When And How Should Agricultural Insurance Be Subsidized?

Issues And Good Practices

Global Index Insurance Facility

MANAGED BY WORLD BANK GROUP

IFC International Finance Corporation WORLD BANK GROUP

IMPACT INSURANCE

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Acknowledgements

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Global Index Insurance Facility

The Global Index Insurance Facility (GIIF) is a multidonor program that supports the development and growth of local markets for indexed/catastrophic insurance in developing countries, primarily in Sub-Saharan Africa, Latin America and the Caribbean, and Asia Pacific. Funded by the European Union, Japan, and the Netherlands, the Global Index Insurance Facility is managed by the World Bank Group, as part of the Finance & Markets Global Practice.

Impact Insurance Facility

Housed at the International Labour Organization, the Impact Insurance Facility enables the insurance industry, governments, and their partners to realize the potential of insurance for social and economic development. The Facility was launched in 2008 with generous support from the Bill & Melinda Gates Foundation, and has received subsequent funding from several donors.

Executive Summary

Agricultural insurance is subsidized in many countries, at a global cost to governments of well over $20 billion each year. There are many reasons behind these subsidies, some having to do with market failures and externalities that constrain the development of privately provided and unsubsidized insurance, and some having more overt political and social objectives such as helping specific segments of poorer farmers access insurance, protecting agricultural lending institutions, reducing the need for disaster assistance payments, or simply as a politically acceptable means of supporting farm incomes. Very little is really known about the effectiveness of insurance subsidies in achieving their intended purposes, or whether the impacts they generate justify their costs, and there is a real need for more evaluations and impact assessments of subsidized agricultural insurance programs. Much more is known about the challenges that can all too easily undermine the benefits from agricultural insurance subsidies. These include well known challenges with the design and operation of agricultural insurance programs themselves, poorly designed subsidies added to those programs, plus political dynamics that make it hard to terminate or contain the amount of the subsidy. Poorly designed subsidies can also inadvertently create disincentive problems that lead to significant economic costs and inefficiencies, and in some circumstances, to environmental degradation. To avoid these problems, any insurance subsidy needs to be carefully designed to be "smart", in the sense that it is cost effective in achieving its underlying purpose, minimizes disincentive problems, and does not become a growing financial burden on the government. This paper discusses these issues in detail and draws upon available literature and case study experiences to propose some good practice guidelines for the design and implementation of subsidized agricultural insurance.

1. Introduction

Agricultural insurance, defined here to include crop and livestock insurance, is an instrument of choice in many countries for helping farmers and rural communities cope with risk. Some insurance is private, sold by insurance companies to farmers on a purely commercial, non-subsidized basis, but, as will be seen, most agricultural insurance is provided on a subsidized basis as part of government efforts to further development, social or political goals. Many billions of dollars are spent each year on premium subsidies and other forms of financial support for agricultural insurance. A World Bank study estimated that in 2007, the total global cost to governments was about $20 billion (Mahul and Stutley, 2010). However, that figure seems low today given that just three countries - China, India and the US, are together spending about $17.7 billion each year. To put this in perspective, total OECD bilateral and multilateral support for agriculture in the developing world was about $11 billion in 2014[1].

This paper explores the reasons why governments and donors subsidize agricultural insurance, and asks a) is this a worthwhile way to spend public money, and b) if insurance must be subsidized are there smarter ways of doing it that can achieve the same objectives, but at lower cost, and which avoid some of the economic and institutional pitfalls that have plagued subsidized agricultural insurance in the past.

The paper is structured as follows. The next section reviews existing types and levels of subsidies for agricultural insurance, both globally and for the developing world. Section 3 reviews the various arguments that have been offered for subsidizing agricultural insurance, while section 4 discusses some of the key challenges that have arisen when insurance subsidies are poorly designed. Section 5 seeks to balance the benefits and costs of subsidized agricultural insurance, and asks whether this has proven to be a worthwhile way of spending public funds. Given that many governments and donors seem likely to continue to subsidize agricultural insurance, section 6 presents a set of guiding principles and best practices to be used in their design and implementation. Finally, section 7 concludes.

[1] Calculated from OECD DAC data: http://www.oecd.org/dac/stats/documentupload/1%20World%20-%20Development%20Aid%20at%20a%20Glance%202016.pdf

2. Existing Types and Levels of Subsidies for Agricultural Insurance

The extent of agricultural insurance around the world was assessed in 2008 by researchers at the World Bank. They estimated that 104 countries had some form of agricultural insurance in 2007, and that the total premium collected that year, including premium subsidies, was an impressive $20 billion (Mahul and Stutley, 2010). More detailed insights were obtained for 65 countries that completed a questionnaire. The total premium collected in these countries in 2008 was $15.1 billion. Of this amount, 86% was collected in high-income countries and only 0.03% was collected in low income countries, showing that agricultural insurance is largely the preserve of the rich.

Globally, about 90% of the total premium collected was for crop insurance and 10% was for livestock insurance. Multiple Peril Crop Insurance (MPCI) was available in two thirds of the countries, but was most popular in the middle-income countries. Named peril insurance was available in 69% of the countries, including half of the low-income countries. Area-yield insurance was available in 15% of the countries, and weather index insurance was available in 22% of the countries, but mostly on a pilot basis.

There has been significant expansion of agricultural insurance since 2008, especially of index based schemes in the US, India and China. Based on a recent review of documented index-based agricultural insurance programs in the developing world, Hess and Hazell (2016) estimate that about 198 million farmers were insured in 2014, divided into approximately 650,000 in Africa, 3.3 million in Latin America and the Caribbean, and about 194.2 million in Asia - of which 160 million were in China and 33.2 million in India. Given that there are about 550 million farms in the developing world (Lowder et al., 2014), it would seem that about one third of them now have some kind of agricultural index insurance. Clearly IBI has achieved scale.

Yet despite these impressive numbers, market penetration remains small, even in rich countries. In 2008, the total insurance premium collected (including subsidies) in the World Bank survey amounted to 0.9% of agricultural GDP, ranging from virtually zero in low-income countries to 2.3% in high-income countries (Mahul and Stutley 2010). One reason for this low coverage is that only a small part of the crop area and livestock population is insured. Another

reason is that most programs only insure farmers against losses for specific crops or livestock, or pay to replace purchased inputs or repay credit when insured losses occur. As such, the insured coverage typically represents just a small fraction of a farmer's total exposure to farm income and asset risks.

The majority of agricultural insurance programs are subsidized. Mahul and Stutley (2010) found that of the 65 countries that completed their questionnaire, one third had an unsubsidized crop or livestock insurance program. However, the unsubsidized programs are at a much smaller scale, and of the total premium collected from farmers in all 65 countries, only 15% was not matched by a premium subsidy (Mahul and Stutley, 2010, Tables 3.23 and 3.24). The premium subsidies added up to $6.6 billion, or 44% of the total premium collected. In addition, governments spent at least another $1.5 billion subsidizing administrative and operational costs, and another $2.2 billion in the form of direct payments to insurers to help settle claims. When these additional costs are added in, the average subsidy equivalent increases from 44% to 68%. The cost of insurance to governments has since increased, largely because they have been scaled up. For example, each year the Chinese government now spends about $6 billion annually[2] on its insurance programs, the Indian government spends $ 2.75 billion[3], and the US government is programmed to spend $9 billion annually over the next 10 years[4].

Of all the IBI-like programs Hess, Hazell and Kuhn (2016) reviewed, the only programs with low or no subsidies were for insurance coverage provided within contract farming arrangements, which also included access to modern inputs, markets and credit. Most other forms of IBI were subsidized: the average subsidy was 37% for input supplier schemes, 40% for farmer group schemes, 63% for credit-linked schemes, 67% for direct insurance, and 80% for safety net insurance schemes.

The producer claims ratio (PCR), calculated as I/P, where I is total claim payments and P is total premium collected from farmers net of any subsidy, is a direct measure of how much the farmer gets back in claim payments on average for each dollar of premium he/she pays. Hazell (1992) reported PCRs for 7 country programs in the 1980s, ranging from 0.99 in Japan to 5.11 in India. This meant that in India, for example, farmers on average received payments worth $5.11 for every dollar of premium they paid. Remarkably, the insurance still had to be made compulsory for farmers who borrowed credit. In their update, Mahul and Stutley (2010) found that PCRs were lower during 2003-07, as, for example, in the comparative numbers reported in Table 1. Yet still most farmers are getting back far more than they pay on average (e.g., Indian farmers are getting back $3.36 for every dollar of premium they pay) and still many farmers are choosing not to purchase insurance.

[2] 2014, source: CIRC, Chinese Regulatory Authority.

[3] Proposed budget for the new PMFBY scheme, comprehensive agricultural insurance especially for farmers with loans. http://pmjandhanyojana.co.in/pradhan-mantri-fasal-bima-crop-insurance-scheme/.

[4] Joe Glaubner, personal communication.

Table 1: Producer Claim Ratios for Seven Countries

Country	Producer Loss Ratio			
Brazil	1975-81	4.29	2004-07	1.19
Costa Rica	1970-89	2.26	2003-07	1.75
India	1985-89	5.11	2003-07	3.36
Japan	1985-89	0.99	2003-05	1.84
Mexico	1980-89	3.18	2003-07	0.72
Philippines	1981-89	3.94	2003-07	1.42
US	1980-89	1.87	2003-07	1.70
Canada			2003-07	2.20
Iran			2003-07	4.05
Italy			2003-06	1.47
Russia			2003-06	1.23
Spain			2003-07	2.44

Note: Calculated as total claim payments divided by total premium paid by farmers.

Source: Hazell (1992) and author's calculations based on data in Mahul and Stutley (2010).

3. Reasons for Subsidizing Agricultural Insurance

There are many reasons why governments and donors subsidize agricultural insurance. Some are based on narrow economic arguments like market failures, externalities and establishment problems that constrain the development of private sector insurance and insurance markets, or which systematically exclude certain segments of farmers from insurance, such as poor or women farmers, or farmers in high risk regions. Many governments also subsidize agricultural insurance as a way of achieving other social and political goals in addition to risk management, where insurance subsidies are seen as a more politically acceptable or cost efficient way of achieving those goals than other available policies. Despite their varying purposes, insurance subsidies all seek to reduce risk exposure for farmers, whether against catastrophic natural disasters or more normal agricultural production risks. Most often, subsidies also help scale up the demand for agricultural insurance.

Subsidies to Correct Failures and Externalities in Insurance Markets.

