

The effect of disaster insurance on community resilience: a research agenda for local policy

Karina French & Carolyn Kousky

To cite this article: Karina French & Carolyn Kousky (2023): The effect of disaster insurance on community resilience: a research agenda for local policy, Climate Policy, DOI: [10.1080/14693062.2023.2170313](https://doi.org/10.1080/14693062.2023.2170313)

To link to this article: <https://doi.org/10.1080/14693062.2023.2170313>



Published online: 01 Feb 2023.



The effect of disaster insurance on community resilience: a research agenda for local policy

Karina French  and Carolyn Kousky 

Environmental Defense Fund, New York, NY, USA

ABSTRACT

The risk of climate disasters has spurred increased interest in public policies that help expand the number of households with disaster insurance, particularly for financially vulnerable populations. In recent years, local governments, concerned with their community's resilience to climate disasters, have started to consider insurance programs as part of their adaptation strategies. However, we do not yet have a robust body of research that shows if, and how, expanded insurance take-up among households affects community-wide recovery after a climate disaster. Filling this disaster insurance research gap will better equip public sector leaders to assess if investments in insurance programs can further community resilience goals and when disaster insurance is an appropriate climate adaptation tool. In this article, we assess the state of empirical evidence through existing frameworks of community recovery and put forward an agenda for future research that is attuned to local policy needs.

Key policy insights:

- There is increasing interest by policymakers in expanding the number of households with disaster insurance to provide financial protection in the face of increasing climate risks, but little evidence exists on how household-level insurance affects community-level resilience outcomes.
- Expanded research on this topic could support local decision-makers in designing effective and efficient policies to support community recovery from climate extremes.
- Future research should focus on testing more holistic disaster recovery measures and downscaling global and national research to the local scale.
- Emerging pilot insurance programs and experimental policies offer novel opportunities to study impacts at the local level.

Introduction

Climate disasters are negative financial shocks to households, businesses, and communities. The widespread destruction from hurricanes, wildfires, flooding, and other climate extremes necessitates high post-disaster expenditures for repair and rebuilding; disasters can also simultaneously reduce income or revenue. As climate change increases the frequency, severity, and co-occurrence of extreme weather events worldwide, the economic costs of these 'climate disasters' are projected to increase (IPCC, 2022). Financial risk transfer through formal insurance plays a critical role in managing risks from climate extremes by smoothing disaster costs over time and making funds available to more quickly repair and rebuild (Kousky, 2022). There is a growing body of evidence that through these channels, insurance improves disaster recovery outcomes for individual households (Kalfin et al., 2022; Kousky, 2019).

Often, however, disaster insurance markets fail. Disasters, by their very nature, are difficult for the private market to insure at a price that insured people are willing or able to pay. In response to lack of private market coverage options, the public sector in countries around the world has stepped in to make insurance

more available or affordable. In some developed economies, countries mandate holistic coverage and provide state-guaranteed re-insurance or a public backstop for private firms that offer coverage (e.g. France, Spain, or Turkey), or have quasi- to fully-public insurance programs that write policies directly (e.g. the US and the UK) (McAneney et al., 2016; Paleari, 2019). In developing and agriculture-based economies with smaller insurance markets, some countries (i.e. India, Bangladesh, Ethiopia, Kenya, Nicaragua) have partnered with development agencies, NGOs, and/or private companies to support micro- and index-based insurance programs (Hellmuth et al., 2009; Miranda & Farrin, 2012; Surminski & Panda, 2020).

Despite these public-sector programs, there is still a large disaster insurance gap worldwide. This gap is the difference between total economic losses and the share that are insured. Globally, only about a quarter of disaster losses are insured (AIR Worldwide, 2019). International development entities like the World Bank, private firms in the insurance sector, and sovereign governments all have made public commitments to help close the disaster insurance gap, motivated by the financial benefits for insureds and the potential promise of decreased fiscal burden on the public sector.¹

Local governments are also increasingly concerned about disaster insurance coverage in their communities. The ability of residents to recover from climate disasters is not only important for individual wellbeing, but also thought to improve broader community-level welfare by strengthening post-disaster economic activity. For example, in the US, some cities are now exploring policies to close insurance gaps, particularly for lower-income households (Baker, 2019; Dixon et al., 2017; Sherman & Kousky, 2018).²

