

Microinsurance & Disaster Risk Finance

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ABSTRACT

Uninsured risk changes how rural households make decisions that affect their livelihoods today and well into the future. Microinsurance provides households a measure of certainty so they can invest in profitable opportunities and, in the event of a disaster, reduce their use of costly coping strategies that compromise their livelihoods. Index insurance is a promising alternative to conventional loss-based insurance because it forgoes the need for costly loss verification and minimizes the risk of moral hazard. Even with these benefits, product quality remains a challenge. This paper summarizes the current state of evidence on index insurance for disaster risk and development including its impacts in the field, remaining challenges and opportunities, research gaps, and the knowledge frontier today.

There is ample evidence that uninsured risk “distorts” behavior, in the sense that risk leads low wealth households to forego investment in risky, but (on average) profitable opportunity, and also leads them to engage in costly coping strategies that compromise future income-generating capacity in the wake of shocks. The logic for microinsurance is that providing protection directly to households will give them the certainty they need to prudentially change their understandable but costly risk management behavior.

Unfortunately, for conventional, loss-verified insurance is often infeasible for low wealth households due to high information collection costs, asymmetric information, and high costs of collecting payments or disbursing payouts. When the insured are in remote locations and, or when their sum insured is small because of their low wealth, the fixed costs of information verification make it impossible to profitably

offer conventional contracts. Hazell (1992) offers several striking examples of conventional loss-adjusted contracts where the insurance provider cannot cost-effectively verify losses, with national insurance programs from the 1980s paying out 2-5 times the premiums collected.

Against this backdrop, index-based insurance appears as a promising solution. Index insurance employs an externally determined indicator of losses to trigger payouts. Using such indicators forgoes the need for costly loss verification. It also minimizes risks of moral hazard, i.e., claims based on intentionally negligent behavior rather than exogenous factors. The logic here is that if the scale of the index is at a level higher than the insured (e.g., average yields in the district where the farmer resides), or is based on measures that the insured cannot control (e.g., rainfall), then index insurance maintains full effort incentives for the insured party. Because of its reduced cost of administration, index-based insurance offers the promise of extending protection to lower wealth households across the globe.

Despite the enthusiasm for index insurance, the first generation of agricultural index insurance contracts suffered a variety of problems related to the contracts’ inability to reliably detect and cover the losses that farmers (or agricultural lenders) might want to insure. As Clarke (2016) notes, the worst thing that can befall the farmer (a total crop loss) gets worse with poorly designed index insurance (a total crop loss, a paid premium but no indemnity payment). This concern is not trivial (Economist 2018) and is intrinsic to index insurance where individual losses are not measured.

The problem is more daunting when it comes to using index insurance to protect non-agricultural businesses. What

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The Feed the Future Innovation Lab for Markets, Risk & Resilience at UC Davis generates and transfers knowledge and innovations that promote resilience and empower rural families, communities and markets to share in inclusive agricultural growth.

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is the index that reliably signals losses and their magnitude for an urban, non-agricultural business? In what proved to be a spectacular failure, a Haitian microfinance lender (Fonkoze) tried to use index insurance (triggered by seismic readings and other indicators of natural disaster) to provide business and home protection to their microfinance clients. It was clear to the lender that the index was an unreliable predictor of individual loss, and hence they required further individual loss verification as a condition for issuing payments. In practice, the loss verification worked very poorly and the insurance scheme collapsed with the kinds of loss ratios mentioned by Hazell (1992) for conventional insurance in agriculture (Breza *et al.*, 2014). While there are some continuing efforts in this regard (notably MiCRO's efforts to offer business continuation insurance in Central America), the underlying problem of index construction is a difficult one without an obvious solution in the urban sector, and there is little if any evidence on disaster risk financing through microinsurance beyond the agricultural sector.

The preponderance of recent research has principally focused on increasing access to and demand for agricultural and other emerging forms of household disaster microinsurance. As we delineate below, the problem of index design is itself highly problematic even for agriculture. And yet, as insurance tools become more sophisticated, the sector is advancing more finely targeted, inclusive, higher-quality and better-integrated applications of microinsurance for comprehensive disaster risk management. Several relatively recent survey papers provide good starting points for this rapidly growing literature (Jensen and Barrett, 2017; Carter, *et al.*, 2017; and, Benami *et al.* 2020). The remainder of this brief note aims to summarize and supplement these other review pieces.

