Chapter 11.

IS COMPULSORY CATASTROPHIC RISK INSURANCE THE ONLY OPTION?

The increasing frequency and economic impact of natural disasters are intensifying the debate about the development of insurance as a tool for risk financing and management. The success and sustainability of insurance schemes for natural disaster losses rely on various factors, many of which extend beyond insurance itself. Catastrophe risk insurance provides compensation after a disaster to mitigate its consequences and works alongside other recovery strategies, including government-provided compensation.

Low insurance coverage rates increase pressure on governments to fund disaster recovery. However, if governments offer full compensation after disasters, citizens have less incentive to buy insurance, a situation known as charity hazard, which further decreases insurance demand.

Disaster risk management encompasses both recovery and risk reduction strategies, which are interconnected. Insurance companies consider prevention and mitigation when assessing risks and potential losses, impacting the insurability, accessibility, and affordability of disaster insurance. While insurance focuses on risk pricing and transfer, moral hazard must be considered to avoid economic inefficiencies and market failures.[359]

Moral hazard can occur at the government level, where effective private insurance might reduce the urgency to prevent risks, and at the individual level, where insurance might create a false sense of security. This issue is particularly evident in compulsory schemes with flat premiums supported by governments, which tend to offer uniform catastrophe benefits without discrimination. Consequently, moral hazard is also associated with government compensation after disasters.

Better data and new digital technologies potentially reduce risks, making this one of the greatest societal benefits. The fact that enormous amount of data is globally available for analysis at all times, allow insurers to better assess individual and dynamic risks and provide continuous feedback to policyholders,

[359] World Bank Group, GFDRR, UK Aid, FERDI (2015). *Disaster risk financing and insurance: Issues and results*. Clairmont-Ferrand: FERDI

with no or limited human interaction.[360] By providing risk insights to policyholders, such ”digital monitoring” encourages behavioral change to reduce risks. Moreover, new data sources allow for the implementation of advanced risk management systems that use predictive analytics as a basis for early intervention and risk prevention. Ultimately, thanks to digital technologies the insurance industry evolves from pure risk protection towards risk prediction and prevention.[361]

European countries have developed various approaches to provide households with financial protection against losses from natural disasters, aiming to achieve objectives like coverage availability and affordability, solidarity, and incentives for risk reduction. These approaches come with trade-offs and can be categorized into two basic insurance models.[362]

First, there is the voluntary add-on insurance scheme, where natural hazard coverage is optional and offered by private insurers alongside standard property policies. These schemes typically use risk-based premiums, which help limit moral hazard but can lead to adverse selection, as only those at higher risk are likely to purchase the coverage. Consequently, insurance penetration remains low, increasing the need for government assistance after disasters.

The second model is the compulsory offer, where property insurance must include disaster risk coverage. This model generally uses non-risk-based premiums to ensure affordability and availability in high-risk areas. While insurance penetration is high in this model, it also leads to significant moral hazard among policyholders and substantial potential losses. Therefore, these schemes are often supported by the state to manage the high risks involved.

Scholars have identified several strategies to address the weaknesses of voluntary and compulsory natural disaster insurance models. For voluntary schemes, increasing insurance penetration can be achieved by requiring

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[360] Asimakopoulou, E., & Bessis, N. (2010). Advanced ICTs for disaster management and threat detection: Collaborative and distributed frameworks. *IGI Global*, pp. 80-94.

[361] Chroneos Krasavac, B., & Kaličanin, Đ. (2020). The Impact of Big Data and Business Analytics on the Competitiveness of Insurance Companies. *Insurance market after COVID-19,* Kočović, J., Rakonjac-Antić, T., Jovanović Gavrilović, B., Boričić, B. (eds.), Belgrade: Faculty of Economics, University of Belgrade, pp. 383-401.

[362] Paleari, S. (2019). Disaster risk insurance: A comparison of national schemes in the EU-28. *International Journal of Disaster Risk Reduction, 35,* 101059.

coverage for mortgage approval or bundling it with property insurance contracts, especially if opting out is not allowed. Limited or no government compensation after a disaster can also drive demand for such insurance. Additionally, bundling major risks into a single policy and applying exclusions can reduce adverse selection. Affordability can be enhanced through premium subsidies or tax relief for disaster insurance premiums.