However, we do not yet have a robust body of literature that examines whether widespread insurance coverage affects recovery for a whole community, beyond just the individual households. Current disaster recovery theory characterizes community-wide resilience as dependent on individual resilience and recovery (Cutter et al., 2008), and the same may apply to insurance, where greater uptake of insurance by individual households could improve recovery for the community overall. Prior research has found that insurance improves *individual* economic recovery and housing stability in rural, urban, developing, and developed economies (Janvry, Ritchie, & Sadoulet, 2016; Chantarat et al., 2017; Bertram-Huemmer & Krahnert, 2017; ; Kousky, 2019). For low-income households, the benefits of income smoothing can protect against falling into ‘poverty traps’ post-disaster (Kovacevic & Pflug, 2011; Noritomo & Takahashi, 2020), and there are a small number of papers that show a link between insurance uptake and country-level economic recovery (Melecky & Raddatz, 2015; Von Peter, von Dahlen, & Saxena 2012; Carpenter et al. 2020). But we have very little understanding about the link between household disaster insurance and community-level recovery outcomes, such as housing access, local economic activity, health of residents, or fiscal impacts on the local government.

While causal mechanisms that link household disaster insurance to these community-level outcomes can be theorized, evidence is sparse. These impacts are likely heterogenous at any scale, varying by income and disaster type, but empirical studies exploring this complexity are also rare (Nguyen & Noy, 2020a). Evidence of this link could inform local public sector efforts to increase disaster insurance and show when publicly supported insurance is an appropriate local climate resilience and adaptation strategy.

In this paper, we use existing frameworks of community recovery to evaluate the current research on how insurance take-up among households affects community-level recovery outcomes. Our scope is a narrow slice of the broader insurance and recovery literature, limited to research that explores how formal insurance take-up impacts disaster recovery at a scale beyond households. We include research on all natural disasters beyond just climate-driven disasters, such as earthquakes, since the insurance and recovery dynamics are similar and can help inform responses to climate-driven disasters. We categorize the causal mechanisms and community recovery outcomes from existing research, and identify the extent to which these relationships have been observed, modelled, or theorized. We then identify gaps in the existing evidence base and propose a research agenda to inform local policies aimed at building financial resilience to climate disasters.

Defining community disaster recovery

Exploring the relationship between household insurance coverage and community recovery outcomes requires first defining ‘recovery’ and ‘community’. Research on post-disaster recovery began with a case-study synthesis conducted by Haas et al. (1977), who define recovery as a predictable four stage process of emergency

Sector	Recovery Domains	Potential Indicators
Economic	Employment	Rates of unemployment and underemployment; number of open jobs
	Economic Activity	GDP; cumulative GDP; local production value; retail sales; tourism revenue; property values
	Businesses	Office vacancy; agricultural, manufacturing, and industrial productivity
	Household Fiscal Health	Median income; household wealth; average household credit; poverty rates
	Government Fiscal Health	Budget deficit; debt level, tax revenues; government credit
Social	Health & Wellbeing	Morbidity and mortality rates; hospitalizations; rates of mental health and stress
	Population	Population; displaced population; migration
	Welfare & Basic Needs	Population of housed and unhoused; cost of housing; food access
	Schools & Education	Public school attendance; educational attainment
Physical Infrastructure	Residential Buildings	Residential units; permitting or construction rates; temporary structures
	Commercial Buildings	Commercial building units; permitting or construction rates
	Public Facilities	Government buildings rebuilt; regular government services resumed; hospitals operational
	Transportation	Length of functional roads; presence of vehicles; bus and train services operational
	Utilities	Utility (power and water) facilities operational; rate of reconnections; quality and consistency of service

Figure 1. Framework of community recovery indicators.

response, restoration, replacement, and commemoration. The subsequent 45 years of disaster research has complicated that definition. Current consensus is that communities are comprised of social, physical, and economic systems that affect and interact with each other. Therefore, 'recovery' is multi-dimensional and nonlinear, such that communities may not necessarily return to pre-existing conditions but could move into a new condition entirely (Comerio, 2014; Koliou et al., 2020; Olshansky & Chang, 2009). A 'community' in this context refers to local boundaries that reflect the geography that would experience similar disaster risk, and where these planning and adaptation decisions are being made (i.e. region, district, county, neighbourhood).

The multi-dimensional aspect of recovery explains why there is no single, unified framework used to track recovery from a disaster. While a systems-based definition better captures real-life processes, it requires multiple indicators across sectors to fully assess community recovery. In the absence of a unified framework, recovery studies have organized findings based on different structures depending on the research question, scale and data available. While few studies use the same exact framework to measure recovery, several components of community recovery are commonly referenced.

