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Evidence Landscape for Microinsurance & Other Risk Management Instruments

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ABSTRACT

Uninsured risk changes how rural households make decisions that affect their livelihoods today and well into the future. Microinsurance and other risk management instruments provide 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. This paper summarizes the current state of evidence on microinsurance, contingent credit, stress-tolerant seeds and other risk-management instruments that create new ways for small-scale agricultural households to manage weather-related risks such as drought and flood, including their 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 opportunities, 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, 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 imperfect risk coverage of index insurance, as well as its expense, motivates the use of other tools that might

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replace or complement index insurance, as discussed in our concept note. In this brief evidence review, we consider other financial instruments as well as stress tolerant seed varieties that can in principal play a role similar to index insurance. Despite the promise of these other instruments, 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. 2021 (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. (2021) 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.

Impacts of Savings Accounts for Risk Management

SHFs have long used informal savings (often in-kind savings) to manage agricultural risk. Because such savings are not intermediated they typically generate negative real rates of return for a variety of reasons (including deterioration of stored commodities as well as what the literature often calls problems of self- control (Ashraf et al., 2006) and other control (Platteau, 2000). In response, a number of NGOs promoted a sort of semi-formal village based savings groups, typically referred to as VSLAs (Ashe and Neilan, 2014).

While generalization is difficult, many groups seem to include multiple, named savings accounts, including one set aside to assist the saver in the event of shocks or extraordinary needs. Evaluation of VSLAs to date has been modest (Ksoll et al., 2016, Beaman et al. 2014 and Cassidy and Fafchamps, 2020), with these studies finding some indication of improved food security, but little evidence of the kind of ex ante investment response that has been documented in the case of microinsurance products.

There have also been efforts to expand direct individual access to formal savings accounts by making such accounts cheaper, paying higher interest or expanding availability. However, Prina (2015), for example, finds no consistent evidence that formal savings account have measurable economic effects. Like Prina, Carter et al. (2018) find that savings account provision and incentives lead to significant increases in total savings (formal and informal), but like Prina they find no spillover. They hypothesize that this null result may reflect the fact that savings is by construction a flexible financial tool, meaning some may hold savings balances to buffer shocks, others to invest in agriculture, while others may use it as a way to exit agriculture and undertake other economic activities.

The branch of this literature that is perhaps closest to the current proposal to use savings as part of a risk management package is that on commitment savings accounts. Commitment accounts limit the use of savings (either by withdrawal restrictions or heavy-handed marketing) to certain named uses. Brune et al. (2016) examine the impact of a commitment savings program designed to facilitate agricultural investment and find that indeed the accounts achieved this goal. In an analysis of a commitment savings program that bears important similarities to the ideas under consideration here, Dupas and Robinson (2013) find that a health savings account increased savings by 66% and helped families manage the expense of health shocks. This latter paper does not, however, explore whether this improved risk management capacity allowed households to invest more in productive activities.

In short, the literature on savings indicates that improved savings accounts are popular and seem to face ready demand. Untested is whether savings can be woven into a more comprehensive package that can underwrite resilience and resilience-plus.

Impacts of Contingent Lines of Credit for Risk Management

Lane (2020) is perhaps the only study that explores contingent lines of credit (CLOC) as an explicit risk management tool for SHFs. The supply side requirements for CLOCs are substantial, as the lender needs to be willing to lend the SHF money in a moment of stress. In the Lane study, BRAC had pre-qualified a number of good borrowers (meaning those with excellent repayment histories on conventional loans) for CLOC that would only be made available if a flood index was triggered. Drawing analogies to the microinsurance impact literature summarized above, Lane finds that the CLOC program had substantial impact on ex ante investment and (perhaps) helped families smooth consumption.

While promising a challenge is to learn how to make CLOCs more widely available, perhaps through improved credit scoring methods.

Stress Tolerant Seed Varieties

Stress tolerant seed varieties bred to withstand abiotic weather shocks like drought or flood are among the new technologies that potentially improve the resilience of smallholder farmers. Encouraging evidence highlights this potential. Emerick et al. (2016), for example, finds that flood tolerant rice varieties not only protected Indian farmers against the worst consequences of a shock, but also gave them confidence to intensify their investment in productivity-enhancing inputs. Boucher et al. (2021) find similar effects for drought tolerant maize varieties.

Stress tolerant varieties are a particularly attractive innovation because of their very low marginal cost. While breeding these varieties demands substantial upfront investments in lab work and field trials, once tolerant varieties are developed they can be multiplied and distributed to farmers with little or no additional cost relative to non-tolerant varieties. This marginal cost advantage is especially pronounced for smallholder farmers in developing countries since much of the fixed cost of developing these varieties is either covered by public research entities, often with support from private firms (e.g., CGIAR, Drought Tolerant Maize for Africa), or by private firms that intend to recoup this investment in more lucrative developed country markets and provide preferential access to their stress tolerant traits for farmers in Africa (e.g., as Monsanto has through the Water Efficient Maize for Africa initiative). Since these stress tolerant traits are generally added to improved seed varieties, accessing these new varieties does require farmers to purchase new seed rather than reusing their saved seed from previous seasons, but the retail markup of these improved stress tolerant varieties over comparable improved but not stress tolerant varieties is minimal (or zero). Farmers may consequently pay little or no price premium to access these stress tolerant varieties compared to purchasing other improved varieties. However for the majority of the farmers in our sample, who rely on local seed varieties retained from the previous harvest, a shift to stress tolerant varieties represents a large increase in investment.

Despite the low marginal costs of producing stress tolerant seeds, they offer farmers protection against only a limited range of the shocks that they confront. The flood tolerant rice variety studied by Emerick et al. (2016) provides protection against flood events that last no more than 15 days (Dar et al. 2013), but succumbs like other rice varieties to longer periods of flooding. In the year of the Emerick et al. (2016) impact evaluation, some study farmers experienced floods which fortunately lasted only 14 days. Had the flood waters not receded at that time, the results of the study would likely have been quite different. Similarly, the drought tolerant (DT) maize varieties studied by Boucher et al. (2021) protect against mid-season drought, but remain vulnerable to early and late season drought in addition to the other biotic and abiotic stresses that afflict other maize varieties. This limited or single peril protection reflects the fact that plant breeders face biological constraints that limit how much and what types of stress these new varieties can withstand.

The narrow single-peril protection offered by stress tolerant seeds also raises an adoption dilemma for smallholder farmers—especially those who would normally re-use their own saved seed to avoid purchasing new seeds. That is, it is not obvious that stress tolerant seeds alone are an adequate foundation for increased SHF investment and an inclusive agricultural transformation. The evidence on these varieties does raise the intriguing possibility that financial instruments can be designed to pick up where the stress tolerant traits leave off. Bundling with such an instrument could provide smallholder farmers more comprehensive risk mitigation and more effectively reduce the welfare burden of uninsured risk.

Demand Challenges & Opportunities for Microinsurance

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 offer visible improvements in income over a short period of time. 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.

Decisionmaking 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 Production 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 effectively 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 dissolvement 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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