In compulsory schemes, moral hazard might be mitigated by adopting risk-based premiums, applying deductibles, setting compensation limits, offering premium discounts, and including exclusions. However, the effectiveness of these measures, influenced by behavioural factors, remains uncertain and requires further study.[363]

The global economic losses caused by natural disasters have increased significantly over the past few decades and are projected to increase further in certain regions of the world as result of climate change and population and economic growth in areas at risk.1 This has initiated a discussion among insurers and governments within several countries about whether or not natural disaster risks are insurable with current arrangements. A well-designed natural disaster insurance arrangement can ameliorate and limit climate change impacts by spreading risk and providing incentives for risk reduction

The first section of this chapter deals with important lessons that needs to be learned about how existing insurance arrangements for extreme events are designed in different countries, what their main components are and how they are integrated into systems.The technical aspects of the reliability and the sustainability of PP insurance schemes are also examined. The financial viability and long-term robustness of an insurance system are determined by several key components: their main characteristics, funding mechanisms, and achievement of risk reduction. These elements provide valuable insights for policymakers seeking to establish or enhance a natural disaster insurance arrangement.

The second part of this chapter focuses on innovative new models of catastrophe insurance delivery to secure widespread coverage and help sustain communities following a catastrophic event. One such approach is community-based catastrophe insurance (CBCI)[364], a disaster insurance program arranged

[363] Paleari (2019), op. cit.

[364] Bernhardt, A., Kousky, C., Read, A., & Sykes, C. (2021). *Community-based catastrophe insurance: A model for closing the disaster protection gap.* Philadelphia: Wharton University & Marsh& McLennan Advantage.

by a local government, a quasi-governmental body — such as a special-purpose district — or a community group covering individual properties within the community, with the potential to enhance the financial resilience of communities and their residents, provide affordable and reliably available disaster insurance, and create incentives for community-level and individual risk reduction.

1. NATURAL DISASTER INSURANCE SYSTEM ESTABLISHMENT: COMPONENTS, INDICATORS AND KEY LESSONS

A large variety of catastrophe insurance systems can be observed across the globe. Experience has proven that the introduction of new big data technologies and tools in the insurance sector enables the development of new powerful business models, which in turn enables the insurance to evolve from "understand and protect" towards "predict and prevent".[365]

The general characteristics of a natural disaster insurance system include:

1. **Year of Establishment**: The inception date of the system, which provides context for its development and maturity over time.
2. **Voluntary or Mandatory**: Whether participation in the insurance system is optional for individuals and businesses (voluntary) or required by law (mandatory). This distinction affects enrollment rates and overall coverage.
3. **Roles of Stakeholders**: The main responsibilities and contributions of both public and private sector stakeholders. Public sector roles often include regulation, oversight, and providing subsidies or funding. Private sector roles typically involve underwriting policies, managing claims, and offering risk assessment services.

Understanding these characteristics helps in assessing the design and functionality of the insurance system, as well as the collaboration between different sectors in managing natural disaster risks.[366]

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[365] Senousy, Y., Ghitany, N., & Riad, A. (2018). Recent Trends in big data analytics towards more enhanced insurance business models. *International Journal of Computer Science and Information Security, 16*(12), p. 39.

[366] Martinez-Diaz, L., Sidner, L., & Mcclamrock, J. (2019). *The Future of disaster risk pooling for developing countries: Where do we go from here?* Washington, DC: World Resources Institute.

Furthermore, the main characteristics of insurance arrangements are determined by the size of the catastrophe risk, which consists of the standard disaster return period and the damage that can be expressed as a percentage of GDP. The damage and frequency of the hazard can influence the degree of responsibilities that each stakeholder takes on within the system. The market penetration rate of an insurance scheme indicates how many people are covered by the insurance. Sometimes insurance is compulsory in order to achieve a high market penetration rate. In PP systems, where the government covers part of the damage, indemnities may be paid conditional on an official trigger in the form of an official declaration of a disaster.

