

Explore Government Support Measures and Implications of Crop Insurance from International Experience

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ABSTRACT

Crop insurance is one of the more important branches of agricultural insurance, and because of global climate change, it is becoming more important for the financial wellbeing of the agricultural sectors across many countries. However, because many commercial insurance companies do not cover the losses incurred by natural catastrophes, governments need to intervene and support the market for crop insurance by using the measures of legal and regulatory frameworks, reinsurance mechanisms, premium subsidies, and the establishment of an insurance database.

The purpose of this research is to explore government support measures for crop natural disaster insurance based on international examples, which has wider implications for the domestic implementation of crop insurance.

The market for crop insurance in many countries has grown significantly over the last decade, and has shifted agricultural protective policies to agricultural insurance. Our research suggests that governments should be devoted to establishing agricultural insurance funds, building risk transfer systems and reinsurance mechanisms, improving techniques on loss assessment. In addition to the insurance policy tied to agricultural credit systems and protective policies, it is especially important to encourage farmers to purchase crop insurance by subsidizing premiums. Overall, crop insurance should have substantial government support and collective participation among farmers. It is expected that agricultural insurance will become integral within the framework of agricultural policy, and will replace traditional domestic support of the AMS in the future.

Key words: crop insurance, climate change, premium subsidy, government support

I. INTRODUCTION

One of the risk features for crops is their production under an open environment, which includes exposure of any farmland to natural hazards such as typhoons, floods, landslides, droughts, earthquakes, volcanic eruptions, and tsunamis. Many of these natural hazards come from climate change, including abnormal change in rainfall, temperature, and wind speed, which result in a decrease in crop quality, quantity, and variation. Consequently, farmers' incomes are adversely affected, especially small farmers. Now more than ever, stronger government policy and support is needed to protect these people.

Many countries have prevailed in adopting market support programs and subsidies to protect farmers' incomes. However, expenditures of these market mechanism distortion measures are incorporated into the Aggregate Measures Support (AMS), which, in turn, have to be eliminated under the requirements of the Uruguay Round Agreement on Agriculture (URAA). Conversely, fiscal spending on agricultural insurance, which falls under the auspices of Green Box (which is exempted from the URAA), would protect farmers' income in the long-run.

Over half of the world's countries have implemented some form of agricultural insurance. For instance, the United States and Japan have been carrying out crop insurance since 1938, with the United States applying agricultural insurance reforms in 1994. South Korea began to administer crop insurance from 2001. China restored agricultural insurance in 1980s, and made strong efforts to push agricultural insurance schemes and create pilot insurances in 2004.

In general, insurance is a form of risk management used to hedge against a contingent loss. The

conventional definition is the equitable transfer of a risk of loss from one entity to another in exchange for a premium or a guaranteed and quantifiable small loss to prevent a large and possibly devastating loss. However, agricultural insurance is quite different from commercial insurance in some features, including natural disaster causing damage, systematic risk, asymmetry information in underwriting, production process with biological production complexity, and geographical dispersion of agricultural production. These features cause difficulties in achieving adequate diversification for agricultural insurers and create moral hazards and inverse selection in setting premiums. Agricultural insurance is considered as a special business line within the insurance market.

Agricultural insurance needs public support for premium subsidies, reinsurance arrangements, risk transfers, agricultural insurance acts, technical assistant in loss assessment, and the like. The purposes of this study are to overview crop insurance and explore some lessons learned from international examples of government policies and the consequences thereof.

II. GROWTH IN INTERNATIONAL AGRICULTURAL INSURANCE MARKET

Premium volume

In 2008, the World Bank conducted a survey on agricultural insurance programs in 65 countries, which accounted for 75 percent of the global total premium. Between 2004 and 2007, the global agricultural premium increased dramatically, rising from US\$ 8 billion to about US\$ 20 billion, US\$ 15 billion of which is captured by the World Bank survey in Table 1. Agricultural insurance provision has been dominated by high-income countries and China, which has been attributed to 90 percent of global agricultural insurance premiums that are underwritten.

From a geographical perspective, the bulk of this premium is underwritten in the United States and Canada, with approximately 62% of the market. This is followed by Asia with 18%, Europe with 16%, Latin America with 2%, and 1% in both Oceania and Africa.