Several economic arguments have been made in the literature for subsidizing agricultural insurance programs to correct market failures and externalities (Hill et al., 2014; Clarke, 2011). These include:

- Public spending in the form of subsidies or direct service provision for building and maintaining weather station infrastructure and data systems, supporting agro-meteorological research leading to product design, and educating farmers about the value of insurance. These services are needed to enable insurance markets to work. Private insurers are willing to make some of these investments themselves, but there is an inherent problem in that they may not be able to recoup their investment costs given the ease with which competitors can use the same knowledge and services once established. This is a classic 'public goods' problem that inevitably leads to insufficient investment, and hence a need for complementary public spending. There may also be spillover benefits for other types of financial and service sectors, including public relief or disaster assistance programs, which help justify such public spending;

- Temporary subsidies might be warranted for some types of farmers if there are positive externalities. A good example is when the insurance enables poor farm households to access credit and game changing technologies that can lift them out of poverty. In this case the underlying problem is often an inability of many poor farmers to bear the initial risk of adopting such innovations without subsidized insurance, and/or an inability to access credit without insurance because they are perceived to be high-risk borrowers by financial institutions.
- Temporary subsidies might be justified when farmers or insurers are initially uncertain about a new type of insurance product because they have insufficient knowledge to assess its real risks and benefits. For example, a premium subsidy might encourage farmers to purchase and experiment with a new insurance product about which they have no prior experience, much as seed companies sometimes give out free trial seed packets. Another example is when an insurer initially charges a high-risk loading for a new line of insurance because it has inadequate data to properly assess the actuarial risks, and the risk loading is expected to fall once the insurer has acquired additional data over time. In this case the government might want to subsidize part of the risk loading cost, or offer subsidized reinsurance, during an initial learning phase;
- Related to the previous point, temporary subsidies might also be warranted as part of a strategy to assist farmers adapt to climate change. This might take the form of subsidizing some of the high-risk loadings that insurers build into premium rates when they are uncertain about how climate change will impact on the risks they are insuring. Another view is that since many small farmers are the victims of climate change, they should be entitled to a temporary premium subsidy that helps them adopt new climate smart technologies that have risk characteristics that are initially not well known[5].
- Siamwalla and Valdes (1986) have argued that a subsidy might be warranted in some circumstances when region-wide agricultural losses impact on the nonfarm population by reducing farmers' demand for the services and outputs of small businesses in the rural nonfarm economy. In this case, the insurance subsidy might help by buffering reductions in farmers' spending, though it ought first to be established that insuring farmers was more effective than offering insurance products to the community at large.
- A less credible argument is that insurance subsidies may be justified if they lead to positive benefits for consumers. For example, if the introduction of an insurance subsidy leads to greater production of food staples which lowers food prices and benefits consumers, then a subsidy would essentially transfer some of the consumer benefit back to producers. The need for such a subsidy is perceived to be greater the more inelastic the demand for food staples, since consumers then capture a larger share of the total benefits from an increased food supply. Siamwalla and Valdes (1986) refute this argument by showing that if the subsidy lowers the cost of the insurance to producers and shifts the supply function for food staples outwards compared to unsubsidized insurance, the net

[5] Some have argued, based on the principle of 'polluter pays', that there is a case for the industrialized countries (through green climate funds, for example), subsidizing the increase in the pure risk component of insurance premiums as a result of climate change in developing countries.

social gain from that shift will always be less than the cost of the subsidy. The effect is similar to a subsidy on any other farm input (such as fertilizer or credit). The reduction in unit cost is partly paid for by the subsidy, and the cost of the subsidy is always greater than sum of the additional producer and consumer welfare that it generates (Siamwalla and Valdes 1986). Only if there are externality benefits beyond the gain to consumers could there conceivably be a net social gain from a subsidy.

Subsidies to Achieve Broader Social and Political Goals

Governments are rarely constrained by narrow market failure arguments, and often choose to heavily subsidize agricultural insurance for broader political and social purposes. Insurance subsidies are commonly used as a means to:

- To increase food production or agricultural exports for national purposes, even though the value of that production may be less than the cost of the subsidy (see previous section);
- Improve equity of coverage by extending insurance access to previously excluded groups, such as low-income farmers or high-risk regions, on a more permanent basis.
- Support farm incomes more generally, as is done in many middle and high-income countries. This happens when the average annual claim payment exceeds the unsubsidized part of the premium rate by farmers (i.e., PCRs greater than 1.0), and which, as seen in Table 1, amounts to a substantial income transfer in some countries.
- Substitute for safety net and disaster assistance spending by providing farmers and other rural people with subsidized insurance against catastrophic losses, like droughts;
- Insure disaster assistance programs (DAPs) so that they have assured and quick access to funds when disaster payments need to be made, whilst also annualizing the cost of DAPs in the form of an insurance premium rather than lump sum payments when disasters occur;
- Protect banks and agricultural credit programs from bad debt, especially against systemic losses that lead many farmers to default on their loans at the same time. It is often hoped that this will also encourage banks to extend credit to riskier farmers.

Sometimes subsides are used to obtain multiple goals. For example, in the US, the crop insurance program provides income support to farmers - an average PCR of 1.7 during 2003-07 (Table 1), and since the major claim payments are tied to disaster years, the insurance also helps substitute for disaster assistance programs. In India, insurance subsidies are intended to expand agricultural lending, while also providing protection for the agricultural banks. If the insurance also encourages farmers to adopt riskier but higher income earning strategies, the social and political goals may also be win-win with agricultural growth and higher farm incomes.

Of course, governments usually have alternative ways of achieving many of these social and political goals, and using an insurance subsidy to achieve them is only justified from an economic perspective if it is more cost effective and less distortionary for markets and resource allocation decisions (see next section).

4. Challenges in Subsidizing Agricultural Insurance

Agricultural insurance faces challenges of its own when it comes to the design, delivery and administration of insurance contracts that farmers are willing to buy, and as reviewed elsewhere, important problems remain despite considerable progress over recent decades (Hazell, Hess and Kuhn, 2016). Additional challenges arise when the insurance is to be subsidized, and as discussed in this section, care is needed in the design and implementation of subsidies, otherwise they can prove unnecessarily expensive, worsen inequality, and create disincentive problems that undermine the insurance program, distort markets and resource allocation decisions.

Poorly designed insurance subsidies can inadvertently create disincentive problems that lead to significant economic costs and inefficiencies. The main reason for this is that subsidizing insurance leads farmers to assume more risk in their resource allocation decisions than when the insurance is not subsidized. In some circumstances this may be desirable. For example, it might enable smallholders who were previously underinsured to adopt more risky crop mixes and technologies that increase their average incomes and help lift them out of poverty. However, premium subsidies that reduce the cost of insurance below its actuarially fair value may also encourage farmers to take on too much risk, such as growing unsuitable crops in risky environments, or growing more of them, adding to the future costs of insurance and possibly damaging the environment (Siamwalla and Valdes, 1986; Hess and Hazell, 2016; Goodwin and Smith, 2013).

Of course, other types of policy interventions designed to help farmers manage risk also create disincentive problems. These problems can be particularly severe for some types of disaster assistance programs (DAPs) because DAPs are invariably fully funded by governments and/or donors given the difficulties of recovering costs from beneficiaries. In effect, a DAP provides what is equivalent to 100% subsidized insurance payouts. A classic example of the disincentive problems associated with DAPs is how publicly provided compensation to repair or rebuild houses after hurricane disasters in the US may have contributed to a net increase in the housing stock in vulnerable areas (Kunreuther et al., 1978). Another example was the negative impact of publicly subsidized barley feed and credit for herders in drought years in the

low-rainfall areas of the North Africa and Middle East region. This intervention contributed to the eventual overstocking of rangeland areas and crop expansion into drought prone rangelands, helping to undermine well established and sustainable rangeland management systems (Hazell, Oram and Chaherli, 2003). One way to reduce the negative incentives associated with DAPs is to combine them with compulsory insurance for some kinds of catastrophic losses, even if the premium has to be partially or fully subsidized for poorer people. This is a common practice in many higher income countries for managing flood risks. Another way is to provide insurance coverage as long as the beneficiaries take some prescribed actions to reduce risks. For example, in several countries earthquake insurance is conditioned on houses being built or adapted to building codes that make them more earthquake resistant

Poorly designed insurance subsidies can also create other kinds of problems:

- When subsidized insurance is used to insure farmers' credit, the claim payments need to be tied to verifiable losses against specific and insured perils or index outcomes, otherwise there is potential to reduce due diligence in the lending practices of banks. An egregious example was the former Mexican insurer ANAGSA, which insured the loans of an agricultural development bank (Banrural) with MPCI policies that repaid the bank for most sources of farmers' crop losses. Not only did ANAGSA end up making large claim payments each year to offset loan defaults, but knowing that they could easily collude with farmers to obtain claim payments from ANAGSA, Banrural staff had limited incentive to perform due diligence on loan applications or to attempt to recover defaulted loans (Hazell, 1992).
- Subsidies in the form of direct payments to insurers to help settle claims have the potential to undermine efficiencies and incentives for due diligence within the insurance industry, especially if the government automatically covers any claims that the insurer cannot pay (Hazell, Pomareda and Valdes, 1986; Hazell, 1992). Direct payments to insurers need to be tied ex ante to specific formulas, such as reinsurance within agreed rules on the tail end risks to be covered.
- Subsidized insurance may raise WTO concerns if the subsidies have more than a minimal impact on production and trade.
- Without a clearly defined strategy, using insurance subsidies for some political and social purposes can easily become more expensive than planned, in part because the demand for insurance is typically inelastic, and premium subsidies have to be set at high levels to attract the kinds of participation rates that governments look for to achieve their social and political purposes (Glauber, 2012; Hill et al., 2014).
- Insurance subsidies can also lead to undesired distributional consequences. For example, the benefits from proportional subsidies are skewed towards those farmers who buy more insurance, and they are unlikely to be poor.

Another difficulty with insurance subsidies is that they can be difficult to phase out or remove once established. In fact, like most input subsidies, experience shows that their cost to government typically grows over time as more of the input is used, or in this case, larger crop areas are insured (Hazell, 1992; Glauber, 2012). Recent examples are the rapid growth in public spending on subsidized insurance in China, India, and the US. The problem

can be especially acute when the subsidies are untargeted and paid on a proportional basis, since this can benefit a clientele of larger and politically well-connected farmers who lobby for its continuation and expansion (e.g., in the US). Subsidies may also benefit the insurance and financial sectors, which are also effective lobbying groups. The dynamics of the political support for subsidies can even be driven by governments themselves, as, for example, when subsidized insurance is seen as a way of influencing election outcomes, or writing down farm debt (the former ANAGSA program in Mexico was a classic example – Hazell 1992). The danger of losing control over insurance subsidies seems greater when used for broader political and social purposes than when targeted at fixing specific market failure or externality problems.