In this paper, we use a simple framework of community recovery based on those common organizing structures and metrics (Figure 1). We organize measuring recovery into 3 main sectors (economic, social, and built environment) and define the domains of each, based on the conclusions common across the handful of global-

scale and often-cited disaster recovery literature reviews (Chang & Rose, 2012; Johnson & Hayashi, 2012; Jordan & Javernick-Will, 2013; Lindell & Prater, 2003; Rouhanizadeh et al., 2020). We highlight a set of representational indicators used in disaster recovery studies in both developed economies (Beniya, 2007; Chang, 2010; Horney et al., 2018; Johnson, 2014; Miles & Chang, 2011), and developing economies (Brown et al., 2010; Feeny et al., 2022; Hettige & Haigh, 2016; Platt et al., 2020). This framework is not exhaustive, but it provides a structure to assess gaps in the disaster insurance literature. While many of these outcomes are interdependent, no single measure can capture a community's recovery after a disaster. Depending on how recovery is defined, studies vary in whether indicators are measured for speed or quality, and with various baselines – returning to pre-disaster conditions, trends, or a new stable state (Chang, 2010). Clarifying those distinctions is important for comparing research outcomes across studies, though we do not address them here.

The role of insurance in community recovery

Current literature and pathways of impact

Based on this framework, we map how insurance take-up might influence a community's recovery after a climate disaster. Many possible causal pathways could be theorized, often representing the multi-dimensional aspects of insurance. For example, greater insurance uptake in a community could lead to greater financial resources for rebuilding quickly, which could influence multiple metrics, such as increasing the number and speed of repaired buildings, reducing out-migration, and maintaining municipal tax revenue. Of course, these are all measures that are also influenced by other social and built environment dynamics.

Figure 2 summarizes the current literature on how insurance affects community-level outcomes. We organize the studies by sector, outline the multi-dimensional mechanisms of impact, and classify these pathways by level of empirical evidence:

- *Observed*: mechanisms observed in data from prior disasters
- *Modelled*: mechanisms explored from synthesized scenarios of disasters
- *Theorized*: mechanisms proposed in literature from case studies and interviews

We also note the geographic scale and location at which the causal pathway has been studied.

Identifying evidence gaps

Figure 2 allows us to assess the current literature on the role of insurance in community recovery by sector, evidence type, and geography. Some of the gaps in evidence are readily apparent from the figure. Most of the research in this space focuses on economic recovery (e.g. Attary, Cutler, Shields, & van de Lindt, 2020; Kraemer, Mrsnik, & Petrov, 2015). Of the existing empirical studies, all but one measure economic outcomes, and there are no studies on insurance's role in health outcomes, infrastructure, and basic services. The research on non-economic outcomes is predominantly theorized or modelled (Eriksen & de Vet, 2021; Lee, Shen, & Tran, 2009; Peacock, Dash, Zhang, & Van Zandt, 2018; Zhao, Lee, Li, & Yin, 2020). We do find multiple empirical studies based on observed data; however, the scale of that data is almost always at the global scale.

Looking at the combination of these factors clarifies the salient gaps in our evidence base. As Figure 2 shows, there are very few papers that are both observational and at the community scale; these are predominantly from developed economies (New Zealand, Australia, and the US). Nguyen and Noy (2020a, 2020b) and Owen et al. (2021) find that high insurance take-up led to quicker restoration of economic activity (measured by nightlights) in New Zealand after earthquakes and extreme weather events, respectively. Nguyen et al. (2020) find that in New Zealand, higher insurance payouts through direct cash payments post-earthquake are associated with lower average property value stemming from a disincentive of property improvements. Bill- ings et al. (2019) and Kousky et al. (2020) find that higher insurance take-up meant US households after Hurricane Harvey were less likely to default on mortgage payments and communities' average credit score was higher. Counter to Nguyen et al. (2020), Turnham et al. (2011) find that insurance was associated with