The comparative analysis in the previous section shows that, while each system has its own characteristics, there are certain features from which lessons can be drawn for setting up a well-functioning natural disaster compensation arrangement. Such a system should, ideally, be financially sustainable, have adequate policies for preventing and mitigating risks, and be able to provide affordable insurance with low management expenses to a broad public in hazard-prone areas. Four main aspects—mandatory vs. voluntary participation; the costs of the insurance; the role of the private insurance market and the government in financing the insurance, and incentives and policies for mitigation—appear to be important for the functioning of insurance.[367]

1.1. Mandatory insurance and the market penetration

Insurance systems have low market penetration rates if there are not, or only weak, mandatory purchase requirements. The market penetration rate is especially low in the private insurance system in Germany. The public insurance systems in Switzerland and Spain have very high market penetration rates, which also applies to some PP insurance systems with strict mandatory purchase requirements (CatNat, WN). A notable exception is the TCIP that has a low market penetration rate, which is caused by the failure of the government to enforce the mandatory purchase requirements.[368] In several countries, such as the U.S. and Germany, low market penetration rate may be the reason for the provision of large amounts of government relief after a disaster to compensate uninsured damage, which reduces incentives for individuals to purchase insurance. Therefore, it is beneficial if the government establishes and enforces a strict mandatory purchase requirement because this can result in a high market

[367] Paudel, Y. A. (2012). Comparative study of public-private catastrophe insurance systems: Lessons from current practices. *The Geneva Papers on Risk and Insurance - Issues and Practice, 37*, pp. 257-285. https://doi.org/10.1057/gpp.2012.16

[368] Ibid.

penetration and a large pool of insured, which facilitates risk spreading and may reduce costs while it limits the need for ad hoc government relief.[369]

Traditional business information systems acquire data through batch processes before making the data available to the business, but with the introduction of new open-source technology, insurer companies are now able to quickly acquire the process and exploit both structured and unstructured data within seconds, rather than at fixed points in the week, month or year [370].

In conclusion, big data has become a very beneficial approach for insurance companies. It mainly provides added values through the five 'V' parameters: volume, velocity, variety, veracity, and variability, to which some researchers also add visualization and value.[371]

1.2. Costs of insurance

Fully private insurance systems generally result in the highest premium levels. In contrast, fully public insurance systems have lower premiums and appear to be the most cost-effective. The premiums for public-private (PP) insurance systems typically fall between those of fully private and fully public systems.

Fully public or PP mandatory systems are often guided by social and collective risk-sharing principles based on mandatory participation. This approach creates a large pool of policyholders, allowing administrative costs and claims to be spread across a broader base. Additionally, because the public sector covers part of the risks, there is less reliance on more expensive private reinsurance.[372]

However, public reinsurance or a state guarantee can lead to additional indirect costs for taxpayers. Despite this, almost all insurance systems utilize the private

[369] Chroneos Krasavac, B., Nedeljković, S., & Bijelić, M. (2015). The Role of Government in Disaster Risk Management. *Catastrofic Risks and Sustainable Development*, Kočović, J., Jovanović Gavrilović, B., Đukić, V. (eds.), Belgrade: Faculty of Economics, University of Belgrade, pp. 61-82.

[370] Chroneos Krasavac, B., Soldić-Aleksić, J., & Petković, G. (2016). The Big Data Phenomenon - Business and Public Impact. *Industrija, 44*(2), pp. 117-144.

[371] Swan, M. (2015). Philosophy of Big Data: Expanding the Human-Data Relation with Big Data Science Services. *IEEE First International Conference on Big Data Computing Service and Applications.* DOI: 10.1109/EITT.2015.29.

