingent credit and insurance. Layering rather than substitution is the design principle their model expresses.

Oulehlova et al. (2021) address subnational budgeting directly, arguing that public authorities do not systematically plan funds for crisis situations in regional budgets and proposing a methodology for calculating minimum fund allocation across disaster management phases from regional property values, predicted crises, administrative area and budget expenditures. Across 13 regional budgets from 2013 to 2019 they confirm insufficient provision, with implementation phases most underfunded.

The protection gap and what insurance does

Holzheu and Turner (2018) analyse the natural catastrophe protection gap, finding that it has widened steadily over four decades and distinguishing historical from expected underinsurance: climate-related events such as flood and windstorm dominate historical losses, whereas earthquake constitutes the largest share of expected underinsurance. Over 1977 to 2016 earthquake accounts for approximately a third of historical losses but 51 per cent of modelled expected exposures, on a regression base of 53 countries over 15 years. The authors were insurance-industry economists using industry loss data, and the study is cited here with that noted.

Kousky (2019) reviews how disaster insurance markets function and the empirical evidence on insurance's role, reaching a conclusion that constrains what risk transfer should be expected to achieve: insurance coverage does improve recovery outcomes, but impacts on risk reduction may be modest. Insurance is therefore a recovery instrument that does not automatically become a prevention instrument, and designing it to do the second requires deliberate additional features.

Poontirakul et al. (2022), using a Thai provincial panel from 2009 to 2018 within a Granger non-causality framework, find bidirectional causality between insurance and poverty, between insurance and hazard outcomes, and between poverty and hazard outcomes, concluding that non-life insurance plays a significant role in alleviating poverty through both rapid and longer-term effects. Bradt (2022) addresses the demand side experimentally with 331 participants, finding that affective nudges raise willingness to pay for flood insurance by approximately 21 dollars per month and informational nudges by approximately 11 dollars per month relative to a numeracy intervention, which indicates that the protection gap is partly a demand and framing problem rather than solely a pricing one.

Adaptation finance and the subnational tier

Colenbrander et al. (2018) establish the allocation pattern that this study treats as central. Climate adaptation finance is allocated primarily to multilateral entities and national governments rather

than to local organisations, so the same social, political and economic processes that create inequalities within a country determine how adaptation finance is used. Using an urban lens, they identify the obstacles local governments and civil society face in accessing such finance as a function of systemic power imbalances between levels of government, and argue that even relatively small amounts reaching local organisations could have a catalytic effect.

Manuamorn et al. (2020) examine what determines whether internationally financed adaptation projects focus on local communities, noting that the overall amount of international finance reaching local recipients remains low. Applying qualitative comparative analysis to 30 projects, they find that the absence of high exposure to projected future climate risk is a necessary condition for stronger community focus, and identify three sufficient configurations involving projected risk, civil society governance and access to direct financing modalities. The necessary-condition result is uncomfortable: projects in the highest-risk settings were less community-focused.

Political economy

Heersink et al. (2017) examine a historical case in which aid was broadly and fairly distributed and the relief effort was personally overseen by a national figure, and find that voters nonetheless punished him, with his vote share falling by more than ten percentage points in affected counties, robust to synthetic control. Their conclusion that the aggregate electoral effect of disaster remains broadly negative even where voters can distinguish response quality complicates the standard account in which relief spending buys votes while prevention goes unrewarded.

The complication matters for design. If disasters are electorally costly regardless of response quality, then the incentive an incumbent faces is to prevent the event from occurring in their jurisdiction rather than to be seen responding well to it, which is an argument for prevention that does not depend on voters rewarding invisible work.

Indonesian evidence

Marlina et al. (2024) examine disaster risk financing and insurance for earthquake-prone state buildings in Indonesia, combining literature analysis with structural vulnerability modelling using rapid visual screening across nine vulnerability factors and seismic zones. They find reliance on public budgets for disaster recovery and insurance frameworks lacking specificity about which structures are eligible, and recommend applying insurance selectively to the highest-risk building categories.

Handoyo et al. (2024) survey responses following a 2022 earthquake on emotional reactions, risk perception and willingness to participate in risk insurance, stating that heavy reliance on ad-hoc government relief for risk transfer is not sustainable. Their three findings are low insurance participation attributable to limited insurance literacy and enrolment, a significant financial burden on government from material losses, and a critical need for disaster insurance schemes

covering homes and fixed assets, with emphasis on the vulnerability of poor and low-income households.

