



# Best practices for subsidizing agricultural insurance

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## ABSTRACT

Many governments subsidize agricultural insurance for farmers. There are several reasons behind these subsidies, some having to do with market failures that constrain the development of private insurance markets, and some having more overt political and social objectives. 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. Also, before subsidizing insurance, governments should first ensure that the basic public goods needed to create an enabling environment for insurance are in place, without which insurance markets cannot be expected to work well nor subsidies to achieve their intended purposes. This paper discusses these issues and proposes some best practice guidelines for the design and implementation of subsidized agricultural insurance.

## 1. Introduction

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 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. Moreover, governments also need to ensure that the basic public goods are in place for insurance markets to develop and work, including maintaining weather station infrastructure and data systems, and providing an enabling legal and regulatory environment. Without such an enabling environment, insurance markets cannot be expected to work well and neither are subsidies likely to achieve their intended purposes. 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.

## 2. Extent of agricultural insurance and its subsidies

Agricultural insurance is widespread around the world. In 2007, an estimated 104 countries had some form of agricultural insurance, of which about 90% of the total premium collected was for crop insurance

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and 10% was for livestock insurance (Mahul and Stutley, 2010). Moreover, 86% of the total premium was collected in high-income countries and only 0.03% was collected in low-income countries, showing that agricultural insurance was largely the preserve of the rich. However, since 2007 there has been significant expansion of agricultural insurance in some developing countries, especially China and India, which has helped correct this imbalance. Hess et al. (2016) estimate that in 2014 about 198 million farmers in the developing world were insured with some form of IBI product.

Yet despite the growth in insurance, the insured coverage typically represents just a small fraction of farmers' total exposure to farm income and asset risks; less than 1% of the global value of agricultural GDP (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.

In order to encourage farmers to purchase more insurance, many governments have subsidized it in various ways. In fact, Mahul and Stutley (2010) found that in 2007 about 85% of the total premium collected from farmers from all insurance programs was matched by a premium subsidy, and the average premium subsidy was 44%. In addition, many governments also directly subsidize the administrative and operational costs of insurers, and provide direct payments to insurers to help settle claims. When these additional costs are added in, Mahul and Stutley (2010) found the average subsidy equivalent increased from 44% to 68% of the premium. The global cost of all direct and indirect agricultural insurance subsidies is substantial. Mahul and Stutley (2010) estimated the total global cost of insurance subsidies to governments was about \$20 billion in 2007, but that figure seems low today given that just three countries - China, India and the US, are together spending nearly \$18 billion each year (Hazell et al. (2017)). Moreover, the levels of subsidy in these three countries are much higher than the averages observed by Mahul and Stutley in 2007.

### 3. Why do governments subsidize agricultural insurance?

Some subsidies are justified on the basis of narrow economic arguments like market failures, externalities and establishment problems that constrain the development of private sector insurance and insurance markets. 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. Most often, subsidies also help scale up the demand for agricultural insurance. We consider the main reasons in more detail.

#### 3.1. 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:

a) 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 reduced needs for public relief or disaster assistance programs, which help justify such public spending;

- b) 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 re-insurance, during an initial learning phase (Carter, 2013).
- c) 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.
- d) Temporary subsidies can sometimes play an important role in helping to launch or speed up the development of credit-linked insurance. For example, temporary subsidies might be justified when farmers, financial service providers (FSPs) or insurers are initially uncertain about a new type of credit linked insurance product because they have insufficient knowledge to assess its real risks and benefits (Meyer et al., 2017).

#### 3.2. Subsidies to achieve broader social and political goals

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

- a) Increase food production or agricultural exports for national purposes;
- e) Improve equity of coverage by extending insurance access to previously excluded groups, such as low-income farmers or high-risk regions. Most often such subsidies need to be sustained for the longer term, but situations can arise where an initial subsidy enables farmers to purchase insurance that opens up access to credit and game changing technologies that can transform their livelihoods, reducing their need for any further subsidy.
- b) Support farm incomes more generally, as is done in many middle and high-income countries. This happens when, over time, the average payments farmers receive from the insurer exceed the unsubsidized part of the premium rate they pay. For example, over the five-year period 2003–07, farmers received on average \$1.70 in the US, \$1.84 in Japan, and \$2.20 in Canada for every \$1 they paid in premiums from their own pockets (Hazell et al., 2017).<sup>2</sup>
- c) Partially substitute for safety net and disaster assistance spending by providing farmers and other rural people with subsidized insurance against catastrophic losses, like droughts;
- d) Protect banks and agricultural credit programs from bad debt, especially against systemic losses that lead many farmers to default

<sup>2</sup> Calculated as total claim payments divided by total premium paid by farmers, and often called the producer claim ratio.

on their loans at the same time. It is often hoped that this will also encourage banks to extend more credit to farmers, and especially riskier farmers.