[372] Few, R., Scott, Z., Wooster, K., Avila, M., & Tarazona, M. (2016). Strengthening capacities for disaster risk management II: Lessons for effective support. *Journal for Disaster Risk Management, 20,* pp. 154-162.

sector to sell and administer insurance policies and process claims. This collaboration can be cost-effective, provided that the fees paid to private insurers for these services are not excessively high, as seen in some cases.[373]

1.3. Financing the insurance system

Public or public-private (PP) insurance systems are often designed to address specific historical and potential disasters and their associated damage. Most of these arrangements, with the exception of Switzerland, transfer damage above a certain threshold to the government. This transfer is typically financed through a state guarantee, state-backed reinsurance, or a combination of both.[374]

In both public and PP insurance arrangements, such as in Spain, private insurers typically sell and administer policies. They also provide expertise and tools to assess catastrophe damage. In PP systems, the private sector usually offers limited coverage for more common types of damage. This division of responsibilities is generally cost-efficient, leveraging the private insurers' expertise in covering medium-sized damage from catastrophic events under public sector regulations.[375]

From the PP flood insurance systems, it is evident that the government tends to play a larger role in covering risks associated with more significant potential damage. For instance, in the U.S., federal disaster relief and the National Flood Insurance Program (NFIP) illustrate the government's substantial role in managing large-scale flood risks.

With the exception of the NFIP, all the public and PP insurance systems have some integrated form of risk-transferring mechanism, with the purpose of making insurance available for extreme risks that would, otherwise, often be uninsurable for a broad public at an affordable price. It is important to integrate adequate risk-transferring mechanisms in PP insurance schemes for three main reasons:[376]

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[373] Mechler, R. (2016). Reviewing estimates of the economic efficiency of disaster risk management: Opportunities and limitations of using risk-based cost–benefit analysis. *Natural Hazards, 81,* pp. 2121-2147.

[374] Faure, M. G., & Heldt, T. (2016). Resilient compensation mechanisms: The role of government intervention in the insurance of catastrophic risks. *Law and the Management of Disasters,* Herwig, A, Simoncini, M. (eds), London: Routledge, pp. 224-244. DOI:10.4324/9781315639321-13

[375] Ibid.

[376] Paudel (2012), op. cit.

(1) A PP natural disaster insurance scheme without a state guarantee, reinsurance or reserves with tax-exemptions may prevent private insurers from offering insurance against catastrophe risk. A reason for this is that private insurers are reluctant to cover uncertain risks with potentially very large damages, which could result in insolvency in the absence of a state guarantee or a risk-transferring mechanism, such as public reinsurance. A potential downside of voluntary public reinsurance is the problem of risk selection. This issue arises when only higher-risk individuals or entities opt into the reinsurance, leading to an imbalanced risk pool. This selective participation can undermine the financial stability of the insurance system, as it concentrates the risk and increases the likelihood of significant payouts.[377]

(2) Premiums can be kept more affordable if the government covers part of the extreme damage because in a private market, premiums often considerably exceed "actuarially fair" values due to the reinsurer's high costs of capital and anomalies in reinsurance markets. Apart from a state guarantee or public reinsurance, most of the systems are able to diversify the extreme catastrophe risk across insurers by pooling risk or by purchasing reinsurance in the local and international market and, thereby, reduce their costs of holding large amounts of internal capital, which translates into low premiums.[378]

(3) Countries with a risk-transferring system usually allow insurers to build technical or equalization reserves with a specific level of tax-exemption in order to prevent cash flow depletion in the event of a catastrophe. The NFIP is an exception and does not have tax-exempted reserves or private reinsurance, but can borrow deficits from the Goverment. This is likely to have a negative effect on the NFIP's financial position and its long-term solvency. In general, it seems to be advisable to integrate adequate public and/or private risk transferring mechanisms in a PP natural disaster insurance system in order to ensure long-term solvency, keep premiums affordable and prevent the need for ad hoc public disaster relief.

[377] Botzen, W. J. W., Kunreuther, H., & Michel-Kerjan, E. (2019). Protecting against disaster risks: Why insurance and prevention may be complements. *Journal of Risk and Uncertainty, 59*, pp. 151-169. https://doi.org/10.1007/s11166-019-09312-6

[378] Thirawat, N., Udompol, S., & Ponjan, P. (2017). Disaster risk reduction and international catastrophe risk insurance facility. *Mitigation and Adaptation Strategies for Global Change, 22*, pp. 1021-1039.