Basri and Gusnardi (2021) provide the only verified study engaging subnational contingency budgeting administration directly. Their qualitative case study of one province during the pandemic documents four rounds of budget refocusing and reallocation, and records problems in recording unforeseen expenditure attributable to the absence of technical guidelines for administering it. Handayani et al. (2023) examine land value capture as an alternative disaster funding mechanism and conclude that it can serve as an additional strategy for funding disaster risk management in Indonesia.

The fiscal capacity that contingency provision presupposes

A calculated contingency provision presupposes an administration able to calculate and to disburse it, and the Indonesian evidence on that capacity is not encouraging. Vidyattama et al. (2022), examining budget formation across districts, find human capacity and administrative problems slowing both development and enactment of budgets, with bargaining over infrastructure commitments weakening participatory processes. A contingency line competes for attention within a process that is already delayed by capacity constraints in ordinary years.

Mahdavi and Westerlund (2018), testing convergence in subnational tax capacity and effort across more than three decades, find no convergence in either. The implication for disaster financing is that a uniform contingency requirement imposed across jurisdictions of persistently unequal revenue-raising capacity will bind very differently, and that the jurisdictions least able to fund a reserve are not on a trajectory toward being able to. Van Rompuy (2021) finds the contribution of transfers to regional convergence diminishing and eventually reversing as dependence grows, which cautions against relying on higher-tier transfer as the permanent answer.

Chalil (2020) finds significant fiscal spillovers among Indonesian municipalities coexisting with no significant electoral response to neighbourhood performance, so the comparison between jurisdictions that might otherwise discipline under-provision is not operating. Lewis (2023) assesses the 2022 fiscal relations statute as directed at central control through performance incentives, earmarks and spending mandates rather than at subnational capability, and concludes it is unlikely to improve subnational tax mobilisation or spending efficiency.

Taxation, participation and the willingness to pre-fund

Whether citizens accept pre-funding for an event that has not occurred is partly a question about the fiscal relationship itself. Weigel (2020), evaluating a randomised property tax campaign across 356 neighbourhoods, finds compliance rising from 0.1 to 11.6 per cent and political participation rising by approximately five percentage points, with citizens bearing participation costs worth about a day's household income — a participation dividend from taxation. Nupia (2024) qualifies the mechanism formally, showing that higher taxes raise political demands without automatically

improving provision, and that causation also runs from accountability to higher equilibrium tax rates.

Halling and Baekgaard (2024), reviewing 119 studies, establish that administrative burden is constructed at the point of delivery and shaped by communication rather than determined by statutory design. For post-disaster assistance this is the operative finding: relief that is formally available but procedurally demanding reaches the households with the most documentation capacity, which are by construction not the most affected.

Research gap and an evidential absence

Three gaps shape this study, and one of them is a finding in its own right. No verified benefit-cost estimate for disaster prevention published between 2017 and 2024 was located. Khan et al. (2024), analysing disaster risk reduction budgetary allocation across 2000 to 2022 in one Pakistani province, report a significant negative correlation between such expenditure and disaster damages including mortality, injuries and structural damage — but a correlation is not a benefit-cost ratio and is not presented as one here. The frequently quoted returns to prevention derive from institutional reports rather than from peer-reviewed articles within this window.

Second, no verified peer-reviewed study of Indonesia's national disaster pooling fund was located, so the instrument at the centre of current Indonesian disaster financing policy is unexamined in the indexed literature. Third, the developed-versus-developing split in the protection gap could not be verified at the level of specific figures, so the gap is characterised qualitatively.

3. METHOD

The study is a structured review. It generates no primary data, estimates no losses, and evaluates no instrument's performance in any jurisdiction.

Source identification and verification

Peer-reviewed studies published between 2017 and 2024 on disaster risk financing, catastrophe risk pooling and insurance, the fiscal impact of disasters, climate adaptation finance and the political economy of disaster spending were identified and retained only where bibliographic details could be verified against a publisher page, a digital object identifier record, an indexing database record or an institutional repository. Sources whose findings could not be read directly were excluded, and three otherwise relevant articles were excluded on that ground. Two further sources were excluded because their publisher's institutional affiliation raised independence concerns that could not be resolved.