EVIDENCE LANDSCAPE

Evidence on disaster risk microinsurance to date has largely clustered in the three primary categories: impacts, demand and supply. The evidence to date has focused primarily on index-based agricultural insurance, the most common form of disaster risk microinsurance currently available.

Impacts of Agricultural Microinsurance

The working hypothesis of agricultural microinsurance is that insured individuals are better able to cope with shocks, reducing reliance on costly coping mechanisms such as consumption reduction, selling of assets and reliance on food aid, all of which can have devastating consequences from the next season to the next generation. Research testing this hypothesis is especially challenging as it can only be fully tested if a disasters cooperate and strike a study population during the usually short time of any study. For this reason, it is useful to divide the evidence up into that which studies the “ex post” impacts of insurance (meaning the impacts of insurance after disaster strikes) and its “ex ante” impacts (meaning behavioral change caused by insurance before any disaster strikes):

Ex Ante Impacts of Microinsurance: As mentioned in the introduction, the case for microinsurance is based in large measure on its ex ante effects: improved ability to cope should a disaster occur encourages insured households in advance of any disaster to take on productive investment risks, such as investing in improved seed varieties or costly agricultural inputs, expanding production of high-value crops. A handful of sophisticated studies (mostly randomized control trails) have established that insurance leads to substantial increases in on-farm investment, usually in the range of 15-30% compared to uninsured, control households [see Cai, 2016 (tobacco in China), Elabed & Carter 2016 (cotton in Mali), Hill *et al.* 2019 (rice in Bangladesh), Jensen *et al.* 2017 (livestock in Kenya), Karlan *et al.* 2014, (maize in Ghana) Mobarak and Rosenzweig 2014 (crops in India), Stoeffler *et al.* 2020 (cotton and sesame in Burkina Faso)].

Ex Post Impacts of Microinsurance: While ex ante effects can be observed even if no shock occurs, a few studies have been to observe the impacts of insurance in the wake of a shock. Studying the IBLI livestock insurance program in Kenya, both Janzen and Carter (2019) and Jensen *et al.* (2017) find that insurance fundamentally affects coping strategies, with the former paper showing that for poorer households, insurance reduces reliance on meal reduction as an ex post coping strategy, while better off households (who were already smoothing consumption with livestock sales) reduce reliance on this coping strategy. Several studies [Hill *et al.*, 2019 and Boucher *et al.* 2020 (maize in Mozambique and Tanzania)] show that insured households avoid decapitalization from shocks and show higher rates of agricultural investment in the year following a shock and an insurance payout compared to a control group. A less orthodox study by Stoeffler *et al.* (2020) finds that insurance allows cotton farmers to preserve their capital for cultivation the year following a shock. Without the insurance, farmers would have sold off equipment and exited cotton production, at least until they could have rebuilt their capital and reputation with the lender.

Demand Challenges & Opportunities

Despite the evidence indicating the positive impacts of disaster insurance, insurance is consistently met with stubbornly low demand. Disaster risk insurance is particularly challenging for smallholders to learn about and trust:

- *Insurance quality is a hidden trait:* Similar to many other inputs (e.g, improved seeds), it is impossible for the farmer to gauge the quality of the input and the protection it will provide by simply examining the contract (or inspecting the seed). Experiential learning thus becomes vital to building demand.
- *Insurance offers infrequent (stochastic) benefits:* Experientially learning about an input like insurance which offers stochastic benefits is even more difficulty than learning

about, say, improved seeds that almost offer visible improvements in income. As Lybbert and Bell (2010) show for another technology with stochastic benefits (stress tolerant seeds), it may take a rational learner a generation to become convinced of the veracity of the new technology, implying that demand will emerge very slowly. This same problem is even more severe for index insurance (Cai, de Janvry and Sadoulet 2020).

Because understanding and trust of disaster risk insurance products are significant barriers to adoption, a significant amount of research has focused on identifying innovative approaches to overcome these challenges to influence consumer demand for and uptake of insurance, with varying levels of success.