1.4. Policies and incentives for mitigating catastrophe damage

Providing (financial) incentives and designing policies for damage mitigation has benefits for both the policyholders and the insurers, since they decrease risk and hence enhance financial solvency and decrease the costs of the PP catastrophe insurance system in the long run. In the face of a projected increase in natural disaster risk as a result of climate change, it is especially important to integrate policies and incentives for risk reduction in natural disaster insurance systems and thereby promote climate change adaptation. The importance of mitigation has been recognized by most of the insurance systems, albeit to different extents. The lessons that can be drawn from the comparative analysis concern the following three main aspects:[379] (1) risk assessment and mapping; (2) policies and regulations that are integrated in the insurance system; and (3) (financial) incentives that the insurance provides to policyholders to invest in mitigation:

(1) Risk assessments can guide protection, spatial planning and building code measures by identifying the areas and properties at (high) risk. Creating risk maps that depict properties or zones at risk of a specific hazard is a convenient way of summarizing and depicting the results of a risk assessment. Risk assessments are probably best conducted by collaboration between insurers and the governments. Insurers have a useful expertise in assessing risks and using risk assessments as an input for determining actuarially sound premiums, while natural disaster risk assessment can provide an important input for prevention and mitigation programs of the public sector.[380]
(2) Policies for damage mitigating for flood and earthquake risks are: enhancing early warning systems and risk awareness; implementing zoning and building code standards; providing subsidies for mitigation; and investing in public protection infrastructure. It seems advisable that a PP catastrophe insurance system incorporates mitigation policies that focus on the full spectrum of prevention of hazards, mitigating damage through building codes and providing financial resources (e.g. subsidies) for implementing such measures. These mitigation policies

[379] Gurenko, E. N. (2004). Building effective catastrophe insurance programmes at the country level: A risk management perspective. *Catastrophe Risk and Reinsurance: A Country Risk Management Perspective*, Gurenko, E. N. (ed.). Washington: World Bank Group, pp. 3-16.

[380] Surminski, S., & Hudson, P. (2017). Investigating the risk reduction potential of disaster insurance across Europe. *The Geneva Papers on Risk and Insurance - Issues and Practice, 42*(2), pp. 247-274.

are, mostly, a public task. Prevention of damage can be regarded as a local public good that is likely to be undersupplied by private insurers, because the benefits of prevention, in terms of lower flood damage and hazard to human lives in general, accrue to the broader community that is protected, while such benefits cannot be completely captured by an insurer in a competitive market.[381]

(3) Financial incentives can stimulate policyholders to take measures that reduce their risk. For example, risk-based premiums can provide incentives to prevent building in high-risk areas, because living there would imply high insurance costs. Moreover, policyholders can be rewarded for taking mitigation measures by giving them discounts on premiums or deductibles. Differentiation of premiums according to risks involves administrative costs but is likely to save future claims because risk-based premiums stimulate mitigation. In general, the fully public insurance systems have not integrated financial incentives for mitigation, the private insurance systems provide such incentives to some degree by charging partly risk-based premiums, and several PP insurance systems stimulate mitigation via premiums discounts (e.g. the NFIP, the CEA, the JER and the TCIP). The French CatNat is the only system that provides this incentive through deductibles, although the monitoring and enforcement of this incentive could be improved. In general, incentives for mitigation are unlikely to provide a substantial contribution to limiting natural disaster risks in voluntary systems because the incentives only apply to the low number of policyholders who purchase the insurance.[382]

2. MODELS FOR CLOSING THE DISASTER PROTECTION GAP

Insurance plays a critical role in the recovery from disasters, but many households and small businesses do not have sufficient savings to fund repair and rebuilding on their own. Disaster aid can be insufficient and delayed, leaving victims struggling and with uncertain prospects.[383]

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[381] Thirawat et. al. (2017), op. cit.

[382] Chroneos Krasavac, B., & Gurenko, E. (2016). Government as a Risk Manager Designed for New Times. *Risk Management in the Financial Service Sector*, Kočović, J., Jovanović Gavrilović, B., Trifunović, D. (eds.), Belgrade: Faculty of Economics, University of Belgrade, pp. 503-521.