Treatment of quantities and of source type

Every quantity reported here derives from a peer-reviewed journal article and is identified with its source. Figures circulating in institutional reports, including the widely quoted returns to disaster

prevention investment, are not reported, since this study cites journal literature and no equivalent peer-reviewed estimate within the window could be verified. Where a peer-reviewed source was authored by industry or government researchers using their own institution's data, this is stated at the point of use.

Analytical structure

The analysis separates three questions that are often merged: what a disaster costs a government, which tier of government pays, and when the payment falls. Each reviewed finding is assigned to one of these, and the design implications are derived from the combination rather than from any single finding.

4. RESULTS AND DISCUSSION

The cost is larger, later and differently located than it appears

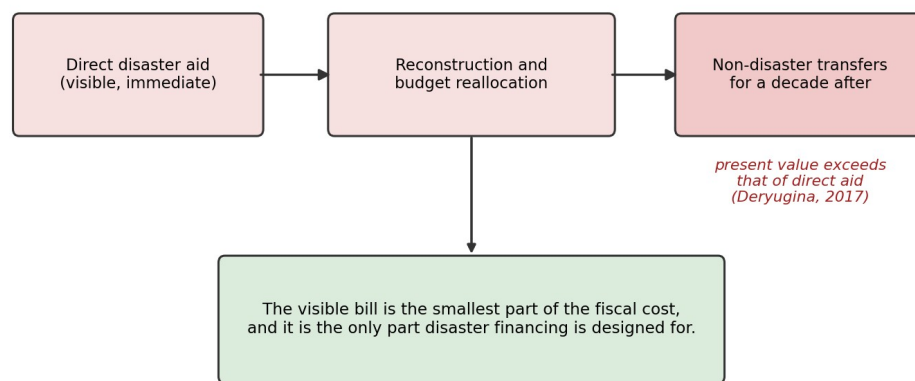


Figure 1. Components of the post-disaster fiscal cost and their relative magnitude (authors' construction, after Deryugina, 2017)

Table 1. Verified findings on the fiscal cost of disasters

Finding	Scope	Source
Present value of increased non-disaster transfers exceeds that of direct disaster aid	US hurricanes, decade-long effect	Deryugina (2017)
Fiscal cost of disasters significantly underestimated	Same study	Deryugina (2017)
Disaster-induced spending largely financed through federal transfers	50 states, 1970–2013	Miao et al. (2018)
Limited impact on total tax revenues; amplified fluctuation in components	Same study	Miao et al. (2018)
Rising losses attributed mainly to population and economic growth in exposed areas	Review of models and studies	Botzen et al. (2019)

Authorities do not systematically plan funds for crisis situations	13 regional budgets, 2013–2019	Oulehlova et al. (2021)
Implementation phases most underfunded	Same study	Oulehlova et al. (2021)

Source: compiled by the authors. Studies differ in country, period and method and are not pooled.

The first two rows change what a disaster financing strategy should be sized against. If the dominant fiscal consequence is a decade of elevated routine transfers rather than a period of emergency expenditure, then an instrument scaled to emergency response is scaled to the smaller component. It also means the cost is largely invisible in disaster accounting, since it appears in social protection lines that would exist anyway.

The third and fourth rows describe the mechanism by which a subnational government survives an event it could not have financed. Transfers from above absorb the shock, and total tax revenue proves resilient even as its components fluctuate. That resilience is real and is not a criticism. Its consequence, however, is that the tier bearing the physical risk is not the tier bearing the fiscal risk, and the sixth and seventh rows show what that produces: regional budgets that do not systematically provide for crises, with the implementation phase — the point at which money must actually move — least provided for.

What the instruments can and cannot do

Table 2. Instruments and the evidence on them

Instrument	Verified finding	Source
Sovereign catastrophe risk pooling	Global pooling raises diversification by up to 65 per cent over existing regional pools	Ciullo et al. (2023)
Regional solidarity fund	Reasonably robust to more frequent events, but does not embed needs-based solidarity	Hochrainer-Stigler et al. (2017)
Layered pool, contingent credit and insurance	Model built from vulnerable populations' own risk perspectives	Fernandez Lopera et al. (2024)
Insurance generally	Improves recovery outcomes; impacts on risk reduction may be modest	Kousky (2019)
Non-life insurance	Significant role in alleviating poverty, with rapid and longer-term effects	Poontirakul et al. (2022)
Demand-side intervention	Affective nudges raise willingness to pay by about US\$21 per month; informational nudges about US\$11	Bradt (2022)
Subnational contingency budgeting	Not systematically planned; implementation phase least funded	Oulehlova et al. (2021)

Source: compiled by the authors. The pooling figure concerns sovereign pools and does not describe subnational arrangements.