Information, Learning & Understanding: There are a number of methods being tested to increase learning, finding various degrees of success. Recent results from Ethiopia estimated the impact of educational games to increase the likelihood of unsubsidized insurance purchase by 10% and the amount purchased by 33% (Vasilaky *et al.* 2020). Cai and Song (2017) find similar effects in China. The evidence on the success of these games as a demand stimulant is, however mixed as other studies have found no such effect (e.g., Janzen and Carter 2019, Lybbert *et al.* 2010). Some studies have found mechanisms of community impacts on demand to be primarily information diffusion (Cai, *et al.* 2015, Gine *et al.* 2014). There is also evidence that peer decisions to purchase insurance influence own decisions, suggesting that consumers may use peers as an information input in their insurance decision-making processes (Cai, *et al.* 2015, 2020).

Timing of Premium Payments: Considerable research has also focused on easing liquidity constraints at the time of premium payment to enable increased demand and uptake. For example, Casaburi and Willis (2018) find that by moving the premium payment to time of harvest rather than up-front payment boost take-up from 5 to 72 percent (with the strongest effects for the poorest farmers). Vargas Hill *et al.*, (2019), too, observed increased demand with the offer of discount coupons.

Decision Making under Risk: While (almost) any economic student can prove that instrumentally rational, risk averse people will demand insurance, there is an array of experimental evidence that many if not most people do not behave in the instrumentally rational way that economics students presume. For example, individuals often make decisions as if low and high probability events have a different chance of occurring than they objectively do. These alternative behavioral rules raise questions about how to value the benefits of insurance (Harrison and Ng 2016). They also sometime suggest simple (Serfilippi *et al.* 2020) and not so simple (Elabed and Carter, 2016) ways to design insurance contracts so

that they are more attractive given the way people process information on risky alternatives. This is still a nascent area, but as Harrison *et al.* (2020) stress, it raises a number of ethical issues, especially if marketing ploys are used to nudge people into buying insurance that actually makes them worse off, either by their own internal welfare metric or by an instrumentally rational metric.

Keeping with this point that insurance uptake is a poor metric of success and impact for insurance, Vasiliky *et al.* (2020) note that to focus on increasing demand alone would not necessarily yield positive outcomes, and if the insurance is not appropriate for farmers demand should actually be reduced. Carter and Chiu (2018) demonstrate that some products may leave farmers worse off with insurance than without. Additional research demonstrates that for many individuals the decision to not purchase insurance may be more welfare-enhancing than purchasing it (Harrison *et al.*, 2020). Insurance demand and uptake cannot be considered in isolation.

Clarke and Wren-Lewis (2013) discuss how investments in increasing demand alone can inadvertently create a “market for lemons.” Because disaster risk insurance, as a credence good, can only demonstrate its quality after it is purchased, there is little to no incentive for product developers to invest in quality design. In this way, stimulating demand without attention to quality product design first may do more harm than good.

Quality Design: When characteristics of quality and basis risk are known and understood by potential purchasers, both willingness to pay and product demand decline (Ward and Makhija 2018, Janzen *et al.* forthcoming). Discussions about product demand cannot and must not be distinct from discussions of quality product design (discussed in further detail below).

Quality Implementation: The quality of a product extends beyond the product’s basis risk and index design, but to the quality of implementation. Projects have been plagued with late sales periods, unconfirmed suspicions of fraud and delays in payouts that deterred potential customers despite interest in the products (Stoeffler *et al.* 2020). In fact, Ghosh *et al.* 2020 estimates that, on average, farmers in India would prefer to substantially pay more than the heavily subsidized premiums in exchange for guaranteed timely (6-week) indemnity payments.

KNOWLEDGE FRONTIER

Recent research has been pushing the knowledge frontier in a number of ways, largely focused on increasing value to the insured through product redesign for quality, comprehensive risk coverage.

Innovations to Improve Contract Value

Innovations are being designed and tested that minimize

exposure to basis risk and reduce the probability of contract failure to better contribute to disaster risk management. New innovations include new contract designs, such as an audit rule and dual triggers help to overcome the inherent basis risk challenges that plague index-based insurance (Carter *et al.* 2017). New research is also investigating the feasibility of flexible product design, concluding that “selling index insurance as a single, one-size-fits-all policy seems to be misguided” (Ceballos and Robles, 2020).