[383] Charpentier, A., Barry, L., & James, M. R. (2022). Insurance against natural catastrophes: balancing actuarial fairness and social solidarity. *The Geneva Papers on Risk and Insurance-Issues and Practice*, *47*(1), pp. 50-78.

Insurance is a vital source of adequate and immediate recovery funds, yet many remain uninsured against disasters — referred to as the protection gap. The impacts of the disaster protection gap can cascade; having the financial resources to repair and rebuild is linked to many aspects of well-being, since the stress of recovery is lessened and funds do not need to be diverted from other essential spending. Further, as more properties in a community are insured, overall community recovery improves and helps to reestablish the local economy.

Despite the importance of insurance, many households and businesses at risk from disasters around the world are uninsured. According to catastrophe modeler AIR, only about 25 percent of economic losses from natural catastrophes are insured globally, and the uninsured portion could potentially exceed $US one trillion in a particularly bad year (AIR 2019).

A large body of research has demonstrated that in situations of risk, people may be prone to many biases in their decision-making that could discourage them from taking proactive risk management measures, including the purchase of insurance. The cost of disaster insurance coverage can either discourage voluntary purchase or be a fundamental barrier for those without sufficient means to pay. Concerns about concentration of risk, adverse selection, and regulatory constraints can impede greater offering of disaster cover from private insurers. These and other factors combine to make attempts at closing the disaster insurance gap an ongoing challenge.

New models of catastrophe insurance delivery need to be considered that could secure widespread coverage for catastrophes and help sustain communities following a catastrophic event. One such approach is community-based catastrophe insurance (CBCI).[384] In a CBCI program, a community — loosely defined as any community organization, special-purpose district, or public entity — arranges insurance protection on behalf of its members or to the benefit of its members. By securing coverage for a group of properties, CBCI has the potential to help close the disaster protection gap, improving financial recovery for communities. CBCI could also be designed to provide more affordable disaster insurance coverage and could be linked directly to financing approaches for community-level hazard mitigation.[385]

[384] Bernhardt et al. (2021), op. cit.

[385] Ibid.

2.1 CBCI concept and the potential benefits

Community-based catastrophe insurance (CBCI) is defined as disaster insurance arranged by a local governmental or quasi-governmental body or community group covering a group of properties within the community.[386] There are two key features of CBCI: that it is purchased or facilitated by some type of community entity and that it covers multiple properties. Beyond these two features, there can be enormous flexibility in the structure and design of CBCI.

It should be noted at the outset that CBCI can play many roles in the already dynamic ecosystem of existing public and private catastrophe insurance mechanisms. In most cases, it will make sense for CBCI to serve as a complement to traditional property insurance markets, potentially in the form of supplemental disaster protection. This could either provide small cash payouts to community members in the event of a disaster or offer full-limit, single-peril property protection in areas with high risk. In areas where the uptake of private insurance is low or protection gaps persist for other reasons, CBCI can offer the community
a means to work with carriers or private capital providers to rebuild (and subsequently sustain) insurance uptake while facing loss volatility. Even in circumstances where a community elects to pursue CBCI as a replacement to existing private coverage, this is likely to present partnership opportunities to carriers or reinsurers in the form of providing risk capital to the CBCI program.

CBCI has the potential to deliver three important benefits, such as:

- Enhances the financial resilience of communities and their residents
- Provides affordable and reliably available disaster insurance
- Creates incentives for community-level and individual risk reduction

Individuals and communities with insurance recover better and faster from disaster events than those without insurance. Insurance is especially critical for lower-income households without other options to fund recovery.[387]

Beyond the individual level, as insurance funds come into an area, rebuilding speeds up and as the share of total damages that are insured increases, economic output post-disaster improves. This can also help maintain tax receipts and protect communities against credit downgrades. Alternatively, communities that rely on disaster relief rather than insurance following a loss event face

[386] Bernhardt et al. (2021), op. cit.

[387] Botzen et al. (2019), op. cit.

significant uncertainty and complexity as well as limited ability to control recovery for both community and survivors.

The second benefit is that CBCI could potentially lower premiums through five possible mechanisms, which collectively increase the affordability and availability of coverage:[388]

• By securing broader participation in a risk pool, including among lower-risk individuals, necessary premiums could fall. (CBCI also has the potential to concentrate risk).