Of course, alternative policies for achieving some of the same political and social objectives as subsidized insurance (e.g. farm income or price support policies) can also become politically entrenched and distort incentives and markets. As such, the indirect costs of subsidized insurance need to be evaluated relative to the indirect costs of alternative policies, and not held to unrealistically high standards that eliminate it from consideration.

5. Does Subsidizing Agricultural Insurance Pay?

Although there may be sound economic reasons for subsidizing agricultural insurance in some contexts, it is not guaranteed that it is a worthwhile way to spend public money. That depends on more than the just the size of the hoped for benefits. In the first place, an insurance program that is being subsidized may have problems of its own in designing, delivering and administering insurance contracts that farmers want to buy. Problems have been widespread in the past (Hazell, 1992), and challenges remain despite recent progress in the use of public-private partnerships and new forms of IBI (Mahul and Stutley, 2010; Hazell, Hess and Kuhn, 2016; Jensen and Barrett, 2017). Problems with underlying insurance programs are not necessarily resolved by adding a subsidy (e.g., a subsidy would not solve a basis risk problem), and in some circumstances a subsidy could compound existing problems (e.g., by crowding out alternative insurance programs). Then there are the potential disincentive problems that arise from adding a subsidy, and which could lead to additional economic costs and inefficiencies. So whether or not it pays to subsidize agricultural insurance is an empirical matter that requires careful collection and analysis of data about the performance of insurance programs.

Unfortunately, there have been only a few quantitative studies of whether or not subsidized agricultural insurance leads to favorable net social returns for a country. These include ex post cost-benefit studies of the Japanese and Mexican programs, where it was found that the social returns were negligible in relation to the programs' high costs (Tsujii, 1986; Bassoco, Cartas and Norton, 1986). However, these were evaluations of old style MPCI programs, and there have been significant improvements in the design and implementation of agricultural insurance programs since then (Hess, Hazell and Kuhn, 2016). At present, we simply do not know if subsidizing agricultural insurance is economically worthwhile, or how the net benefit might vary with the type of insurance subsidy and the context in which it is introduced. This does not mean that subsidizing agricultural insurance is not economically worthwhile - the lack of evidence does not prove the case one way or the other, but it does highlight the urgent need for ex post cost-benefit evaluations of more recent types of subsidized crop insurance programs, including IBI products.

There is a growing body of experimental data showing how subsidized insurance can help immediate beneficiaries (Cole et al, 2012; de Janvry; Jensen and Barrett, 2017), but these gains have not been valued and compared to the costs of the insurance programs, nor have they been tested and evaluated at scale. A good starting point would be more ex ante evaluations of subsidized insurance programs before they are launched, and a recent World Bank analysis of a proposed insurance program for Bangladesh shows how this can be done (World Bank, 2015 – Box 1). Although the ex ante benefits look favorable in this case, the analysis did not go so far as to sum all the benefits and compare them to the projected cost of the program to the Government of Bangladesh, so it is not entirely clear that the program would be socially worthwhile. Ex ante evaluations would not only help screen out less promising proposals, but also provide a basis for subsequent ex post evaluations.

Box 1: Ex Ante Cost-Benefit Evaluation of an Insurance Program in Bangladesh

Agriculture is a key sector in Bangladesh, but it is highly exposed to risks. Indeed, Bangladesh is commonly ranked as one of the most vulnerable countries in the world to natural disasters with agriculture heavily exposed to floods, cyclones, and drought. In 2007, for instance, Cyclone Sidr destroyed 0.69 million ha of cultivated crop lands and killed over 460,000 head of livestock and poultry.

In the past, the government of Bangladesh and development partners have provided substantial support to farmers in the aftermath of large disasters, but this approach has disadvantages in that support is not guaranteed to farmers and may be slow. In the aftermath of Cyclone Sidr, recovery and reconstruction needs were estimated at US$1.3 billion, or 28 percent of government expenditures.

Agricultural insurance offers the government a planned, fast, ex ante alternative to ad hoc disaster response, one that (1) reduces the ex post fiscal burden on the government, (2) improves farmers' resilience to shocks, and (3) supports the expansion of agricultural credit.

To assist the government, the World Bank undertook an ex ante evaluation of a proposed agricultural insurance scheme, which is now being implemented. Key findings from the evaluation follow.

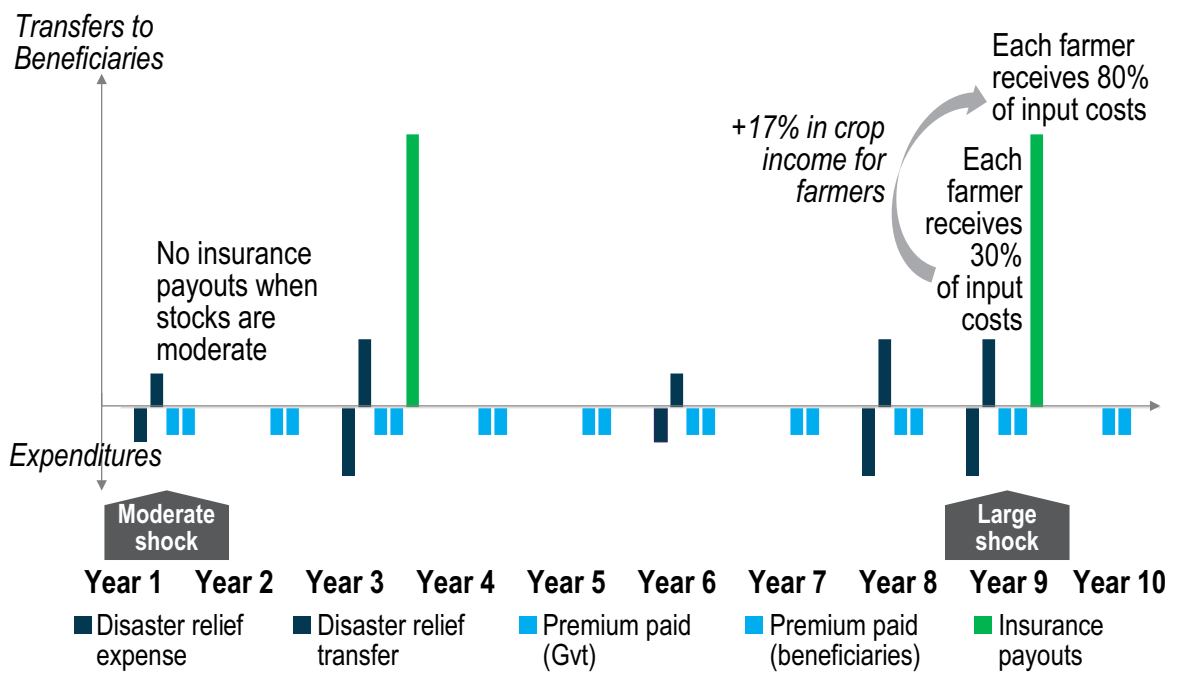
Annual fiscal costs to be borne by the government for supporting the development of a national area yield index insurance (AYII program) for aman and boro paddy are estimated at between US$6 million and US$9 million in 2020, when about 10 percent of the area cultivated with aman and boro paddy would be insured. This fiscal costing exercise is based on the assumption that the government will provide financial support to the AYII scheme through 50 percent premium subsidies as well as investment in data market infrastructure and support to awareness-raising activities. As a reference, this amounts to about 0.05 percent of the government of Bangladesh's 2014 budget, and 1 percent of the Ministry of Agriculture's budget for the same year.

Welfare impact analysis shows that commercial insurance could help small- and medium-scale farmers stabilize and increase their crop income by up to 41 percent if insurance unlocks credit and adoption of high-yielding varieties. Indeed, if farmers currently growing aman local or boro HYV switched to higher-yielding varieties (aman HYV or boro hybrid respectively), the increase in expected yield would largely compensate for the increase in input costs. Given that AYII could increase loan repayment by up to 35 percent in bad (1-in 10) years, insurance could unlock these productive investments through enhanced access to

cheaper credit. For large-scale farmers, the impact of AYII on access to credit and adoption of technologies would be more moderate.

Subsidized AYII could also result in a 100 percent increase in small- and medium-scale farmers' crop income in bad (1-in-10) years, compared to pure disaster relief. This positive impact of insurance is expected to result from two combined effects. On the one hand, AYII could crowd in credit and adoption of high-yielding varieties, thus increasing crop income in bad years by 83 percent. On the other hand, insurance could mobilize larger compensation to farmers following catastrophic shocks than can existing disaster relief programs, thus increasing crop income by 17 percent in bad years relative to disaster relief program (see figure 1).

Figure 1. Illustrative Comparison of Disaster Relief and 50 percent Subsidized AYII Across Years with Different Levels of Shocks



Source: World Bank (2015).

There have also been only a few studies that compare the relative costs and benefits of subsidized insurance with alternative policy approaches for achieving the same political and social goals. Pomareda (1986) showed that for the Agricultural Development Bank of Panama during the 1980s, a 2% increase in the interest rate it was allowed to charge on farm loans would have been equally as effective as the entire crop credit insurance program in protecting the bank's lending portfolio. Even a subsidy to cover the extra 2% interest charge would have been more cost effective for the government than funding many of the costs of the insurance agency.

Using subsidized insurance as a means to transfer income, either as a safety net or a farm income support measure can be expensive. As shown in Table 2, it cost governments about $0.50 to transfer each $1 to farmers through subsidized insurance in

four major insurance programs during the 1980s, and the transfer cost had increased from $0.63 to $0.95 in more recent years in the US program, despite improvements to the design of the program[6]. This is expensive compared to an average 2009-13 transfer cost of between $0.12 and $0.19 per $1 delivered for the Ethiopian Productive Safety Net Program (World Bank, 2016, pp. 57-58). It is also expensive compared to a cost of $0.20 to transfer a dollar of food under Mexico's Oportunidades program, which itself is ten times higher than the cost of transferring one dollar of cash (Gentilini, 2016). In richer countries with well developed income tax systems, it may also be less costly to allow farmers to offset weather related losses in any one year through income tax averaging over several subsequent years (as in the US). Subsidized insurance does have an advantage over some alternative income transfer mechanisms in that it pays out during years of insured losses, and hence also helps to stabilize incomes. But so do programs like the Ethiopian Productive Safety Net Program and Mexico's Oportunidades program.