Sometimes subsidies are used to obtain multiple goals. For example, in the US, the crop insurance program provides income support to farmers 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.

#### 4. Challenges in subsidizing agricultural insurance

Care is needed in the design and implementation of insurance subsidies. 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 them grow 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 the insurance to government and possibly damaging the environment (Siamwalla et al., 1986; Hess et al., 2016; Goodwin and Smith, 2013).

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

- a) 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 by making it easier to collect loans from the insurer rather than farmers. The former ANAGSA program in Mexico was a classic example of what can go wrong (Hazell, 1992).
- b) 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 et al., 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.
- c) Subsidized insurance may raise WTO concerns if the subsidies have more than a minimal impact on production and trade (Glauber, 2015).
- d) 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 may need 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).
- e) 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). 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 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.

#### 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 anticipated 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 et al., 2016; Jensen and Barrett, 2016). 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 private insurance programs). Then there are potential disincentive problems that arise from adding a subsidy, and which could lead to additional economic costs and inefficiencies. 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 et al., 1986). However, these were evaluations of old-style multiple peril crop insurance programs run by public insurers, and there have been significant improvements in the design and implementation of agricultural insurance programs since then (Hess et al., 2016). More recent studies based on experimental trials of IBI have shown that subsidized insurance can help immediate beneficiaries (e.g., Cole et al., 2012; Jensen and Barrett, 2016; Elabed and Carter, 2015), but the gains have not been valued and compared to the costs of the insurance programs, nor have they been tested and evaluated at scale. At present, we really 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 thorough *ex post* cost-benefit evaluations of more recent types of subsidized crop insurance programs, including IBI products.

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 a mere 2% increase in the interest rate charged on farm loans by the Agricultural Development Bank of Panama during the 1980s would have been equally as effective as the entire crop credit insurance program in protecting the bank's lending portfolio. Using subsidized insurance as a means to transfer income, either as a safety net or a farm income support measure can also be expensive. For

example, in the US over the ten year period 1981–90, it cost the government \$0.63 to transfer each \$1 of net benefit to farmers through subsidized insurance, and this cost had increased to \$0.95 during 2000–11 (Hazell et al., 2017).<sup>3</sup> Similar calculations for Mexico, Costa Rica and the Philippines during the 1980s show they spent \$0.22, \$0.43 and \$0.61, respectively, on transferring each \$1 of net income to farmers (Hazell et al., 2017). These transfer costs are 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). They are 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.

## 6. Principles and good practices in the design of subsidies for agricultural insurance

To avoid disappointing results, 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 good practice guidelines have been proposed by Hazell et al. (2017) drawing on their own work and the available literature (e.g., Hill et al., 2014; Clarke, 2011; Hess et al., 2016).

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:

**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 and alternative interventions like disaster assistance may be required. 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 even then insurance needs to supplement rather than crowd out traditional risk-avoiding strategies like crop and income diversification which may sometimes be 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.

**Take account of other risk management policies that may already be in place and which could impact on the insurance.** Examples are

<sup>3</sup> Calculated as total cost to government in the form of subsidies, administrative and operations accosts, and loss or reinsurance payments, divided by net indemnities received by farmers, all minus 1.0.

disaster assistance programs that compensate farmers in the event of certain natural disasters, and the availability of catastrophe insurance against natural hazards that is intended to complement disaster assistance programs for farmers. Such programs can reduce the demand for agricultural insurance since farmers may have less incentive to buy agricultural insurance if they can rely on free disaster assistance or subsidized catastrophe insurance. There may also be complementarities that can be exploited; for example, if disaster assistance or catastrophe insurance remove extreme covariate risks from the market, this can facilitate the development of more flexible forms of agricultural insurance to cover remaining risks. When government funds or subsidizes such multiple interventions, it should establish clear guidelines about which risks are to be covered by each program. 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.