Two rows deserve to be read against each other. Kousky's (2019) conclusion that insurance improves recovery while its risk-reduction impacts may be modest establishes what risk transfer is for. It converts an uncertain future liability into a certain present premium, which is valuable for fiscal planning and for recovery speed. It does not, by itself, reduce the underlying exposure that Botzen

et al. (2019) identify as the dominant driver of the loss trend. A government that has insured has not thereby prepared.

Hochrainer-Stigler et al.'s (2017) finding that a solidarity fund did not embed needs-based solidarity — lower-income members receiving disproportionately less relative to eligible losses even while receiving more than they contributed on average — identifies a design failure that risk pooling arrangements are prone to. Compensation rules based on eligible loss favour jurisdictions with more insurable assets, which are the jurisdictions with more capacity to begin with.

Bradt's (2022) experimental result is the most directly actionable finding for closing the coverage gap. If affective framing raises willingness to pay roughly twice as much as informational framing, then the standard approach of publishing risk information is the weaker of the two available levers, and the finding transfers to public communication about subnational coverage schemes at low cost.

Why financing does not reach the tier that bears the risk

Table 3. The subnational gap, by mechanism

Mechanism	Evidence	Source
Adaptation finance allocated primarily to multilateral entities and national governments	Access barriers as a function of power imbalances between tiers	Colenbrander et al. (2018)
Finance reaching local recipients remains low	30 Adaptation Fund projects analysed	Manuamorn et al. (2020)
Absence of high projected climate risk is a necessary condition for community focus	Same study	Manuamorn et al. (2020)
Higher-tier transfers absorb disaster costs	50 states, 1970–2013	Miao et al. (2018)
Subnational budgets do not systematically provide for crises	13 regional budgets	Oulehlova et al. (2021)

Source: compiled by the authors. The mechanisms are drawn from studies in different settings and describe a pattern rather than a single measured process.

Read together, these describe a system that is internally consistent and collectively perverse. Adaptation finance is allocated upward because upper tiers have the absorptive and reporting capacity to receive it. Disaster costs are absorbed upward because upper tiers have the fiscal capacity to bear them. The subnational tier therefore has neither the finance to prepare nor the exposure to compel it, and its budgets reflect exactly that.

Manuamorn et al.'s (2020) necessary-condition finding is the sharpest element. That the absence of high projected climate risk is necessary for stronger community focus means that, among the projects examined, the highest-risk settings received the least community-focused designs. Whatever the cause — risk-averse project design, capacity requirements, fiduciary conditions — the effect is that finance is least locally directed where local exposure is greatest.

The Indonesian evidence describes the same structure in national terms. Marlina et al. (2024) find reliance on public budgets for recovery and insurance frameworks lacking specificity about eligible structures; Handoyo et al. (2024) state that heavy reliance on ad-hoc government relief for risk transfer is not sustainable and find low insurance participation attributable to limited literacy and enrolment. Basri and Gusnardi (2021) document the administrative face of the same problem at subnational level: four rounds of budget refocusing in a single year, and difficulties recording unforeseen expenditure attributable to the absence of technical guidelines for administering it.

That last finding is worth isolating. An unforeseen expenditure line exists precisely so that a local government can move money quickly when an event occurs. If its administration lacks technical guidance, the instrument designed for speed becomes the instrument officials are most cautious about using, which converts a financing problem into a procedural one at exactly the moment procedure is most costly.

An absence worth reporting

The argument for prevention over response is ordinarily made with a benefit-cost ratio. No such ratio from a peer-reviewed article published between 2017 and 2024 could be verified for this study. The closest verified evidence, Khan et al. (2024), reports a significant negative correlation between disaster risk reduction budgetary allocation and disaster damages across 2000 to 2022 in one province, which is consistent with the claim but does not establish a return.

This absence should be stated rather than papered over, and it has two implications. For policy, it means that the most common argument for shifting expenditure toward prevention currently rests on institutional analysis rather than on peer-reviewed estimation, which is a weaker footing than the argument's ubiquity implies. For research, it identifies a specific and tractable gap: subnational budget data on ex ante and ex post disaster expenditure, matched to loss outcomes, would permit the estimation that is missing.