Digital Advances & New Technology

Advances in technology – especially remote sensing and crop modeling – allow for more reliable and affordable assessment of crop yields for use in index-based contracts, despite relentlessly challenging and complex conditions. These advances, such as increased availability of earth observation data supplemented with ground-referenced data (Benami *et al.* 2020) or picture-based insurance (Ceballos, Kramer and Robles 2019), may allow higher-quality indices with lower basis risk to be designed more cheaply and to be administered more quickly.

Interlinking Credit and Insurance

There is a strong theoretical case for linking credit with insurance as they are in principle real and strong synergies between the two financial services (Carter *et al.* 2016). However, despite efforts stretching back at least to the mid-2000s, the practical realization of this promise has been weak. As Carter *et al.* (2016) stress, Interactions with credit default rules can be complex, and they can trip up actual implementations (Gine and Yang, 2009). Other efforts have suffered other problems (Miranda *et al.* forthcoming and Syll and Weingartner 2020). On the brighter side, Mishra (2017) shows credit-insurance interlinkage can improve women’s access to credit.

Bundling for Greater Impacts

Increasing research is being done to investigate how to effectively bundle microinsurance with other risk management tools, so that combined they can do more than individually to manage disaster risk. Several promising approaches are amassing increasing evidence of impacts. For example, stress tolerant agricultural technologies (Lybbert and Carter 2015, Boucher *et al.* 2019, Ward *et al.* 2020) and disaster risk microinsurance can better manage a farmer’s risk profile together than either can individually, and allow farmers to take advantage of more productive opportunities.

New Disaster Insurance Products and Approaches

New innovations continue to test new ways to incorporate formal insurance in informal networks and to embed insurance in existing frameworks, such as embedding savings for insurance purchases into regular savings group planning and transactions (Carter *et al.* 2017, Steinmetz and Carter 2016). New approaches to sales are also being tested, such as allowing family members (who may have more liquidity)

to purchase insurance for their households after they have left home – in the style of remittances (Kazianga and Wahhaj 2020).

ONGOING RESEARCH QUESTIONS

There are a number of ongoing research activities that are pushing the knowledge frontier both in new directions, particularly toward improved quality, greater inclusivity and sustainable and scalable solutions.

Quality Design and Consumer Protection

There have been a number of different approaches to measure quality and effectiveness of agricultural insurance in managing risk (Carter and Chiu 2018, Benami *et al.* 2020, Karlijn *et al.* 2016, Barre *et al.* 2016, Shirsath *et al.* 2019, Harrison *et al.* 2020). These approaches can be applied with consideration to a multitude of quality factors valued by potential clients, including index accuracy, cost, and timeliness of payments (Jensen *et al.* 2019). Seeking to apply these efforts to overcome the “market for lemons,” the University of California Davis is currently leading a pilot Quality Index Insurance Certification (QUIIC) in East Africa (quiic.ucdavis.edu). Efforts to assess the impacts of a quality certification are ongoing, and more work is needed to determine how to effectively integrate quality measures into consumer protection policies.

Integrated Graduation and Shock-Responsive Social Protection Programs

Previous evaluations of graduation programs have shown promising results across a number of countries, however, critical evidence indicates program gains were quickly undone when confronted by disasters (see the discussion of the Honduras case in Banerjee *et al.*, 2016). New research is evaluating the synergies between social development programs and social protection programs, plumbing the theoretical case put forward in Janzen *et al.* (2020) and Ikegami *et al.* (2019).

Making Insurance Work for Women and Less Well-off Households

When shocks occur, the poor and women are disproportionately affected. Women’s assets are the first to be liquidated if a disaster occurs (Quisumbing *et al.*, 2018). A recent experiment indicated that women would buy significantly more insurance when its benefits were made more salient to women by framing the benefits around household expenses rather than livestock (Hobbs 2019). This work used tablet-based experimental games and has yet to be implemented in practice despite its demonstration that simple changes in contract farming can boost women’s demand for insurance. In addition, relatively wealthier households are observed to be the first adopters of insurance included (Takahashi *et al.* 2020). However, without dedicated attention to social equity, index insurance interventions may actually reinforce inequalities and undermine insurance’s potential as

effective disaster risk management that is inclusive and pro-poor (Fisher *et al.* 2019).