On the other hand, as an income support measure, insurance subsidies might be less costly than payment schemes for environmental services, given the high administrative costs incurred in selecting, monitoring and enforcing environmental projects at farm and landscape levels. It may also be less costly than price support mechanisms, which can lead to costly public storage schemes and distortions in commodity markets.

One of the key expected benefits of agriculture insurance is to unlock credit for agricultural activities exposed to risks such as drought, floods or pests and diseases. Indeed by absorbing large covariate agriculture production risks, subsidized insurance has the potential to help financial institutions offer larger loans and to more farmers. While several rigorous studies have shown significant impact of agricultural insurance on farmers' risk-taking behavior (Karlan et al., 2012; Elabed and Carter, 2015), evidence of the impact of insurance on credit is still missing. There is virtually no credible evidence available to show that subsidized credit insurance has any impact on the lending practices of agricultural lenders. Even with large scale and well-established agricultural insurance programs such as in India or Mexico, there is no credible evidence to show whether the insurance has helped to protect agricultural lending ex post (e.g. through a reduction in non-performing loans in bad years), or has been used by financial institutions to expand agricultural lending ex ante (e.g. larger volumes of credit, a broader segment of borrowers reached, cheaper rates, longer maturities). To the contrary,

Table 2: Cost to Government of Transferring Income to Farmers Through Subsidized Crop Insurance Programs in Four Countries

Country	Total government spending in dollars to transfer $1 to farmers*
USA 1981-90 2000-11	1.63 1.95
Mexico (1980-89)	1.22
Costa Rica (1970-89)	1.43
Philippines (1981-89)	1.61

Source: Hazell (1992) and author's calculations based on data in Glauber (2012).
*Calculated as total cost to government (premium subsidies plus A&O subsidies and reinsurance payments) divided by net indemnities received by farmers.

[6] According to Joe Glauber (personal communication) this is in part because of the severe drought in 2012 when the government had to pick up a substantial part of the producers' claim payments.

many financial institutions in India are finding ways to avoid the requirement of bundling rural loans with insurance. An estimated 30-40% of rural loans are actually insured, which suggests that financial institutions are not strictly enforcing mandatory bundling even though it ought to be in their self-interest. A series of factors could explain this relatively low penetration: burdensome paperwork for insurance enrollment; borrowers unwilling to pay additional charges for insurance; reputation risk faced by financial institutions if a customer experiences agricultural losses but does not receive payouts (or "basis risk"); and banks cherry picking and only asking for insurance for riskier loans/ clients. Research is too scarce to fully understand the mechanisms involved, but it seems clear that, regardless of the potential benefits to small farms, bundling insurance with credit for individual farm loans is not necessarily seen by financial institutions as a way to protect and expand their agriculture lending.

6. Principles and Good Practices in the Design of Subsidies for Agricultural Insurance

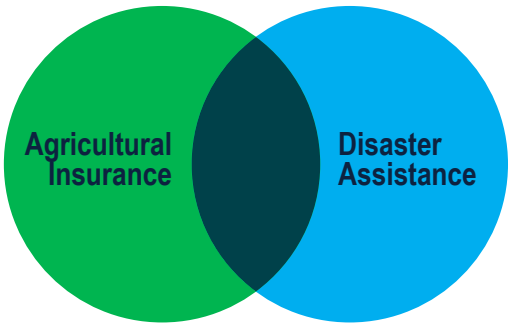
As seen in earlier sections, there are contexts in which subsidized agricultural insurance has the potential to offer private and social benefits, but experience shows that once introduced, challenges in the design and operation of insurance programs, poor design of subsidies, plus political dynamics can lead to disappointing results, an expensive draw on the public purse, and the creation of disincentive problems that lead to significant economic costs and inefficiencies, and in some circumstances, to environmental degradation. To avoid these problems, any insurance subsidy needs to be carefully designed and implemented so that it is cost effective in achieving its underlying purpose, minimizes disincentive problems, and does not become a growing financial burden on the government. Some useful good practice guidelines have been proposed in the literature, and we draw on these and our own work in proposing the guidelines set out below (e.g., Hill et al., 2014; Clark, 2011; Hess, Hazell and Kuhn, 2016).

In developing guidelines, it is useful to distinguish between agricultural production insurance for farmers (including yield and credit insurance), and catastrophe insurance against natural hazards that is intended to complement or replace disaster assistance programs for farmers. While both types of insurance should be limited to objective and verifiable risks using index based or special peril contracts, a key difference between the two is that agricultural production insurance is designed to cover a range of crop and livestock production risks, while disaster insurance covers extreme natural hazards that can lead to loss of lives, assets and livelihoods, not just seasonal losses in agricultural production. Another difference is that disaster assistance is nearly always provided free of charge to beneficiaries, whereas agricultural insurance typically requires at least a co-payment. Within agricultural insurance, it is also useful to separate out insurance that is targeted specifically to poor farm households, as this requires additional care in setting guidelines.

Agricultural insurance and disaster assistance (or insurance) programs are not necessarily mutually exclusive, and often coexist in many disaster prone regions (Figure 2). When this happens, special care is needed in their design to avoid a) undermining each other (e.g., farmers have less incentive to buy agricultural

insurance if they can rely on free disaster assistance), and b) to exploit possible complementarities (e.g., if disaster assistance removes extreme covariate risks, then this can facilitate the development of more flexible forms of agricultural insurance). One advantage of replacing part or all of disaster assistance program with disaster insurance is that it opens up the possibility of bundling the insurance with other forms of agricultural insurance.

Figure 2. Overlap Between Agricultural Insurance and Disaster Assistance



Guidelines for Subsidizing Insurance for Commercial Farmers

Assuming governments supply the basic public goods needed to create an enabling environment for insurance markets to work (e.g., maintaining weather station infrastructure and data systems), then agricultural insurance for commercial farmers ought in principle to be financially viable without subsidies, except perhaps on a temporary basis because of some externality or establishment problem that constrains the development of the insurance market. However, as seen in section 3, many governments subsidize farm insurance at high and sustained levels in the pursuit of broader social and political goals, and this complicates some of the guidelines. Our guidelines are as follows:

- **Start by assessing risks and establish the need for insurance within a broader policy framework that also encourages risk reduction.** Since a primary purpose of most agricultural insurance subsidies is to reduce the risk exposure of farmers, a good place to start is to ask if insurable farm risks are the main problem in terms of their severity and frequency compared to other risks that farmers face. In some contexts, market, natural disaster, and security risks are more important than agricultural production risks, in which case subsidized agricultural insurance may not be effective. Even where production risks are dominant, subsidized insurance is not necessarily the best solution. Some production risks can be reduced by taking preventative actions, such as investing in irrigation, plant breeding, and flood control. Some of these preventative investments also contribute to higher productivity over time, and may offer more attractive 'win-win' solutions to the risk problem than spending public money on insurance subsidies. Governments may be able to make their own investments in risk reduction or use policies to create incentives for farmers and local communities to make investments. Other risks may be more difficult or costly to prevent, but farmers can often reduce their exposure by using risk-avoiding strategies like crop and income diversification. Such risk avoidance generally comes at a cost in terms of average income forgone, in which case insurance should be explored to see if it is more cost effective. In short, subsidized insurance is best seen as a way to handle some of the residual risk after other and more cost effective measures have been taken to reduce farmers' exposure to production risks. The World Bank, amongst others, works with countries in undertaking broad risk assessments, and this is a useful first step before setting up an insurance program. Such risk assessments should also take account of expected changes in climate risks.
- **Articulate what the subsidy aims to achieve.** Once the need for insurance has been verified, the next step is to develop a clearly stated and well-documented purpose for the subsidy that is agreed with the relevant policy makers. This

should be based on some of the arguments presented in section 3 of this paper, and which have been empirically analyzed to demonstrate a clear ex ante economic rational (for an example, see Box 1).

- **Provide a financing plan for the subsidy.** As part of the plan, there should be an explicit strategy or financing arrangement for the subsidy. If the subsidy is intended to help insurers overcome initial establishment problems for the insurance, then there should be a time bound sunset clause. If the subsidy is intended to continue on a longer-term basis in the pursuit of some social or political goal, then there should be an agreed financing plan so that the subsidy does not become an unexpected burden on the public purse.
- **The subsidy should be implemented through credible agricultural insurance programs or agencies.** Agricultural insurance faces its own challenges in designing, delivering and administering insurance contracts that farmers are willing to purchase, and adding a subsidy to a badly performing insurance program or insurer is unlikely to be a recipe for success. For example, subsidizing an index based insurance program that suffers from a serious basis risk problem is unlikely to make it more attractive to farmers. The first priority in this case should be to overcome the basis risk problem.
- **Encourage competition amongst insurance providers.** Where possible, the subsidy should be used to encourage competition among insurers. For example, if delivery costs are subsidized, insurance companies should be encouraged to deliver at the lowest possible cost. This could be done by having companies bid their delivery services to the government, or by allowing the companies to load expenses onto their premiums and then provide vouchers to farmers to cover delivery costs and let them choose their preferred supplier. Also, awareness campaigns amongst farmers and their organizations can help them become more savvy clients when buying insurance. Consumer protection agencies can also help protect farmers from bad practices by insurers and lenders. In countries where there are few if any existing agricultural insurers, the challenge is to avoid setting up institutional arrangements that crowd out the subsequent development of private sector competition.
- **Avoid using subsidies to reduce the cost of insurance below its pure risk premium.** In order to reduce disincentive problems that lead farmers to take on too much risk or of the wrong types, the premium rate farmers pay (net of any subsidy) should ideally never be less than the actuarially fair (or pure risk) premium. This means that subsidies will be less distorting if limited to offsetting an insurer's administration and development costs rather than subsidizing the premium rates paid by farmers, and these costs can be quite substantial during the early stages of a new insurance program. Few publicly subsidized insurance programs adhere to this guideline[7], and as discussed earlier, governments provide higher premium subsidy rates for commercial farmers in pursuit of broader social and political purposes. **Where the pure risk cost is to be subsidized, there are ways to reduce the disincentive problem.** One way is to restrict the amount of subsidized insurance farmers can buy for each insured crop, or not to offer a subsidy at all for high-risk crops, farmers or regions where disincentive problems are likely to be large. Yet another way is to structure the subsidy in a way that respects the relative risk

[7] Mahul and Stutley (2010) found only 7 countries with subsidized insurance programs during 2003-07 met this requirement.

levels across insured activities[8]. For example, the pure risk component of the premium rates could be subsidized on a proportional basis so that if the unsubsidized premium rate for one crop is initially twice that of another, then its subsidized premium rate would also be kept twice as high.