The absence also strengthens the case for the alternative argument developed here. If prevention cannot presently be justified by a verified return, it can still be justified by the structure of the problem: the true fiscal cost is larger and later than the visible one, the tier that bears physical risk does not bear fiscal risk, adaptation finance does not reach that tier, and disasters are electorally costly regardless of response quality. Each of those is evidenced, and together they support the same conclusion.

Design implications

Five implications follow. First, disaster financing should be sized against the full fiscal footprint, including the decade of elevated routine transfers Deryugina (2017) identifies, rather than against emergency response alone. Second, contingency provision at subnational level should be calculated rather than nominal, along the lines Oulehlova et al. (2021) propose from property values,

predicted events and administrative area, and should provide specifically for the implementation phase their evidence identifies as least funded.

Third, instruments should be layered rather than substituted, as Fernández Lopera et al. (2024) model: a reserve for high-frequency low-severity events, contingent credit for the middle layer, and risk transfer for the tail. Fourth, insurance should be adopted for what Kousky (2019) shows it does — improving recovery — while risk reduction is pursued through separate instruments, since the evidence does not support expecting the first to deliver the second.

Fifth, where risk transfer coverage is the objective, demand-side design deserves the attention currently given to pricing. Bradt's (2022) finding that affective framing raises willingness to pay roughly twice as much as informational framing indicates a lever available at negligible cost, and Handoyo et al.'s (2024) finding of low participation attributable to limited literacy and enrolment indicates that the Indonesian gap is at least partly of this kind. Finally, the administrative point from Basri and Gusnardi (2021) is the cheapest of all: an unforeseen expenditure instrument requires technical guidance for its administration, failing which it will not be used at the speed it exists to provide.

Limitations

Four limitations qualify this study. First, no verified benefit-cost estimate for prevention within the review window was located, so the study's argument for anticipation rests on the structure of the fiscal problem rather than on a rate of return. Second, no verified peer-reviewed study of Indonesia's national disaster pooling fund was located, so the principal current Indonesian instrument is not assessed here. Third, the fiscal-impact evidence is drawn overwhelmingly from one federal high-income country, and its transferability to a unitary middle-income state is assumed rather than demonstrated. Fourth, the protection gap evidence relies on a study authored by industry economists using industry loss data, and the developed-versus-developing split within it could not be verified at figure level.

5. CONCLUSION

The fiscal cost of a disaster is not the bill that follows it. The present value of increased non-disaster transfers in affected areas, sustained for a decade, significantly exceeds that of direct disaster aid, which means most of the cost is carried by routine social spending and never appears in disaster accounting at all. A financing strategy sized against emergency response is therefore sized against the smaller component of what a disaster actually costs a state.

Where that cost falls is determined by the intergovernmental system, and it does not fall where the risk sits. A panel of 50 states over four decades finds disaster-induced spending largely financed by transfers from above, with total tax revenues little affected. That protects subnational solvency and removes the fiscal signal that would otherwise drive subnational preparation — and the

budgets show it, with a study of 13 regional budgets finding that authorities do not systematically plan funds for crises and that implementation phases are least provided for. Adaptation finance compounds this, being allocated primarily to multilateral entities and national governments, with the amount reaching local recipients low and, in one analysis of thirty projects, least locally directed precisely where projected climate risk is highest.

Instruments exist and each does something specific. Global rather than regional pooling raises diversification by up to 65 per cent; layering a reserve, contingent credit and risk transfer addresses different loss frequencies; insurance improves recovery outcomes while its effect on risk reduction may be modest; and demand-side framing raises willingness to pay roughly twice as much as information provision. None of them substitutes for a subnational contingency provision that is calculated rather than nominal, or for technical guidance on administering it — the absence of which, in one documented Indonesian case, made an instrument built for speed into one officials hesitated to use. Finally, an absence deserves stating: no peer-reviewed benefit-cost estimate for prevention within this review window could be verified, so the argument most often made for prevention currently rests on institutional analysis. The argument made here does not depend on it.

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Author contributions (CRediT)

Rodyah Widyarani: conceptualisation; methodology; formal analysis; writing - original draft; writing - review and editing.

Conflict of interest

The authors declare that they have no competing interests.

Data availability

All data supporting the findings of this study are available within the article and from the publicly accessible sources cited therein.

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Declaration on the use of artificial intelligence

No generative artificial intelligence tool was used in the preparation of this manuscript.

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