Effective use of Public Investments

Public investments can be used to advance microinsurance in a variety of ways. Government investments, for example, may more effectively be used to support increased risk coverage or reduced basis risk than massive premium subsidies (Ward *et al.* 2019). However, the majority of public investments in microinsurance are currently applied to partial premium subsidies. Under these schemes, the government pays a fraction of the cost of a total premium, but if the farmer does not want to buy any insurance, then the subsidy is unspent and does not help the market develop. This failing motivates continued research around how to most affectively apply subsidies to stimulate learning and sustainable demand. Carter *et al.* (2011) suggest that public provision of single risk layer could, in a cost neutral way, help build the insurance market more effectively than the current subsidy strategy. Given that fixed costs are a barrier to the development of an insurance market, using a freely provided layer of risk coverage, paid for by the public sector, would appear to be a promising way to go.

Subsidies: Both evidence and experience with insurance subsidies indicates that, in the absence of subsidies, demand for agricultural insurance is often modest, especially outside of products targeted at commercial crops (McIntosh *et al.* 2020). Recent encouraging results, however, demonstrate that subsidies can increase future insurance adoption by allowing farmers to have payout experiences if subsidies are complemented with financial education (Cai *et al.* 2020). The researchers also noted that, without the payout experience, the subsidies would have been an inefficient approach to grow demand. More generally, although work has shown that smart, temporary subsidies can be used to create learning and bolster demand for other agricultural inputs (Carter *et al.*, forthcoming), that same lens has not been applied to subsidies for insurance given how difficult it is for farmers to learn about insurance, as discussed above.

Moving toward a broader perspective of the role public investment in microinsurance and disaster risk protection also requires policy planning beyond interventions designed to stimulate insurance demand. Comprehensive disaster risk management and long-term poverty reduction requires deliberation on evidence of a “social protection paradox” (Carter and Janzen 2017).

Social Protection Paradox: Offering the vulnerable non-poor insurance subsidies may be more cost-effective public investments than needs-based direct transfers (Chantarat *et al.* 2017, Carter and Janzen 2017, Ikegami *et al.* 2019). While designing policy around this evidence may be politically, socially and ethically unacceptable, it highlights fundamental issues around optimal investment strategies


that are critical considerations for broader, integrated, long-term investment strategies in disaster risk management.

While many fear premium subsidies will distort markets and obstruct a future willingness to pay commercial prices, evidence does not support such a price anchoring effect. Though a recent study found a tapering subsidy unlikely to stimulate demand in a cost-effective way (Wong *et al.* 2020), other evidence indicates this is due to a sensitivity to current prices rather than due to a price anchoring effect (Takahashi *et al.* 2020). This indicates that appropriately applied subsidies may have positive impacts without negative price anchoring effects with potentially negative impacts on commercial markets. As mentioned above, the lessons from smart subsidies used to induce learning about other novel technologies have yet to be integrated into the work on index insurance.

ADDITIONAL RESEARCH GAPS

Long-term Impacts: In large part due to the funding cycles and accountability of donors and NGOs, it is typically infeasible to fund long-term research that allows for far downstream confirmation of expected impacts, such as: health, nutrition, loan access, credit supply, interest rates, rates of transient poverty, etc. This is further exasperated as disaster insurance can only rarely demonstrate its true value despite donor expectations for more timely results, which can lead to project dissolution long before payouts even occur.

Consistent, Comprehensive & Inclusive Metrics: There are consistently emerging approaches to measurements of success and resilience from researchers (e.g., see Cissé and Barrett 2018 and their review of approaches used by WFP< USAID and other donors). There is a need for a consistent, long-term, durable metric for progress and success. If the sector strives for comprehensive disaster risk management, the metrics, too, must reflect comprehensive measures of success. A novel approach is the MRR Innovation Lab’s “Resilience+,” or a related measurement of how households increase investment & improve their level of well-being over what it would have been absent improved disaster risk management (Carter, 2020). Having such measures at hand will make longer term evaluations more consistent and useful.

Flexible Risk Management Portfolios: More research is needed on how to effectively integrate a variety of disaster risk management tools – including financial, agronomic, and other tools – cohesively in a way that allows households to create a risk management portfolio that can evolve and change with their own needs and abilities. While there is nascent work on this area discussed above on combining insurance and stress tolerant seeds, incorporating other financial instruments like contingent lines of credit (Lane 2020) has yet to be undertaken. 

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