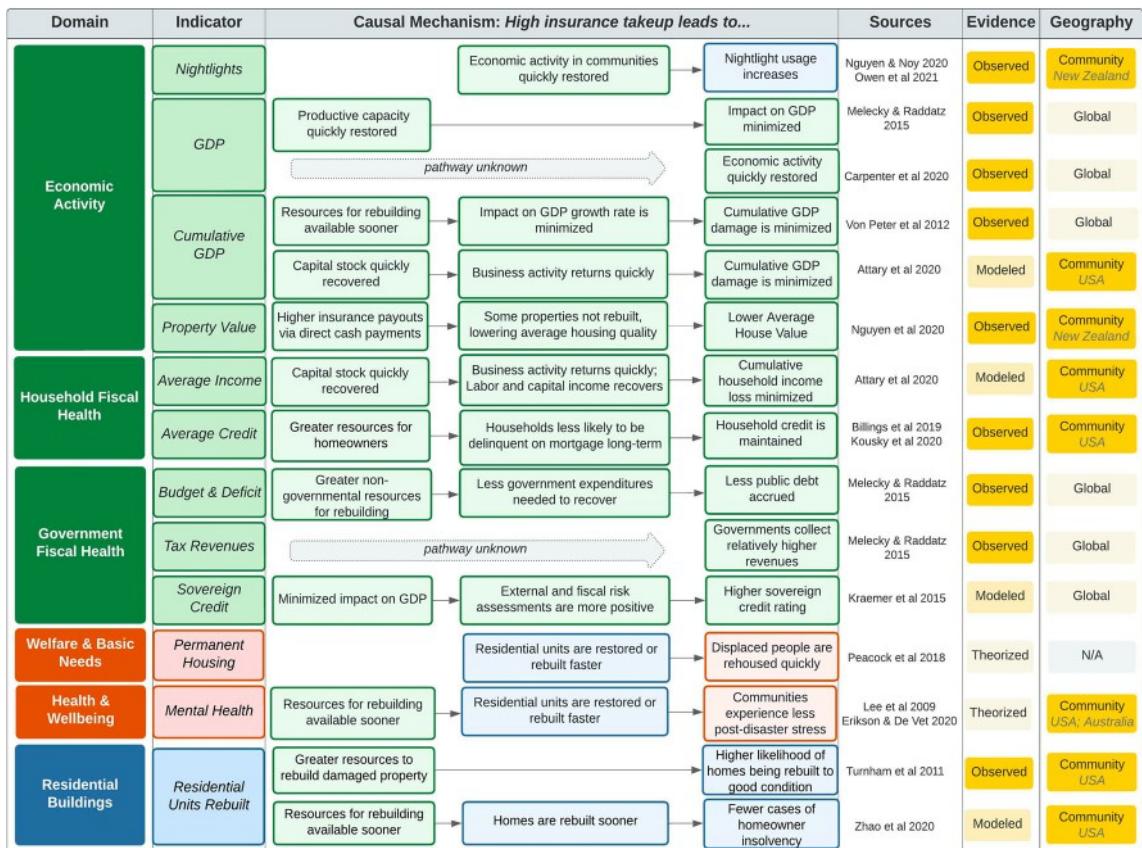


Figure 2. Existing evidence of insurance effects on community recovery.

neighbourhoods being rebuilt at a higher quality on the US Gulf Coast after Hurricane Katrina and Rita. These represent the few pieces of empirical evidence that local leaders could rely on to make decisions about public investments in insurance programs, and suggest greater research on these pathways is needed.

An agenda for future research

The literature reviewed shows the nascentcy of research in this space. We identify four important areas for future research to fill this gap and help inform local policymakers:

- *Scale existing research on economic recovery to the community level.* There are several promising observational studies on the role of insurance in influencing broader economic recovery, but most present findings are at the global scale based on patterns of country-level indicators. Research at that scale is not sufficient evidence to help guide local leaders on whether or when to invest in an insurance program to help secure greater coverage for residents.
- *Investigate impacts of insurance on the social and built environment.* Disaster recovery is not solely an economic process. Understanding if and how insurance impacts the recovery of social services, physical and mental health, access to education, and aspects of the built environment after climate disasters will better equip local leaders to understand how insurance might be a tool to meet more holistic resilience goals.
- *Test modelled mechanisms through observational studies.* Some of these potential pathways are modelled through simulated events. This type of study enables some granularity that may be inaccessible through

observation, but relies on a set of unobserved assumptions and therefore may not represent what will happen on-the-ground.

- *Investigate heterogeneous effects within and between countries and communities.* All of the current studies are situated in developed economies, despite the fact that developing countries stand to be the most affected by extreme events triggered by climate change. While there is a larger body of literature from developing and emerging economies on the impact of insurance on *household* outcomes, the research at a community scale is scarce. Much of the current literature also does not investigate how outcomes could differ by sub-populations. More studies that explore the different effects insurance take-up can have across and between communities based on income, housing tenure, and economic sector can help show how, when, and for whom insurance is an applicable community resilience tool.