This stunning increase was caused by rising agricultural commodity prices and sum insured values on which the premium was paid, and by the expansion of agricultural insurance in China, Brazil, and Eastern Europe—and increasing government subsidy support in major countries include Brazil, China, South Korea, Turkey, and the United States. In 2013, the agricultural insurance premium in China was estimated at US\$ 5 billion, making this middle-income country the second-largest agricultural insurance market after the United States, with a premium of US\$ 12 billion.

In Asia and the Pacific region, the agricultural insurance premium increased from US\$ 1.6 billion in 2005 to nearly US\$ 4.0 billion in 2009, and represented slightly over 20 percent of the total global agricultural insurance premium (FAO, 2011). In 2009, the major agricultural insurance markets in Asia and the Pacific region by premium were China (50% of total premium), Japan (31%), India (11%), Australia (4%) and South Korea (3%); and overall, these five markets accounted for over 98% of the total regional premium.

Table 1. Estimated 2007 Agricultural Insurance Premiums

Development status	Number of countries	Estimated crop premiums	Estimated livestock premiums	Estimated agricultural premiums	Percentage of global agricultural premiums	Penetration
unit		\$ million	\$ million	\$ million	%	%
High-Income	21	11,869.0	1,192.3	13,061.3	86.5	2.3
Upper Middle-Income	18	872.6	40.1	912.7	6.0	0.3
Lower Middle-Income	20	789.3	334.1	1,123.5	7.4	0.2
Low-Income	6	0.2	4.8	5	0	0
All Countries	65	13,531.1	1,571.4	15,102.4	100	0.9

* Penetration defined as premiums as a percentage of 2007 agricultural GDP.

Source: Mahul and Stutley (2009a)

In contrast, in many middle-income countries, agricultural insurance has been operating for only 5–10 years. It takes time to promote agricultural insurance. Since the insurance market is developing and the divisions of insurance companies are not popular in rural areas of middle-income countries, most agricultural insurance schemes depend on agricultural cooperatives and farmers associations. An effective way to promote agricultural insurance would be to ensure that agricultural insurance schemes are connected with an agricultural financial system, which in turn would ask farmers for agricultural insurance while applying for credit.

Table 1 also shows that 91 percent of the agricultural insurance business by premium comes from crop insurance. It implies that crop production risk—and relatively weak economic status—are much more concerning for most countries than is livestock insurance.

Penetration rate

Despite this recent growth, penetration rate is still much lower than non-life insurance penetration in most countries. Agricultural insurance penetration rate is expressed as the ratio of agricultural insurance premium to agricultural GDP. However, even in developed countries, the agricultural insurance penetration rate is only 2.3 percent. In 2011, the United Nations' Food and Agricultural Organization (FAO) pointed out the highest insurance penetration rates are found in countries that have large national subsidized schemes, where crop and livestock insurance is either compulsory or compulsory for crop credit.

Insurance products

Crop insurance products can be classified into three main groups based on the method of determining how claims are calculated: (1) yield indemnity based; (2) weather index; and (3) revenue indemnity based. The yield indemnity based crop insurance classification is often divided into two subclasses—named peril crop insurance (NPCI) and multiple peril crop insurance (MPCI). Perils are damaging weather events. NPCI products provide indemnity against those adverse events (mainly is hail damage) that are explicitly listed in the policy.

In contrast to NPCI, multiple-peril crop insurance (MPCI) provides insurance against all perils that affect production unless specific perils have been explicitly excluded in the contract of insurance. MPCI offers comprehensive cover to the producers but comes at significantly higher cost compared with NPCI. Rates for MPCI insurance contracts depend on the crop, the region where the crop is located, and the level of coverage.

The most popular form of traditional indemnity-based crop insurance product is MPCI, which is found in 53 percent of countries, followed by NPCI, found in 41 percent of countries. MPCI, which is underwritten mainly in the United States and Canada, accounts for 74 percent of the total agricultural insurance premiums underwritten worldwide. NPCI, which is mainly underwritten in European countries, accounts for 16 percent of the total agricultural insurance premium underwritten worldwide.