• A community could provide improved data and information to an insurer that could help indicate where the risk is lower and thus where lower rates are warranted. This may be especially true for a peril such as flood, for which small changes on the ground, local public policies, and mitigation investments can have significant impacts on risk levels.

• Because CBCI is administered by a community with broader social goals, a means-tested affordability or other targeted assistance program could be incorporated into the design.

• CBCI can be tied to community investments in risk reduction, such as improved levees or green infrastructure, which in turn can generate lower premiums.

• Certain models of CBCI can reduce administrative costs by lessening the costs of marketing and distribution and possibly of claims administration. These cost savings could be shared with the insured.

The alignment with community-level risk reduction is the third potential benefit of CBCI. Because standard disaster insurance policies apply at the level of individual properties, using insurance to incentivize mitigation of community scale hazards, such as levees or ecosystem-based interventions creates inherent difficulties. Yet community-level risk reduction can often be the most effective and cost-efficient means of managing a given risk. Additionally, such interventions can create a variety of co-benefits that support other community goals. Unlike property-level coverage, a CBCI program creates a mechanism to provide financial incentives for community scale mitigation. This is important,

[388] Bernhardt et al. (2021), op. cit.

since monetization of avoided losses is otherwise difficult to achieve or warrant in an open market system.[389]

2.2. Delivery models for CBCI

Four broad institutional structures for CBCI illustrate the different roles and responsibilities of the community and other partners:[390]

- A facilitator model
- A group policy model
- An aggregator model
- Purchase through a community captive

The community's role and responsibility increase from lowest to highest moving from the first to the fourth model. In the first model, the community is more of a facilitator and a negotiator. In the second model, the community takes on a role in distribution, choosing insurance options and collecting premiums. In the third model, the community has a dual role: as the insured on a community contract with a reinsurer and as the disburser of claims funds. The fourth model harnesses an existing institutional structure — an insurance captive — that enables the community to provide disaster policies. In all cases, the community could offer the coverage for a property owner to voluntarily decide to purchase, or there may be a few instances where a community would compel residents to purchase coverage. When coverage is voluntary, however, a community would likely need to offer purchase incentives to achieve goals of widespread take-up of the coverage.[391]

First model is the simplest for the community. In this approach, the community helps to facilitate its residents' widespread purchase of catastrophe insurance. Residents then work with an insurer, and the insurance contract is between the insurer and the household or business. The community is not involved in paying premiums or distributing claims, although it will work with the insurer to secure a beneficial policy for residents and undertake targeted outreach in the community to secure greater demand.

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[389] Alton, M. L., Mahul, O., & Benson, C. (2017). *Assessing Financial Protection against Disasters: A guidance note on conducting a disaster risk finance diagnostic.* Washington, DC: World Bank http://documents.worldbank.org/curated/en/102981499799989765/Assessing-financial-protection-against-disasters-a-guidance-note-on-conducting-a-disaster-risk-finance-diagnostic

[390] Bernhardt et al. (2021), op. cit.

[391] Charpentier et al. (2022). op. cit.

In the second model, the community arranges catastrophe insurance on behalf of its members: negotiating policy terms with the insurer, collecting fees or taxes, and paying the premium to the insurer. However, the policy contract is written between the property owner and the insurer, and the insurer pays claims directly to the property owner. This approach requires more effort on the part of the community than the facilitator model, since the community will need to work with the insurer to develop or outsource a platform for providing information about the coverage, letting property owners enroll, and then consolidating premium.

In the third model, the community purchases a policy directly from an insurer or reinsurer to cover a group of properties in its jurisdiction. The community, such as through a particular agency, is thus the policyholder. The contract would further specify that the insured parties are the individual properties. The community would then also be responsible for disbursing funds according to an agreed-upon approach in the contract. Similar models have been used in developing countries to provide coverage to smallholders, and the group holding the policy on behalf of many individuals is referred to as the aggregator. This model adds a layer of responsibility to the community: disbursing claims, which would necessitate a clearly documented procedure for doing so that is communicated to residents in advance of any disaster.