- **Consider what form the subsidy should take.** Where a subsidy is to be paid directly to an insurer to help cover some initial set up costs, then depending on circumstances, it may be better to provide subsidized reinsurance rather than a direct administrative subsidy. A good example is when the subsidy is designed to offset high but temporary risk loadings because of inadequate information about the insured risks. The Annex to this paper explores this guideline in more detail.
- **Consider a cap on the subsidy level.** To avoid adverse distributional outcomes in which larger farms capture a disproportionate share of the subsidy, a cap could be placed on the level of subsidy or subsidized insurance available to each farm.
- **Establish an M&E framework.** To ensure that the subsidy is achieving its intended purpose, a good long-term monitoring and evaluation (M&E) system that tracks the performance of the subsidized insurance is required. This has rarely been done in the past. In addition to basic performance data on coverage (number farmers, sum insured), premium collected, claim payments made, and claims ratios (C over P) recorded by insurers, etc., it is also important to monitor the costs of the insurance to government, and its impacts against the intended goals of the subsidy. The cost data should include the cost to the government in annual premiums subsidies, investments in data collection, contributions to management and audit costs, awareness campaigns, stop-loss arrangements etc. Tracking impact will depend on the purpose of the subsidy. For instance, if the subsidy is intended to increase farmers' access to agricultural credit, then the terms of loan (interest rate, maturity) and loan recovery rates should all be monitored. Morsink, Clarke and Mapfumo (2016) discuss suitable M&E indicators in more detail.
- **Conduct a cost-benefit analysis.** To demonstrate that the subsidy is money well spent, it should be shown that either the subsidy leads to a net social gain through a cost-benefit analysis (as when correcting market failures and externalities), or when the subsidy is being used to achieve broader social and political gains, that it is more cost effective than alternative intervention policies.

Guidelines for Subsidizing Agricultural Insurance for Poor Farmers

Even when agricultural insurance for commercial farmers is well developed, it is often the case that many poor farmers are left out because they are perceived to be too risky or too costly to serve, or because they are too poor to pay an insurance premium. This has led to many attempts to provide targeted and subsidized insurance that meets the special needs of poor farmers. It is often hoped that providing them with subsidized insurance will provide a pathway that enables them to access credit and adopt higher earning but more risky farming strategies and technologies that will lift them out of poverty. For some farmers, an initial subsidy may be sufficient to enable them to transition to unsubsidized commercial insurance, but for many of the poorest a sustained subsidy may be necessary to help keep them afloat. Most of the guidelines provided above for subsidizing insurance for

[8] Past experiences in India has shown that subsidies directed at risky crops may encourage farmers to cultivate more of these crops (e.g., groundnut in Andhra Pradesh and Gujarat). Changes in actuarial design introduced by the Government of India in 2010, with support from the WBG, have significantly improved risk signaling and incentives to adapt to climate change.

commercial farmers still hold, but we make the following exceptions and additions:

- Since the insurance is targeted to poor farmers each of whom will buy only a small amount of insurance, then an intermediary organization that can aggregate up the needs of many small farms and administer the insurance on behalf of an insurance company is typically needed. A variety of institutions might fill this role, including an NGO, a farmers association or cooperative, a mutual insurance group, an agricultural development bank, and a microfinance organization. It is important to identify and select an appropriate intermediary. It also needs to be recognized that providing subsidized insurance on its own is unlikely to be a game changer for the poor unless a) they can access credit if they purchase the subsidized insurance, and b) are able to use the credit to obtain the complementary inputs like fertilizer, improved seeds, and extension needed to raise their farm productivity. This can be a challenge for many poor farmers who are anyway disadvantaged by high transactions costs in accessing inputs and markets, and who are typically the least likely to receive assistance from public extension agents. For many poor households, it typically takes concerted action by governments, donors or an intermediary organization like a cooperative or NGO to provide the subsidized insurance within a complementary package of other requirements for change, and this should also be considered when selecting an intermediary organization to aggregate and distribute the subsidized insurance. A good example is the R4 Risk Resilience initiative in Ethiopia (Box 2).
- Most insurance subsidies for poor smallholders will need to cover a substantial part of the pure risk cost if it is to be affordable. This does mean there are potential negative incentive problems, although these are likely to be less severe for small scale, often subsistence oriented farmers than for larger-scale commercial farmers. One way to reduce the problem for poor farmers is to require them to repay the subsidy in the form of in-kind labor payments by working on community projects that contribute to greater resilience against losses, as with the R4 Risk Resilience initiative in Ethiopia[9] (Box 2). Another way would be to limit the payments so it can be more of an income support (rather than compensation for actual losses) to protect basic needs in the event of severe crop or livestock losses.
- When the subsidy is intended to benefit specific segments of farmers or herders to help them escape poverty, the subsidy should be well targeted to those segments to minimize the cost of inadvertently subsidizing others. When the insurance subsidy is tied to credit at selected financial institutions, then it is relatively easy for the financial institution to distinguish between targeted and non-targeted borrowers. More generally, insurers or intermediary institutions like cooperatives and NGOs will need sufficient household specific information and an operational capacity to identify and service poor households, and some compensation for the extra administrative costs. Hill et al (2014) discuss the issues and some of the options for targeting subsidies in some detail. One promising approach is to link the insurance with existing social protection systems, such as safety net and cash transfer programs, as these already have an infrastructure in place for identifying the poor and vulnerable and delivering assistance. The R4 Risk Resilience initiative in northern Ethiopia has used the Ethiopian Government's safety net program to identify poor households (Box 2).

[9] Based on RCTs in Ethiopia, Tadesse et al (2016) found that most smallholders were willing to undertake such work at below normal wage rates.

Box 2: The R4 Risk Resilience Initiative in Ethiopia

Weather-related shocks are a constant threat to the security and well-being of many poor farmers in Ethiopia. To help them build resilience and face these challenges, Oxfam America, Swiss Re, and their partners developed the Horn of Africa Risk Transfer for Adaptation (HARITA) program in the state of Tigray in Ethiopia in 2008. HARITA is an integrated risk management program aimed at strengthening farmers' food and income security through a combination of improved resource management, insurance and microcredit.

HARITA allows cash-poor farmers the option to work for their insurance cover by engaging in community-identified projects to reduce risk and build climate resilience, such as improving irrigation or managing soil. Though the premium is fully subsidized for some farmers, they still contribute to the cost of the insurance with their work. Farmers who are in a slightly better financial situation, on the other hand, must contribute in cash to the cost of the coverage in order to enjoy the same benefits. The long-term goal of the program is that farmers participating in the "work-for-insurance" modality can eventually graduate and afford to pay in cash, allowing other farmers in need to take their place in the program.

In the event of a seasonal drought, insurance payouts are triggered automatically when rainfall drops below the determined threshold, enabling farmers to afford the inputs necessary to plant in the following season and protecting them from having to sell their assets. However, the most innovative feature of HARITA is that farmers benefit even when there is no payout, as the risk management infrastructures built through their work will help reduce risk during next seasons.

In order to target the vulnerable low-income rural population living in Tigray to participate in the program, HARITA is integrated with the Government's "food- and cash-for-work" Productive Safety Net Program (PSNP), a well-established scheme that serves 8 million chronically food-insecure households in Ethiopia. By using an already existent safety net program, HARITA managed not only to better reach its target population, but also to reduce the costs of establishing a distribution network from the start. While the distribution model makes it easier to reach those who have time to spend on community work, it excludes poor households that do not have excess labor capacity, such as female-headed or elderly households.

In December 2010, after a partnership with the WFP, HARITA was renamed "R4" and expanded to 76 villages in Tigray, reaching around 20,000 farmers. The program has experienced high demand and the "work-for-insurance" segment reaches capacity within the first couple of days of being introduced in a new area. Though the idea is to extend the program to other areas that face the same constraints, lack of funding limits scale. The reliance on subsidies limits the scale at which the insurance can be offered, as funding is needed to pay for the public works and to pay for the premium.

The R4 illustrates several good practices: a) it uses a safety net program to identify the poor, b) it encourages farmers to undertake ex ante risk reduction measures, c) it packages the insurance with access to credit, inputs and extension advice to help promote increases in farm productivity, and d) requires farmers to contribute to the cost of the insurance either in cash or by providing labor to community development projects. However, despite its promise, the program has yet to demonstrate its full impact and net social value through a cost-benefit analysis. Also, while the initiative demonstrates several good practices, and is generally a well designed and administered program, it has not reached scale, even after 8 years, there is no obvious strategy for phasing out the annual subsidy that is provided by donors.

Source: Hill et al (2014) and authors.

Guidelines for Subsidizing Insurance to Improve or Replace Disaster Assistance

Spending on disaster assistance programs (DAPs) has increased significantly in recent years, and seems destined to increase further in many countries with climate change. Such spending is driven more by humanitarian concerns than development agendas and often its primary value is in saving lives. Some DAPs also aim to rebuild assets and livelihoods as part of recovery efforts. DAPs are particularly helpful to the poor, who are generally more exposed to catastrophic risks because they have the least options for coping with losses when they occur, and because they often live in more remote and high-risk areas.

While most DAPs achieve their primary objective of saving lives, they vary widely in terms of their cost, efficiency, and protection of assets and livelihoods. Two of the biggest practical challenges facing DAPs are a) the difficulty of targeting assistance to the truly needy under emergency conditions while at the same time not wasting assistance on the non-needy; and b) by the time an emergency has been declared and an assistance effort funded and launched, the assistance may arrive too late to relieve the worst suffering and losses. Another problem discussed in Section 4 is that since DAPs are fully funded by donors, UN agencies and governments, and, unlike insurance, do not try to recoup their costs from the beneficiaries, they may lead to disincentive problems, particularly once people begin to take them for granted. Finally, because DAPs focus on *ex post* compensation and recovery, they may do little to encourage recipients to take preventative *ex ante* actions that reduce risk exposure and increase resilience, including discouraging recipients from purchasing their own insurance. Recognizing these limitations, there have been some recent and useful innovations in developing better approaches to DAPs, and which involve the application of subsidized insurance.