III. GOVERNMENT SUPPORTS

Rationale

Government support crop insurance policy means market intervention. The rationale for public-sector support to agricultural insurance reasons cited is as follows:

1. Market failure: poorly developed insurance markets and non-availability of private sector agricultural crop and livestock insurance;
2. Reluctance of commercial insurers to develop agricultural insurance programs because of the prohibitively high start-up costs;
3. Financial capacity constraints faced by private commercial insurers, particularly for systemic risk (drought, flood, epidemic diseases, etc.);
4. High costs of insurance administration;

5. Inability of small and marginal farmers to afford agricultural crop and livestock insurance premiums.

Support measures

One common feature of many agricultural insurance programs is government support of agricultural insurance markets, especially when concerning premiums on crop insurance subsidies. Other enabling measures are important as well, such as legal and regulatory framework, reinsurance, technical and administrative assistance, and links to government extension services in agriculture.

Of the 65 countries surveyed, World Bank in 2008 reported that 63 percent of the used premium subsidies to support crop insurance in Table 2, but only 16 percent provided administration cost subsidies. The report also revealed that 41 percent of the countries provided public sector investment in R & D, training, and information gathering for crop insurance and livestock insurance. Special legislation for crop insurance was evident in 51 percent of the surveyed countries, with 32 percent reporting public sector reinsurance programs for crop insurance. Legislation creates infrastructure for implementing agricultural insurance and is representative of government determination.

The percentage of all government support measures to crop insurance in high-income countries is higher than other income level countries. Half of the surveyed countries have some form of crop insurance legislation, with marked differences across regions. In Europe 71% of countries have some forms of crop insurance legislation. The figure is just 30% in Latin America and the Caribbean.

The FAO (2011) presented a series of recommendations on the supporting roles governments can play in promoting the introduction of agricultural insurance. In start-up situations, where there is currently no agricultural insurance supply, governments can play a very important role in creating an agricultural insurance infrastructure that includes establishing an enabling legal and regulatory framework, enhancing weather station infrastructure and data and information systems, carrying out insurance product research and development, and arranging education, training and capacity building for insurers, distributors (banks, MFIs, input suppliers) and farmers. In some situations it may also be cost-effective for governments to provide high layer catastrophe reinsurance protection.

There appears to be a correlation between the level of public sector support and the penetration of agricultural insurance. Public sector support is high in the United States and Canada, and these countries account for 70 percent of the underwritten premium in the market. The governments of many European countries also provide support, with Europe underwriting 17 percent of the global premium. In Africa and countries such as Australia and New Zealand where there is little or no public sector involvement, the levels of underwritten premiums are very low.

Table 2. Percentage of Government Support to Crop insurance, by Development Status and Region

Development status/region	Number of countries	Insurance Legislation	Insurance premium subsidies	Administrative and operational subsidies	loss assessment subsidies	Public sector reinsurance	Other support (R&D, training)
Development status							
High-income	21	67	67	24	14	52	38
Upper-middle-income	18	50	56	6	0	22	39
Lower-middle-income	19	42	74	21	5	21	53
Low-income	5	20	40	0	0	0	60
Region							
Africa	8	38	63	0	0	13	38
Asia	10	60	70	40	20	70	70
Europe	21	71	67	10	5	38	29
Latin America and the Caribbean	20	30	60	10	0	5	45
North America	2	100	100	100	50	100	100
Oceania	2	0	0	0	0	0	50
All countries	63	51	63	16	6	32	44

Source: Mahul and Stutley (2009a)

Many types of government measures in major countries are described as below. We focus on Canada, China, Japan, South Korea, Spain, and the United States of America. They are most representative of crop insurance market in the world and different region and different farm characteristics.

Agricultural Insurance Legislation (Laws)

In Canada, the federal government passed the Crop Insurance Act in 1959. Under this legislation, the federal government was prepared to enter into agreements with any province that established a crop insurance program and their own crop insurance acts. Federally, the Crop Insurance Program evolved into the Production Insurance Program and is now known as AgriInsurance.