In the final model, a local government could create its own insurance captive. A community captive is an insurance company that is fully owned and controlled by the local government. Many municipalities already have their own captives to help them access capital for protecting municipal assets through risk transfer or to provide difficult-to-obtain coverages. Some municipalities, cities, or regional transportation authority's leverage captive structures to place coverages otherwise not offered in private property insurance markets or to receive preferable pricing and coverage through direct access to reinsurance. This model also provides the opportunity for the communities to offer lower premiums for a certain group, such as low-income residents.

CBCI as a new model for disaster coverage, has the potential to be one important tool for improving community resilience to disaster events. Ensuring widespread coverage for residents can lead to faster and stronger recoveries. There is the potential in some communities for CBCI to help offer that coverage at a more affordable price point or to provide supplementary or base coverage for residents. One of the benefits of CBCI is that the structure of the policy is highly flexible, able to be tailored for various types of communities and to meet a range of needs. In all cases, however, CBCI would be enhanced by being part

of a comprehensive risk management program and not an isolated risk transfer solution divorced from other risk management activities.[392]

2.3. Framework for implementation of CBCI

Once community officials, staff, or residents are interested in further considering CBCI, there is an iterative five-part process that can guide them as they consider possible implementation. The protentional road map for implementation incorporates steps such as:[393] define the need, determine authority to act, engage the stakeholders, analyse the risk and transfer the risk. These steps are not necessarily sequential steps; it may be necessary to go back and forth among them multiple times. Before arriving at the decision to pursue these steps, the community may need a local champion or leader who believes CBCI could secure local benefits.[394]

First step considers the following: 1. Determine which groups could benefit, 2. Consider the needs and motivations for CBCI, 3. Identify residents' needs and key risk exposure.

Second step involves: 1. Consider what entities have an interest in helping close the gap through CBCI, 2. Identify who has regulatory authority to implement a CBCI program, 3. Consider what policy reforms or institutional changes are necessary to enable various groups to make use of CBCI.

Third step incorporates the following: 1. Engage community early in the process to inform all subsequent choices, 2. Communicate and educate community about the risk and mitigation options.

In the fourth step it is necessary to: 1. Capture data and modeling to design appropriate risk transfer structures and risk reduction mechanisms, 2. Understand the risk and 3. Set risk-based and means-based premiums associated with desired program structure.

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[392] National Research Council (2015). *A Community-Based Flood Insurance Option*. Washington, DC: Committee on Community-Based Flood Insurance Options; Water Science and Technology Board; Division on Earth and Life Studies; Board on Mathematical Sciences and Their Applications; Division on Engineering and Physical Sciences; The National Academies of Sciences, Engineering, and Medicine.

[393] Bernhardt et al. (2021), op. cit.

[394] Ibid.

Finally, fifth step is about the following: 1. Consider capital providers: reinsurers, insurers, NFIP, residual market mechanisms, captives, 2. Determine premium payment options including funding options for the purchase considering assessments and affordability and 3. Map options for disbursing claims payment.

It is important that communities view CBCI as a concept that is continually adjusted. They could start with a pilot program and then make changes as they learn from disasters that occur. Basis risk and the level of protection can then be managed and improved over time depending on the long-term risk management objectives of the community. Selecting the approach that best fits — whether the facilitator model or a community captive that offers more comprehensive coverage — can be accomplished by following this five-part framework to build long-term risk management partnerships between the community and industry.

With any public initiative, the community managers have an obligation to be good stewards of community resources, follow required procurement processes, and provide community members with maximum transparency. The insurance and reinsurance industry along with capital markets investors have indicated broad support for solutions to address protection gaps.[395] As communities embrace CBCI solutions as part of disaster management and resiliency — and as transactions are brought to market — the risk transfer industry must operationalize this strategic intent, allocate capacity, and leverage authority to align transactional criteria with longer term strategy.

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[395] Schanz, K. U. (2023). The re/insurance perspective on disaster resilience: Editors: A. Jovanović, H. Schernberg, G. Sansavini. *Environment Systems and Decisions, 43*(4), pp. 535-536. https://doi.org/10.1007/s10669-023-09953-8