While this was beyond the scope of this paper, insurance could also indirectly affect recovery by incentivizing households' preventative risk reduction behaviour. However, there is little empirical evidence of this dynamic; most studies rely on survey or constructed experiments, and many find that interest in risk reduction does not fluctuate based on insurance costs (Hanger et al., 2018; Hudson et al., 2016; Mol et al., 2020; Talberth et al., 2006). A few studies highlight potential reasons for this: for example, insurance premiums may be too low to match mitigation costs or distorted from the actual risk (Dixon et al., 2017; Hazra & Gallagher, 2022). Some new innovative models are being piloted to better link insurance and risk reduction (Kousky, 2022). Evaluating their impact is an important area for future work.

It should be noted that there are important methodological challenges that limit empirical analysis on insurance. Detailed insurance data is often not available for research, even from public insurance programs. Insurance take-up is correlated with income or wealth, which can confound identification (Lee & Chiu, 2012). Tackling these challenges will require creativity in research methods, willingness of governments to provide datasets to inform decision making, and seizing the opportunity of emerging pilot programs as natural experiments.

Conclusion

The role of insurance to smooth financial shocks and provide immediate capital for recovery can be critical for households after a disaster. For communities facing increasing risks from climate disasters, a well-functioning and inclusive disaster insurance market could be a tool for increasing community resilience to climate shocks. However, public policy design is currently limited by the incomplete evidence base for what investments in expanded household insurance coverage mean for community outcomes after a climate disaster. We find that the research on this topic has largely focused on global patterns of country-level, not community-level, indicators, and economic outcomes of recovery rather than broader social measures.

Critically missing from the research base is a deeper exploration of how the effects of insurance take-up and diffusion on climate disaster recovery may differ based on geographic and economic contexts. In developing countries, where populations will face more severe climate impacts, insurance sectors are nascent and many households do not have access to insurance at all. Within developed country insurance markets, communities with higher climate exposure and vulnerability often face higher costs that bar them from accessing insurance. In these contexts of low take-up, local public interventions that enable greater insurance coverage could potentially provide a critical new financial safety net, but must be designed carefully as to not fall short in protecting a community facing systemic risk.

Public investments in insurance, particularly when requiring large public subsidization, necessitate greater evidence that such programs will lead to positive community outcomes. A focused research effort as we detail here could fill this policy need. As new programs and pilots are developed and tested to provide greater access to insurance, these should also be carefully evaluated by researchers to identify the specific program and policy design details that have the greatest positive impact. While there are promising signs of positive resilience outcomes associated with insurance take-up in the literature to date, we need a greater understanding of when, where, and how insurance should be a strategy that communities invest in for resilience.

Notes

1. Much disaster insurance is provided by the public sector. The fiscal impact of these programs on the public sector depends on how they are designed and how much costs are publicly subsidized.
2. New pilot programs are emerging, such as New York City's Inclusive Insurance project (see: <https://edf.org/civicinnovations>).

Acknowledgements

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This material is based upon work supported by the National Science Foundation [grant number 2133256].

ORCID

Karina French <http://orcid.org/0000-0001-6777-0462>
 Carolyn Kousky <http://orcid.org/0000-0002-2140-9433>

References

AIR Worldwide. (2019). *Global modeled catastrophe losses*. AIR Worldwide Corporation.

Attary, N., Cutler, H., Shields, M., & van de Lindt, J. W. (2020). The economic effects of financial relief delays following a natural disaster. *Economic Systems Research*, 32(3), 351–377. <https://doi.org/10.1080/09535314.2020.1713729>

Baker, C. (2019). Como approves tax break for syracuse homeowners with flood insurance. *Syracuse.Com*, January 2.

Beniya, S. (2007). The evaluation of the status of disaster areas by using recovery indicators (In the Case of the Great Hanshin-Awaji Earthquake). In *2nd International Conference on Urban Disaster Reduction*, 7.

Bertram-Huemmer, V., & Kraehnert, K. (2017). Does index insurance help households recover from disaster? Evidence from IBLI Mongolia. *American Journal of Agricultural Economics*, 100(1), 145–171. <https://doi.org/10.1093/ajae/aax069>

Billings, S. B., Gallagher, E., & Ricketts, L. (2019). *Let the rich be flooded: The distribution of financial aid and distress after Hurricane Harvey*. SSRN Scholarly Paper ID 3396611. Social Science Research Network. <https://doi.org/10.2139/ssrn.3396611>

Brown, D., Platt, S., Bevington, J., Saito, K., Adams, B., Chenvidyakarn, T., Spence, R., Chuenpagdee, R., & Khan, A. (2010). Monitoring and evaluating post-disaster recovery using high-resolution satellite imagery-towards standardised indicators for post-disaster recovery. In *8th International Workshop on Remote Sensing for Disaster Application*. Tokyo.