**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 understanding of the total cost of the subsidy, and an 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.

**Ensure that the basic public goods are in place that are needed to create an enabling environment for insurance markets to work,** such as maintaining weather station infrastructure and data systems, providing an enabling legal and regulatory environment, educating farmers about the value of insurance, etc.. Without these basic investments, insurance subsidies are also unlikely to achieve their intended purposes.

**Select capable insurance institutions.** Adding a subsidy to an already badly performing insurance program or institution may make things worse, not better. 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. If the insurance is tied to loans through a financial service provider (FSP), then the same kind of due diligence is needed for the FSP.

Wherever possible, **the subsidy should be used in ways that crowd in private insurers and encourage competition among them.** 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 on 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, then care is needed to avoid setting up institutional arrangements that crowd out the subsequent development of private sector competition.

**To ensure the subsidy is achieving its intended purpose, establish a good monitoring and evaluation (M&E) system, and undertake periodic evaluations.** In addition to basic performance data on coverage (number farmers, sum insured), premium collected, and claim payments made, etc., it is also important to monitor the costs of the insurance to government, including annual premium 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 volume of credit, the terms of loans (interest rate, maturity) and loan recovery rates should be monitored. Morsink et al. (2016) discuss suitable M&E indicators in more detail. Given adequate M&E data, it should be possible to conduct a cost-benefit analysis to check whether the subsidy is money well spent in terms of its net social return, or

relative to the cost of alternative policies for achieving the same goals.

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

**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. 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 (Carter, 2013). 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. It will also be difficult to adhere to this guideline when a primary goal of the insurance subsidy is to support farm incomes. Wherever the subsidy does need to include part of the pure risk cost, then practices should be adopted to reduce disincentive problems. These might 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.

**Subsidies for smallholder farmers should be targeted and channeled through appropriate intermediary institutions.** Most farmers and smallholders that purchase insurance find benefits if the insurance is part of a package of other financial (e.g. access to credit) and non-financial services (e.g. access to improved inputs and technologies, access to markets, contract farming, etc.), otherwise they tend to view insurance as only a cost item (Hess et al., 2016). Even with high levels of subsidies smallholder farmers may not purchase insurance if the insurance does not bring additional benefits. For many smallholders, using the insurance to obtain additional benefits requires the insurance be channeled through credible intermediary institutions that can a) link the insurance to credit, and b) ensure that access to credit also means access to complementary inputs like improved seeds, fertilizer, and extension needed to raise farm productivity. Simply providing the insurance to many smallholders is insufficient as they may also be disadvantaged by high transactions costs in accessing credit, inputs and markets, and are typically least likely to receive assistance from public extension agents. Moreover, since smallholders only buy small amounts 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. Many intermediary organizations also have sufficient information about the farmers they serve that they can help target subsidized insurance when it is intended for specific groups (Hill et al. (2014) discuss options for targeting subsidies). For subsistence smallholders who are unlikely to link to value chains, it is likely that social protection schemes in case of disasters are more appropriate than commercial agricultural insurance.

When the insurance is intended to correct market failures or benefit smallholders, then **cap the amount of subsidized insurance available to each farmer** to avoid adverse distributional outcomes in which larger farms capture a disproportionate share of the subsidy. This may be less important if a primary goal is to use the insurance to support farm incomes, or to promote agricultural production and exports in countries with relatively few smallholders.

## 7. Conclusions

Many governments use subsidized agricultural insurance as an instrument of choice for helping farmers and rural communities cope with risk. 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, and which is only really possible if adequate M&E systems are established.

Another general finding is that before governments subsidize insurance, they should first ensure that the basic public goods are in place for insurance markets to develop and work, including maintaining weather station infrastructure and data systems, and providing an enabling legal and regulatory environment. Without such an enabling environment, insurance markets cannot be expected to work well and neither are subsidies likely to achieve their intended purposes.

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. There also appear to be many contexts in which public spending on subsidizing agricultural insurance has the potential to offer attractive benefits. However, 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.

## Declaration of competing interest

None.

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