To obtain quicker and more assured access to funds in times of need, some DAPs have been able to purchase international reinsurance to cover part of their expected assistance payments. Not only does this lead to more assured and timely payments from a reinsurer when a disaster occurs, but reinsurance can also help smooth out the annual cost of a DAP to government and/or donors in the form of a predictable and regular annual premium. Even if only part of the disaster risk is insured, this can enable governments to better plan for disasters, and help fill the short-term post-disaster funding gap while additional assistance is being sourced (Clarke and Dercon, 2016). This kind of reinsurance works because most catastrophic losses caused by natural disasters are relatively easy and transparent to observe, and can be indexed on the basis of existing data series to create an attractive index based insurance (IBI) product for the reinsurance market. A good example is the Agricultural Fund for Natural Disasters (CADENA) in Mexico, which internationally reinsures part of the costs of Mexico's state-managed relief programs (Hess, Hazell and Kuhn, 2016).

To solve the targeting problem, one promising development is the linking of DAPs with existing social protection systems, such as safety net and cash transfer programs, as these already have an infrastructure in place for identifying the poor and vulnerable and delivering assistance (Grosh et al., 2008; Alderman and Haque, 2008). The objective is to give these social protection schemes the capacity to scale up rapidly after a disaster and increase the size of the cash payments they make to beneficiaries and the number of beneficiaries they can support. In Ethiopia, for example, the government, World Food Program and the World Bank established the Livelihoods, Early Assessment and Protection (LEAP) mechanism in 2008 (Hess and Hazell, 2016). LEAP is an integrated food security and early response system that combines early warning, capacity building, contingency planning and contingent finance. While LEAP is based on donor-

provided contingent financing rather than commercial insurance, it uses an index-based approach.

To help encourage greater ex ante risk prevention and management practices among recipients, another innovative approach is to replace part or all of disaster relief with new types of subsidized IBI. The primary object here is to provide subsidized insurance contracts to vulnerable households each year so that when an insured catastrophe occurs, they receive automatic cash payouts from the insurance without having to wait for a relief effort. One example is the use of Early Recovery VOuchers (ERVOs) as proposed by the World Food Program (WFP) and GIZ (Hess et al., 2010. ERVOs are index based insurance contracts targeted to poor households who are identified ex ante based on national poverty lines or by a relevant safety net or cash transfer program (see Box 3). When a disaster occurs, insured households receive a guaranteed and immediate cash payment, preferably though mobile bank accounts. Moreover, instead of distributing the vouchers for free, recipient households can be asked to contribute labor towards enacting certain risk reduction measures, such as participation in training for good agricultural practices or disaster proofing homes, or by participating in community organized activities to improve disaster preparedness and mitigation. This can help increase resilience, and, as with the R4 Risk Resilience initiative in Ethiopia, reduce some of the perverse incentive problems associated with subsidizing the true risk cost of the insurance. The availability of ERVOs that remove important covariate risks may also encourage the uptake of complementary forms of agricultural insurance for managing other agricultural production risks. The index chosen for the insurance should correlate highly (on the downside) with major losses in the income or assets of poor households due to catastrophic events, and need not be limited to farming households. ERVO like schemes are being piloted in China and Peru (Box 4), and have been proposed in Paraguay, and their experience bears watching.

Box 3: Early Recovery Vouchers (ERVOs)

ERVOs seek to make relief more assured and effective for the poor (Hess, Balzer and Calmanti, 2009). ERVOs are motivated by two concerns. First, it is not enough to respond to shocks and rebuild livelihoods; there is a need to invest in disaster preparedness and mitigation measures. Communities that become more resilient and prepared to respond to disasters, when combined with government disaster preparedness efforts, significantly reduce disaster-related losses of life and livelihoods. In fact, studies show that every dollar invested in disaster risk reduction saves four or more dollars in future costs of recovery and rehabilitation.[10]

A second motivation is that the poor, who rely disproportionally on disaster relief when catastrophic events occur, are probably the least well served. The relief they receive is often inadequate because of the type of aid they receive (e.g., food aid rather than cash), the amount they receive (especially when there are high leakages to the non-poor), and the timing is often too late to be truly effective.

ERVOs attempt to address both these problems by providing direct ex ante disaster protection for the poor

[10] In a report to the United States Congress, the Federal Emergency Management Agency (FEMA) and the Multihazard Mitigation Council stated that "On average, a dollar spent by FEMA on hazard mitigation (actions to reduce disaster losses) provides the nation about $4 in future benefits." WFP estimates that US$1 spent on early livelihood protection in Ethiopia generates about US$4 in future cost savings and benefits.

by covering eligible households with an insurance policy that guarantees immediate disaster payments in cash following natural disasters. Moreover, instead of distributing the vouchers for free, recipient households might be asked to enact certain risk reduction measures, such as participation in training for good agricultural practices or disaster proofing homes, or by participating in community organized activities to improve disaster preparedness and mitigation.

ERVOs payments would be triggered by an index using weather station or satellite data about catastrophic events, and which would meet the objectivity and transparency requirements for international reinsurance. The insurance cover is aimed at poor households identified ex ante based on national poverty lines or by a relevant safety net or cash transfer program. With the development of mobile banking systems like M-PESA in Kenya, households could be uniquely identified and registered by mobile phone and payments, when due, made directly into their accounts where they could be accessed by mobile phone. For example, the identified and registered households might receive a natural disaster insurance that paid out up to $500 on their private account in the event of an extreme drought, flood or storm. Governments and donors pay the premiums and the insured household covers a small processing fee in order for the households to realize that they are insured. Where mobile banking is not available, ERVOs might be distributed by existing organizations that have a grass roots presence, such as safety net and cash transfer programs, microfinance institutions, NGOs, farmer cooperatives, etc. Payments could be announced on public radio, and made available at local banks or post offices. Technological advances in delivery technology (mobile wallets) as well as index technology (satellite-based) and geo-referencing of household locations (GPS) allow for the large-scale roll out of such ERVO schemes.

ERVOs have several attractive features:

- They offer benefits to the poor in terms of direct and timely assistance when a catastrophic loss occurs. Moreover, since the amount of assistance is assured, poor households would be able to take on greater risk in their livelihood strategies, hopefully increasing their average incomes.
- Through their conditionality, they could contribute to building more resilient community infrastructure, livelihoods and farming systems.
- They are an indexed form of insurance that can be reinsured through an index product for the managing agency.
- They can also be interfaced with existing safety net and cash transfer programs, which offer a reliable way for the ex ante identification of the poor and vulnerable.
- To avoid the negative incentives that arise from assured but free disaster assistance, households might be asked to make a small financial contribution (e.g. pay a processing fee), or pay a graduated premium – a basic amount of coverage could be free but there would be an option to buy more coverage at an escalating price. For the poor, there might be an option to pay the premium through an insurance-for-work scheme working on community projects that help build resilience. A graduated premium would solve the problem of what to do with households who choose not to buy the insurance – disaster relief would be provided to all the needy during an emergency, but those who had not bought vouchers would only be given the basic amount of assistance that is free.

- Another nice feature of ERVOs is that by removing some of the worst catastrophic risks facing farmers, this could open up more possibilities for insuring the more normal and less covariate risks that arise in agriculture. This might be especially relevant for many small to medium sized farms that want to pursue commercial farming opportunities.

A challenge for ERVOs is finding an index with a low basis risk for the households who receive the vouchers. This is a less daunting task than finding indices for crop insurance because a) the insurance is limited to the kinds of low frequency, high impact, highly covariate weather risks that affect most people in a region at the same time; and b) an index that correlates highly (on the downside) with losses in household incomes or assets may be more robust than indices that correlate with yield losses for specific crops. The type of index required for an ERVO scheme could also be meaningful to poor households in a region who are not engaged in farming, and who would benefit from receiving ERVOs.

ERVOs would have to be substantially funded by governments and donors, but if they could replace part of existing disaster assistance programs, and possibly some forms of publicly funded agricultural insurance that insure some of the same catastrophic risks, then there might be sufficient savings from existing funding commitments to enable ERVOs to be implemented at some scale.

Source: Hess, Hazell and Kuhn (2016).

Box 4: Seguro Agricola Catastrófico (SAC) in Peru

The catastrophic agricultural insurance (or SAC by its Spanish acronym) in Peru, is a government program that has the objective to support the small producers in the poorer and most climatic vulnerable regions of the country. It aims to protect a portfolio of basic crops against various climatic risks. The program started in 2009 and is being implemented in 8 departments, covering approximately 425,000 ha on average per crop year.

SAC is not only a financial resource to enable the provision of this insurance, but the first element of an agricultural policy that aims to strengthen the strategies for prevention and protection of agricultural families within the policy framework for social inclusion.

The main characteristics of SAC are as follows.

- Same insurance policy protects homogeneous groups of crops (basic crops, fruits, vegetables), in extensive areas of small and medium producers.
- Insured value per hectare is the same for all the insured/protected crops corresponding to an average area yield that has been established statistically. This average area yield is the trigger that determines the occurrence of the catastrophic event.
- SAC does not cover all the production costs nor the total losses of farmers when the catastrophic event occurs. SAC aims to provide for a basic compensation that increases the capacity of farmers to endure the negative impacts of the catastrophic event, and more specifically, to enable them to recover their own labor cost and be able to re-plant. The sum insured for 2015/16 was approximately $160/ha.
- Premium is 100% subsidized and paid by the government.
- In 2007 the government passed Law 29148 that establishes SAC.
- Insurance offered by a pool of two private companies: La Positiva and Mapfre Peru. Insurance companies are competitively selected.

Year	Premium (Soles)	Insured Area (Ha)	Sum Insured (Soles)	Loss Ratio %
2009-10	S/.39,447,693.84	490,069	S/.220,995,300.00	29.14
2010-11	S/.39,970,678.29	442,210	S/.238,387,122.00	71.4
2011-12	S/.39,982,850.01	450,108	S/.241,922,716.20	28.85
2012-13	S/.39,589,760.05	414,149	S/.239,543,306.00	35.52
2013-14	S/.30,000,000.00	329,943	S/.181,468,697.62	47.99
2014-15	S/.24,117,855.22	343,441	S/.188,892,324.50	46.35
2015-16	S/.39,000,001.22	550,296	S/.302,662,800.00	NA

Source: Seguro Agricola Catastrófico, MINAGRI, GIZ (2016).

Farmers receive indemnification when a certain threshold of yield loss (average area yield loss) is exceeded. Payment of indemnification is done directly from the insurance company to the beneficiaries, the small holder farmers, who have an account at a financial institution to receive directly into their account the payment from the insurance company. Farmers who are the beneficiaries of SAC are pre-identified and registered. The 8 departments selected for SAC are those with the higher concentration of poorer small holder farmers exposed to climatic risks. Between 2009/10 and 2013/14 crop years a total of 310,587 small holder producers received compensation reaching the sum of S/. 67.5 million (approx. US$22 million; or US$70 average per beneficiary). According to a report by MINAGRI (2016), a key factor for the success of SAC has been the strong support by the government, not only in terms of financial support, but also investments in technical capacity related to understanding small holder agriculture, agroclimatic risk analysis, and insurance, and making insurance an important instrument for the public policies for agriculture.