Carpenter, O., Coburn, A., Platt, S., Mahdavian, F., Mahalingham, A., Tsang, J., Tuveson, M., Copic, J., & Daffron, J. (2020). *Optimising Disaster Recovery: The role of insurance capital in improving economic resilience* (p. 21). AXA XL Reinsurance.

Chang, S. E. (2010). Urban disaster recovery: A measurement framework and its application to the 1995 Kobe earthquake. *Disasters*, 34(2), 303–327. <https://doi.org/10.1111/j.1467-7717.2009.01130.x>

Chang, S. E., & Rose, A. Z. (2012). Towards a theory of economic recovery from disasters. *International Journal of Mass Emergencies and Disasters*, 30(2), 171–181. <https://doi.org/10.1177/028072701203000202>

Chantarat, S., Mude, A. G., Barrett, C. B., & Turvey, C. G. (2017). Welfare impacts of index insurance in the presence of a poverty trap. *World Development*, 94(June), 119–138. <https://doi.org/10.1016/j.worlddev.2016.12.044>

Comerio, M. C. (2014). Disaster recovery and community renewal: Housing approaches. *Cityscape*, 16(2), 51–68. <https://doi.org/10.4324/9781315404264-14>

Cutter, S. L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. (2008). A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18(4), 598–606. <https://doi.org/10.1016/j.gloenvcha.2008.07.013>

Dixon, L., Clancy, N., Miller, B., Hoegberg, S., Lewis, M., Bender, B., Ebinger, S., Hodges, M., Syck, G., Nagy, C., & Choquette, S. (2017). *The cost and affordability of flood insurance in New York city: Economic impacts of rising premiums and policy options for one- to four-family homes*. RAND Corporation. <https://doi.org/10.7249/RR1776>.

Eriksen, C., & de Vet, E. (2021). Untangling insurance, rebuilding, and wellbeing in bushfire recovery. *Geographical Research*, 59(2), 228–241. <https://doi.org/10.1111/1745-5871.12451>

Feeny, S., Trinh, T.-A., & de Silva, A. (2022). Detecting disasters and disaster recovery in Southeast Asia: Findings from space. *Natural Hazards Review*, 23(2), 04021065. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000532](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000532)

Haas, J. E., Kates, R. W., & Bowden, M. J. (1977). *Reconstruction following disaster*. The MIT Press.

Hanger, S., Linnerooth-Bayer, J., Surminski, S., Nenciu-Posner, C., Lorant, A., Ionescu, R., & Patt, A. (2018). Insurance, public assistance, and household flood risk reduction: A comparative study of Austria, England, and Romania. *Risk Analysis*, 38(4), 680–693. <https://doi.org/10.1111/risa.12881>

Hazra, D., & Gallagher, P. (2022). Role of insurance in wildfire risk mitigation. *Economic Modelling*, 108(March), 105768. <https://doi.org/10.1016/j.econmod.2022.105768>

Hellmuth, M. E., Osgood, D. E., Hess, U., Moorhead, A., & Bhojwani, H. (Eds.). (2009). *Index insurance and climate risk: Prospects for development and disaster management*. Climate and society 2. Columbia University.

Hettige, S., & Haigh, R. (2016). An integrated social response to disasters: The case of the Indian ocean tsunami in Sri Lanka. *Disaster Prevention and Management: An International Journal*, 25(5), 595–610. <https://doi.org/10.1108/DPM-11-2015-0263>

Horney, J., Dwyer, C., Chirra, B., McCarthy, K., Shafer, J., & Smith, G. (2018). Measuring successful disaster recovery. *International Journal of Mass Emergencies and Disasters*, 36(1), 1–22. <https://doi.org/10.1177/028072701803600101>

Hudson, P., Wouter Botzen, W. J., Feyen, L., & Aerts, J. C. J. H. (2016). Incentivising flood risk adaptation through risk based insurance premiums: Trade-offs between affordability and risk reduction. *Ecological Economics*, 125(May), 1–13. <https://doi.org/10.1016/j.ecolecon.2016.01.015>

IPCC. (2022). Climate change 2022: Impacts, adaptation and vulnerability. In H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegria, & M. Craig (Eds.), *Contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change* (pp. 1522–1535). Cambridge University Press.

Janvry, A. d., Ritchie, E. R., & Sadoulet, E. (2016). *Weather index insurance and shock coping: Evidence from Mexico's CADENA program*. Working Paper. World Bank. <https://doi.org/10.1596/1813-9450-7715>

Johnson, L. A. (2014). Developing a local recovery management framework: Report on the post-disaster strategies and approaches taken by three local governments in U.S. following major disasters. *International Journal of Mass Emergencies and Disasters*, 32(2), 242–247. <https://doi.org/10.1177/028072701403200201>

Johnson, L. A., & Hayashi, H. (2012). Synthesis efforts in disaster recovery research. *International Journal of Mass Emergencies and Disasters*, 30(2), 212–238. <https://doi.org/10.1177/028072701203000205>

Jordan, E., & Javernick-Will, A. (2013). Indicators of community recovery: Content analysis and Delphi approach. *Natural Hazards Review*, 14(1), 21–28. [https://doi.org/10.1061/\(ASCE\)NH.1527-6996.0000087](https://doi.org/10.1061/(ASCE)NH.1527-6996.0000087)

Kalfin, S., Supian, S., & Mamat, M. (2022). Insurance as an alternative for sustainable economic recovery after natural disasters: A systematic literature review. *Sustainability*, 14(7), 4349. <https://doi.org/10.3390/su14074349>

Koliou, M., van de Lindt, J. W., McAllister, T. P., Ellingwood, B. R., Dillard, M., & Cutler, H. (2020). State of the research in community resilience: Progress and challenges. *Sustainable and Resilient Infrastructure*, 5(3), 131–151. <https://doi.org/10.1080/23789689.2017.1418547>

Kousky, C. (2019). The role of natural disaster insurance in recovery and risk reduction. *Annual Review of Resource Economics*, 11(1), 399–418. <https://doi.org/10.1146/annurev-resource-100518-094028>

Kousky, C. (2022). *Understanding disaster insurance: New tools for a more resilient future*. Island Press. <https://islandpress.org/books/understanding-disaster-insurance>

Kousky, C., Palim, M., & Pan, Y. (2020). Flood damage and mortgage credit risk: A case study of Hurricane Harvey. *Journal of Housing Research*, 29(Suppl. 1), S86–120. <https://doi.org/10.1080/10527001.2020.1840131>

Kovacevic, R. M., & Pflug, G. C. (2011). Does insurance help to escape the poverty trap? A ruin theoretic approach. SSRN Scholarly Paper ID 1964110. Social Science Research Network. <https://doi.org/10.1111/j.1539-6975.2010.01396.x>

Kraemer, M., Mrsnik, M., & Petrov, A. (2015). *Storm alert: Natural disasters can damage sovereign creditworthiness*. Standard & Poor's Ratings Services.

Lee, C.-C., & Chiu, Y.-B. (2012). The impact of real income on insurance premiums: Evidence from panel data. *International Review of Economics & Finance*, 21(1), 246–260. <https://doi.org/10.1016/j.iref.2011.07.003>

Lee, E.-K. O., Shen, C., & Tran, T. V. (2009). Coping with Hurricane Katrina: Psychological distress and resilience among African American evacuees. *Journal of Black Psychology*, 35(1), 5–23. <https://doi.org/10.1177/0095798408323354>

Lindell, M. K., & Prater, C. S. (2003). Assessing community impacts of natural disasters. *Natural Hazards Review*, 4(4), 176–185. [https://doi.org/10.1061/\(ASCE\)1527-6988\(2003\)4:4\(176\)](https://doi.org/10.1061/(ASCE)1527-6988(2003)4:4(176))

McAneney, J., McAneney, D., Musulin, R., Walker, G., & Crompton, R. (2016). Government-sponsored natural disaster insurance pools: A view from down-under. *International Journal of Disaster Risk Reduction*, 15(March), 1–9. <https://doi.org/10.1016/j.ijdrr.2015.11.004>

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. <http://doi.org/10.1093/wber/lht041>

Miles, S., & Chang, S. (2011). ResilUS: A community based disaster resilience model. *Cartography and Geographic Information Science*, 38(January), 36–51. <https://doi.org/10.1559/1523040638136>

Miranda, M. J., & Farrin, K. (2012). Index insurance for developing countries. *Applied Economic Perspectives and Policy*, 34(3), 391–427. <https://doi.org/10.1093/aep/pps031>

Mol, J. M., Wouter Botzen, W. J., & Blasch, J. E. (2020). Risk reduction in compulsory disaster insurance: Experimental evidence on moral hazard and financial incentives. *Journal of Behavioral and Experimental Economics*, 84(February), 101500. <https://doi.org/10.1016/j.soec.2019.101500>