For the insurance sector, SAC has brought new opportunities for the private insurance companies and increased their interest to develop additional insurance products for agriculture beyond catastrophic insurance. An important impact of SAC, has been its impact on financial inclusion, by requiring beneficiary small holder farmers to open an account at a financial institution to receive payments. Many of these farmers prior to SAC had no relation with formal financial institutions. Furthermore, relations with financial institutions now open the possibility that the small holder farmer could potentially access credit. SAC also offers opportunities for these small holder farmers to take new decisions about crop choices to grow and cultivation practices. The protection offered by SAC could enable farmers to take some additional risks in choosing to grow other crops/products or putting more investments in existing crops they grow with potential positive effects on productivity and income growth.

Best practice guidelines for using subsidized catastrophe insurance to complement or replace DAPs are as follows:

- First, assess whether insurable catastrophe risks are the main problem, otherwise continue with a DAP which can be more flexible and ad hoc in choosing when to provide assistance. Also, consider whether it might be better to invest in infrastructure and technologies that can improve resilience and reduce exposure to catastrophic losses.
- Develop a clearly stated and well documented plan that is agreed with policy makers, and which is clear about the risks that are to be insured and which risks may still need to be covered by a DAP.
- Develop a long term financing plan for the subsidy.
- Determine whether the subsidized insurance is to be distributed directly to intended beneficiaries like farmers who would also receive the claim payments (e.g., ERVOs), or used to insure a DAP agency that retains responsibility for making payments to beneficiaries. The Agricultural Fund for Natural Disasters (CADENA) in Mexico is a good example of the latter approach (Box 5). In this case, the budget of local governments for disaster assistance in protected, but farmers may or may not know that they are insured. The scheme only specifies what type of farmers are eligible to receive assistance but leaves discretion to the local government to decide ex post which individual farmers will be compensated. Since the insurance payouts are tied to a regional weather index that may not correlate highly with individual losses, this discretion helps reduce basis risk problems for farmers,. In Peru, the farmers are pre-identified individually and know that they are insured. When an insured event occurs, they receive compensation directly into their bank accounts from the insurance company (Box 4).
- If opting for direct farmer insurance such as ERVOs, then there needs to be an efficient way of identifying the target households who should receive the ERVOs on a fully subsidized basis. One promising development is the linking of DAPs with existing social protection systems, such as safety net and cash transfer programs, as these already have an infrastructure in place for identifying the poor and vulnerable and delivering assistance.
- By removing important covariate risk, ERVOs could open the way for supplementary forms of agricultural insurance for some types of farmers. This should be encouraged.
- Since DAPs are heavily subsidized, then insurance substitutes are likely to be so too. However, given the ex ante nature of insurance, there is greater opportunity with ERVOs to ask some beneficiaries to pay part of the premium, perhaps on a compulsory basis, and this could reduce potential disincentive problems. As with insurance for poor farmers, it may also be plausible to ask poor beneficiaries to participate in community projects to build greater resilience.
- As with agricultural insurance for farmers, there should be an M&E system in place and occasional evaluations to check that the program is achieving its purposes and giving value.

Box 5: The CADENA Program in Mexico

The Mexican Agricultural Fund for Natural Disasters (CADENA) aims to internationally reinsure part of the costs of its state managed relief programs. CADENA was launched in 2003 by the Ministry of Agriculture and contains two main components: a) the Catastrophe Agricultural Insurance (SAC) program for farmers, livestock producers, aquaculture farmers and fishermen; and b) in States where SAC is not provided, direct compensation payments to farmers in the event of natural disasters. Under the program, State Governments purchase insurance to protect their budgetary allocations against natural disaster compensation for the most vulnerable farmers. The states are the insured, and the premiums are financed by the federal and state governments. Payments are made against a number of indices. Small-scale, low-income farmers without access to commercial crop, livestock, or aquaculture insurance are the intended beneficiaries of the insurance coverage, and the program is designed to provide a minimum level of compensation to smallholder farmers to put them back into production following a major catastrophic event. In 2011, the CADENA program insured about 8 million hectares of crops and slightly over 4.2 million head of livestock. There were around 2.5 million beneficiaries and the total sum insured was approximately US$ 1 billion. CADENA is part of a larger national program – the Fund for Natural Disasters (FONDEN), which transfers part of its risk to the international market through reinsurance and the issuing of catastrophe bonds.

Some key characteristics of CADENA:

- Designed as a safety net for small scale farmers (less than 20 ha and 60 Tropical Livestock Units or TLUs) which covers a small sum insured (about 200 USD per ha).
- State governments are strongly incentivized to opt in the insurance program: they receive a 80-90% federal premium subsidy when they opt in. Alternatively, if they opt-out, the federal Government supports 60% of ex-post disaster relief expenses ("Direct support"). As a result 30 out of 32 states have opted in to the insurance program.
- States can choose type of insurance coverage (weather index, area yield, traditional) and have full autonomy on the use of insurance payouts (can be used to pay next year's premiums). Most of CADENA is under area yield index insurance (AYII).
- Municipalities distribute payouts to farmers by check, and farmers need to show proof of identification and property title.

7. Conclusions

Many governments use subsidized agricultural insurance as an instrument of choice for helping farmers and rural communities cope with risk; so widely in fact that globally they spend well over $20 billion annually on such subsidies. There are many reasons behind these subsidies, some having to do with market failures and externalities that constrain the development of privately provided and unsubsidized insurance, and some having more overt political and social objectives such as helping specific segments of poorer farmers access insurance, encouraging increased production of important food or export crops, protecting agricultural lending institutions, reducing the need for disaster assistance payments, or simply as a politically acceptable means of supporting farm incomes.

In reviewing the available literature and evidence on insurance subsidies, we are struck by how little is really known about the effectiveness of insurance subsidies in achieving their intended purposes, or whether the impacts they generate justify their costs. In many cases, it is hard to obtain even basic performance data about subsidized insurance programs and pilot projects, let alone evidence about how they affect the behavior of financial institutions and private insurers, or how they impact on the farmers themselves. This leads us to one general recommendation: there is a fundamental need for more evaluations and impact assessments of subsidized agricultural insurance programs. This should involve a) more widespread use of ex ante impact assessments at the design stage of subsidized insurance programs, b) collection, release and analysis of basic data about the operations and performance of subsidized insurance programs, and c) implementation of more formal M&E systems that can provide credible data for assessing the impacts of insurance subsidies.

While there would appear to be many contexts in which subsidized agricultural insurance has the potential to offer attractive benefits, experience shows that once introduced, well known challenges with the design and operation of agricultural insurance programs, poor design of subsidies, plus political dynamics can all contribute to disappointing results, an expensive draw on government budgets, and the creation of disincentive problems that lead to significant economic costs and inefficiencies, and in some circumstances, to environmental degradation. To

avoid these problems, any insurance subsidy needs to be carefully designed to be "smart", in the sense that it is cost effective in achieving its underlying purpose, minimizes disincentive problems, and does not become a growing financial burden on the government. To this end we have proposed some best practice guidelines for the design and implementation of subsidized agricultural insurance. Some of these guidelines are quite general, while others are more specific to the exact purpose of the insurance. The general guidelines can be summarized as follows:

- First establish that the insurance is the appropriate intervention for the risk problems that farmers face, and that there are no better alternatives.
- Then develop a clearly stated and well-documented purpose for the subsidy that is agreed with the relevant policy makers.
- As part of the plan there should be an explicit exit strategy or long-term financing arrangement for the subsidy so that it does not become a growing and uncontrolled financial burden on the government.
- Select capable partner institutions for implementing the subsidized insurance. Adding a subsidy to an already badly performing insurance, credit program, or NGO program or project may make things worse, not better.
- To avoid adverse distributional outcomes, cap the amount of subsidized insurance available to each farmer.
- To ensure the subsidy is achieving its intended purpose, establish a good monitoring and evaluation (M&E) system, and undertake periodic evaluations.

Some additional guidelines apply but vary according to the purpose of the subsidy:

- Any insurance subsidy that lowers the cost of insurance to farmers below the actuarially fair (pure risk) premium rate has the potential to create disincentive problems that distort resource allocation decisions. If the insurance is targeted at commercial farmers, then it is best if the subsidy is limited to the insurer's administration and development costs, including any high-risk loadings due to inadequate data about the risks involved. As such, the subsidy could be paid directly to the insurer rather than used to subsidize premium rates. If the insurance is targeted at a specific segment of poor farmers, or is intended to replace part of disaster assistance, then the subsidy will likely have to cover part, if not all, of the pure risk premium. Wherever the subsidy does include part of the pure risk cost, then practices should be adopted to reduce disincentive problems. These include restricting the amount of subsidized insurance farmers can buy for each insured crop, and structuring the subsidy in ways that respect the relative risk levels across insured activities. When the insurance is targeted at poor farmers, they could be asked to pay an in-kind premium by working on community projects that build resilience.
- Wherever possible, and especially for subsidized insurance intended for commercial farmers, the subsidy should be used in ways that crowd in private insurers and encourage competition among them.
- Where the subsidized insurance is intended to give a segment of poor farmers access credit and thence game changing technologies and modern inputs, then the insurance should be channeled through credible institutions that can a) link the insurance to credit, b) ensure that access to credit also means access to complementary inputs, and c) can identify and efficiently reach the intended target group of farmers.

- In the case of subsidized insurance intended to compliment or replace disaster assistance payments, it is important to identify which catastrophe risks the insurance will be able to cover, and which will still need to be covered be a disaster assistance program.
- In regions where both agricultural insurance and DAPs or catastrophe insurance coexist, then efforts should be made to make them complementary and not to undermine each other. Since DAPs or catastrophe insurance like ERVOs remove important covariate risks, they should in principle be complementary to agricultural insurance that covers some of the remaining production risks.

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Annex: The Choice Between Subsidizing An Insurer's Costs Verses Providing Subsidized Reinsurance

A common problem in setting up a new insurance program in data-sparse environments is that the insurer has inadequate data to properly assess the actuarial risks, and so adds a high-risk loading component to the premium rate it charges farmers. Although initially high, this risk loading component can be expected to fall once the insurer has acquired additional data over time. Climate change can lead to a similar problem even with established lines of insurance, since the insurer is confronted by growing uncertainties about the risks they are insuring. An insurance subsidy introduced as an interim measure to offset part of the risk loading component of the premium rate charged can help overcome this problem. An alternative, and possibly more cost effective solution is for governments to reinsure at subsidized rates some of the extreme layers of risk faced by the insurer, (Carter, 2013).

Box 6 reviews the pros and cons of providing reinsurance arrangements for insurers, and the circumstances under which this is better than a direct premium subsidy. Where reinsurance is warranted, it can be implemented through the establishment of a public reinsurance company, which provides reinsurance support to commercial insurers (for example, Agroasemex in Mexico). Alternatively, a stop loss is an agreement for governments to pay claims directly to insurance companies above a pre-agreed loss limit (expressed as a percentage of claims) in the event of a major shock. In order for the government to control its risk exposure in a stop-loss arrangement, there is generally an agreement on the minimum premium rate to be charged by insurers. Stop loss agreements can be funded from government reserves, through contingent debt financing (e.g. from the World Bank in the case of Mongolia), or by partnering with a reinsurance company (paying them a regular premium in return for the reinsurer paying claims).

However, governments do face operational challenges when offering reinsurance, such as those arising from the cost of managing budget volatility, timeliness of claim settlement, and challenges with risk-based pricing. Holding large budget lines or capitalizing large contingency funds that will only be drawn down according to the rules of the reinsurance that government is providing can be economically costly, and can undermine sound public financial management principles. For example, it can be challenging for governments

to justify not fully exhausting contingency funds when moderately sized disasters occur, even though additional payments are not due under the reinsurance contract. Moreover, if the reinsurance subsidy extends into a more permanent arrangement, it may provide incentives for farmers or insurers to 'game the system' by acting in inefficient ways that increase the cost to government but reduce the cost to the farmer or insurer. (as in the US) For these reasons, some governments that offer reinsurance to agricultural insurance programs do so by partnering with a regulated reinsurance company or companies, paying them a regular premium in return for the reinsurer(s) paying any claims that government has taken responsibility for as they fall due. Box 7 provides some contrasting examples illustrating circumstances when subsidized reinsurance is and is not preferable to subsidized premium payments for covering risk-loading costs.

Box 6: Pros and Cons of Premiums Subsidies and Public Reinsurance of Extreme Risk Layers

Year	Premiums Subsidies	Public Reinsurance for Extreme Risk Layer
Requirement for financial capacity	**Low:** Government only pays for a share of commercial premiums (ex-ante payment)	**High:** Government might be exposed to severe losses which require setting aside large amounts of capital from the beginning of the project (e.g. Mongolia, Mexico)
Cost-effectiveness	**Uncertainty loads** • In data-sparse environments, insurers charge high uncertainty loads on extreme layers of risks(cf Carter, 2013) • For products where long data series are available (e.g. Satellite products), or where insurance companies see strong market potential, commercial premiums might not include high uncertainty loads (e.g. Kenya). **Profit margins** • Premiums subsidies are partially subsidizing insurance companies' profit margins (not only claims paid to farmers), which Governments/Donors might be reluctant to do.	**Uncertainty loads** • the uncertainty-neutral public sector reinsures extreme layers of risks at a lower cost to insurers, which benefits farmers **Profit margins** • if no claims are paid during the project period that money can be rolled over to future risk periods **Financing costs** • Setting-aside large amounts of capital might be very costly for Governments (depends on borrowing rate/ investment returns)
Sustainability	Premiums subsidies might constitute a large fiscal burden for Governments over time, and are often **hard to phase-out** (Mahul and Stutley, 2010)	If the Government does not set a threshold for commercial premiums, or set the stop-loss too low, this **might not provide incentives** for insurance companies to manage risks (e.g. India NAIS). **Setting a threshold for commercial premiums might be complex where demand cannot be estimated easily.**

Outreach (number of farmers)	Premiums subsidies have a **direct positive impact on sales** (Cai, 2011)	Stop-loss have can help decrease commercial insurance premiums rate, but **not as much as premiums subsidies (given a fixed amount of public support).** Stop loss might have reduced farmer's outreach (e.g. Mozambique).
Level of coverage per product	**Insurers might not offer risky products without stop loss** (e.g. I4 projects insurers would not offer products in half of villages - Hill, 2014) However Government **might choose to only subsidize certain types of products** to ensure products protect farmers when bad shocks happen (e.g. Kenya)	Public Reinsurance of extreme layers may **incentivize insurers to offer innovative or risky products** (e.g. Mongolia)
Political visibility	**High visibility** of Government support to farmers	**Low visibility** of Government support, which can also make exit strategy easier.

Source: Rachel Sbero.

Box 7: Some Examples of Public Reinsurance Arrangements Verses Direct Subsidies for Risk Loading Costs

Mexico - Setting up a Public Reinsurance Company

Fondos are self-insurance funds that have been operating in Mexico since 1988. In 2004, more than 240 Fondos provided insurance against agricultural production risks (including hail, drought, frost, floods, diseases, pests) to their members, accounting for 50 percent of the total insured agricultural area in Mexico. The total liability of the Fondos on an annual basis was approximately US$$400 million dollars in 2004. The Fondos are not allowed to sell insurance to their members unless they have a proper reinsurance treaty negotiated before the beginning of any specific agricultural cycle of production. Since these organizations do not have capital to guarantee the solvency of the Fondos, they must buy enough reinsurance to guarantee that the members of the Fondo will receive the full amount of indemnity in the case of a peril. The regulation requires that any reinsurance contract negotiated by the Fondos should be defined to absorb any exceeding indemnities after the financial reserves of the Fondos have been exhausted. Therefore, an unlimited stop loss reinsurance treaty is implicitly requested. Historically, the state-owned reinsurance company Agroasemex has offered to the Fondos this unlimited stop loss program. Agroasemex provides stop-loss insurance of up to 100 per cent of the total sum insured to mutuals of smallholder farmers whereas traditional stop-loss reinsurance agreements would usually cap the percentage of the total sum insured that they cover.

Index-Based Livestock Insurance Program: In a Data-Sparse Environment, Public Reinsurance of Extreme Risk Layers Can Create Confidence and Crowd-In Private Insurance and Reinsurance

Started in 2005, this program involved a combination of self-insurance by herders, market-based insurance, and social insurance. Herders retain small losses, larger losses are transferred to the private insurance industry, and extreme or catastrophic losses are transferred to the government using a public safety net program. A syndicate pooling arrangement protects participating insurance companies against excessive insured losses, with excess of loss reinsurance provided by the government. The fiscal exposure of Government of Mongolia toward the most extreme losses is protected with a contingent credit facility.

The Government of Mongolia was double exposed to livestock mortality risk under this livestock insurance program (see figure 3 below). First, it covers losses exceeding a specific threshold (e.g., 25-30% of livestock mortality rate) through the Disaster Response Program (DRP). Second, it acts as a reinsurer of last resort for the insurance companies selling the Base Insurance Product (BIP) through stop loss provision at 105% of the base premiums sold to the LIIP (Livestock Insurance Indemnity Pool (LIIP). This double exposure required adequate financing in order to avoid an increase in the fiscal burden of the government. This was financed through: reinsurance premiums received from insurance companies, Government Budget and World Bank Contingent Loan.

Figure 3: Government of Mongolia Is "Double Exposed" to Extreme Risks

This reinsurance agreement between the insurance pool and the government was designed to give the insurance industry time to find external capital on the reinsurance market. Indeed, after seven years, US$ 10 billion was transferred to international reinsurers as part of the Mongolian scheme. The Mongolian IBLI has gone from government reinsurance to international reinsurance funded by donor funds (with some government reinsurance for losses in excess of 2 billion Mongolian Tughriks).

Mozambique: Not Enough Capital for Stop Loss to Boost Demand

In Mozambique, GIIF is supporting the development of index insurance and has conducted a comparative analysis of two options: (1) premiums subsidies, (2) stop loss. Comparing the two options with the same amount of public support over five years (amounting to 1 million USD), it was estimated that this volume of financial support would not be sufficient enough for the stop loss to cover extreme layers of risk (e.g. when claims are above 600% of premiums received). Therefore, preliminary discussions with insurers highlighted that the effect of the stop loss would be minimal on premiums rate (e.g. 10% discount on commercial premiums). It was estimated that a stop loss would only reach 60% of the insurance uptake achieved through premiums subsidy. It was therefore recommended to support agriculture insurance through premiums subsidies.

Kenya: Limited Uncertainty Loads, Due to Strong Growth Potential and Investments in Data

The WBG has supported the Government of Kenya in setting up a Public Private Partnership for the development of livestock and crop insurance (see Figure 4 below). In this case, the Government has opted for premiums subsidies (50% or 100% depending on product), rather than a stop loss.

Figure 4: Agricultural Insurance Program in Kenya

Livestock Insurance

Pasture Degradation Asset Protection Index Insurance

- **Component 1**
  - Fully subsidized **insurance-linked social protection** for the most vulnerable pastoralists
- **Component 2**
  - **50% premium subsidy support**
- Government target of reaching **70,000 vulnerable pastoralists** across all 14 ASAL counties by 2017

Crop Insurance

Area Yield Index Insurance

- Initially for **maize and wheat** farmers, further crops considered going forward
- Linkage to **agricultural credit and inputs**
- **50% premium subsidy**
- Government target of reaching over **170,000 farmers** across all 33 crops growing counties by 2019

As opposed to the livestock insurance product (based on satellite imagery), the crop insurance product was based on area-yield data, for which long data series were not available. It was expected that insurers would charge high uncertainty loads on the crop insurance product. However, given the strong commitment of the Government to support a large-scale program over time and invest in data collection, insurers did not charge high uncertainty loads. On average, commercial premiums for products that would cover 1-in-7 year events reached 7%, which would be brought down to 3.5% for farmers with a 50% subsidy. The Government has therefore opted for a premium subsidy.

South Africa: Premiums Subsidies Could Be More Cost-Effective Due to Good Data Availability and High Opportunity Cost of Capital

The WBG has supported the Government of South Africa in comparing various options for Public Private Partnership for the development of multi-peril crop insurance. The analysis showed that good data on commercial farming already existed and data uncertainty loadings in pricing were low, therefore limiting challenges associated with premium subsidies.

Given South Africa's cost of sovereign borrowing, and the annual effective interest rate that would be obtained on undisbursed reserve funds, the opportunity cost of pre-financing a reserve fund invested in liquid assets for a stop loss would be high (Clarke et al, 2016).

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