Nguyen, C., Noy, I., Sommervoll, D. E., & Yao, F. (2020). Redrawing of a housing market: Insurance payouts and housing market recovery in the wake of the Christchurch earthquake of 2011. *SSRN Electronic Journal, CESifo Working Paper No. 8560*. <https://doi.org/10.2139/ssrn.3699240>

Nguyen, C. N., & Noy, I. (2020a). Comparing earthquake insurance programmes: How would Japan and California have fared after the 2010–11 earthquakes in New Zealand? *Disasters*, 44(2), 367–389. <https://doi.org/10.1111/disa.12371>

Nguyen, C. N., & Noy, I. (2020b). Measuring the impact of insurance on urban earthquake recovery using nightlights. *Journal of Economic Geography*, 20(3), 857–877. <https://doi.org/10.1093/jeg/lbz033>

Noritomo, Y., & Takahashi, K. (2020). Can insurance payouts prevent a poverty trap? Evidence from randomised experiments in Northern Kenya. *The Journal of Development Studies*, 56(11), 2079–2096. <https://doi.org/10.1080/00220388.2020.1736281>

Olshansky, R., & Chang, S. (2009). Planning for disaster recovery: Emerging research needs and challenges. *Progress in Planning*, 72(4), 200–209. <https://doi.org/10.1016/j.progress.2009.09.001>

Owen, S., Noy, I., Pástor-Paz, J., & Fleming, D. (2021). Measuring the impact of insurance on recovery after extreme weather events using nightlights. *Asia-Pacific Journal of Risk and Insurance*, 15(2), 169–199. <https://doi.org/10.1515/apjri-2020-0036>

Paleari, S. (2019). Disaster risk insurance: A comparison of national schemes in the EU-28. *International Journal of Disaster Risk Reduction*, 35(April), 101059. <https://doi.org/10.1016/j.ijdrr.2018.12.021>

Peacock, W. G., Dash, N., Zhang, Y., & Van Zandt, S. (2018). Post-disaster sheltering, temporary housing and permanent housing recovery. In H. Rodríguez, W. Donner, & J. E. Trainor (Eds.), *Handbook of disaster research, handbooks of sociology and social research* (pp. 569–594). Springer International Publishing. https://doi.org/10.1007/978-3-319-63254-4_27

Platt, S., Gautam, D., & Rupakhetty, R. (2020). Speed and quality of recovery after the Gorkha earthquake 2015 Nepal. *International Journal of Disaster Risk Reduction*, 50(November), 101689. <https://doi.org/10.1016/j.ijdrr.2020.101689>

Rouhanizadeh, B., Kermanshachi, S., & Nipa, T. J. (2020). Exploratory analysis of barriers to effective post-disaster recovery. *International Journal of Disaster Risk Reduction*, 50(November), 101735. <https://doi.org/10.1016/j.ijdrr.2020.101735>

Sherman, J., & Kousky, C. (2018). *Local solutions to flood insurance affordability: Portland's flood insurance savings program*. Wharton Risk Management and Decision Processes Center.

Surminski, S., & Panda, A. (2020). *Disaster insurance in developing Asia: An analysis of market-based schemes*. SSRN Scholarly Paper. Rochester, NY. <https://doi.org/10.2139/ssrn.3644910>

Talberth, J., Berrens, R. P., McKee, M., & Jones, M. (2006). Averting and insurance decisions in the wildland–urban interface: Implications of survey and experimental data for wildfire risk reduction policy. *Contemporary Economic Policy*, 24(2), 203–223. <https://doi.org/10.1093/cep/byj021>

Turnham, J., Burnett, K., Martin, C., McCall, T., Juras, R., & Spader, J. (2011). *Housing recovery on the gulf coast – Phase II: Results of property owner survey in Louisiana, Mississippi, and Texas*. Rep. for US Dep. Housing Urban Dev., Off. Policy Dev. Res.

von Peter, G., von Dahlen, S., & Saxena, S. C. (2012). *Unmitigated disasters? New evidence on the macroeconomic cost of natural cat-astrophes*. BIS. <https://www.bis.org/publ/work394.htm>

Zhao, J., Lee, J. Y., Li, Y., & Yin, Y.-J. (2020). Effect of catastrophe insurance on disaster-impacted community: Quantitative framework and case studies. *International Journal of Disaster Risk Reduction*, 43(February), 101387. <https://doi.org/10.1016/j.ijdrr.2019.101387>