In China, although government has been aggressively promoting crop insurance since 2004, there is no specific agricultural insurance legislation until Agricultural Insurance Regulations were issued in 2013. The Agricultural Insurance Regulations involves important issues such as insurer's qualifications, supportive policies, catastrophe risk management, and the two chapters "agricultural insurance contracts" and "business rules" which distinguish agricultural insurance from other insurance products.

In Japan, the Crop Insurance Act was established in 1938. The Agricultural Disaster Compensation consolidates crop insurance and provides relief to farmers whose crops or livestock have been damaged by weather events, diseases, and pests. The Agricultural Insurance Scheme relies on the principle of solidarity among farmers. Each cooperative creates a fund where farmers contribute through premiums. The scheme now insures almost all major crops.

The voluntary or compulsory nature of Japanese agriculture insurance scheme depends on the type of insurance product and the farm size. Main agriculture products like wheat, barley, and rice are insured on a compulsory basis. However, farmers who do not meet some criteria (such as minimum insured area) are not eligible for the compulsory cover and can opt to purchase a policy on a voluntary basis. Other agricultural insurance products like livestock insurance, fruit and fruit tree insurance, field crop insurance, and greenhouse insurance are voluntary. The requirement from the Act would affect insurance penetration rate.

All crop insurance programs are voluntary in most countries. Greece and Cyprus where there is a government program of crop and fruit insurance, this insurance is compulsory. (Labudović, Todorović, 2011).

In South Korea, the Crop Insurance Program was first introduced in 2001 in an attempt to compensate farmers from possible catastrophic losses, thus stabilizing their production activities, using the insurance principle.

In the United States, the Federal Crop Insurance Act began in 1938 when Congress authorized the Federal Crop Insurance Corporation. The legislation affecting Risk Management Agency of the U.S. Department of Agriculture on crop insurance programs include the Federal Crop Insurance Act, the Farm Bill, the Agricultural Risk Protection Plan, and appropriation legislation, among others.

Premium subsidies

Premium subsidies are used as a policy instrument to promote the widest possible voluntary uptake and adoption of agricultural insurance by farmers. The World Bank survey of 65 countries showed that crop insurance premium subsidies cost governments US\$ 5.8 billion or 47 percent of global agricultural insurance premiums in 2007. Crop insurance premium volumes and premium subsidies are significant difference in different income level countries and region. High-income countries and North America share 91% and 75% of global agricultural insurance premiums, respectively.

In 2007, the total agricultural insurance premium in Asia and the Pacific region was estimated at US\$ 2.3 billion divided into crop insurance: US\$1.3 billion (58 percent of total) and livestock insurance US\$ 0.97 billion (42 percent of total). The governments of five countries (China, India, Japan, the Philippines, and South Korea) provided a total of US\$ 423 million in crop insurance premium subsidies—equivalent to 32 percent of total crop premiums.

In 2009, the total cost of agricultural insurance premium subsidies to governments in Asia and the Pacific region rose to nearly US\$ 2 billion, or a 250 percent increase over 2007's subsidy levels. In 2009 total agricultural insurance premiums in the region were US\$ 3.9 billion, and total premium subsidies were US\$ 1.96 billion—or 50 percent of the total premium.

The top 10 providers of crop insurance premium subsidies in the world is shown in Table 3. The United States is a big country in insurance market which premium volume was US\$ 8,020 million or 61% of the total surveyed countries in 2007. Federal crop insurance is often referred to as the centerpiece of the farm safety net because of its cost and broad scope for addressing natural disasters. Program cost is projected by the Congressional Budget Office to total US\$ 8.8 billion per year over the next decade. Producers pay a portion of the premium which increases as the level of coverage rises. The federal government pays the rest of the premium—62%, on average, in 2014—and covers the cost of selling and servicing the policies (Shields, 2015).

Italy and Spain have among the highest levels of premium subsidies of any agricultural insurance program in the world. In Spain, a system of differential premium subsidies applies, government provides different levels of premium subsidies for each type of insurance product (named-peril, etc.), and additional subsidies are provided for collectively purchased policies through associations, for target groups of farmers including young farmers, and for the contracting of multi-crop policies or multi-year covers. In 2006 the maximum premium subsidies available ranged from 27% to 75% for different groups insured crops. Currently, the costs of premium subsidies are shared between national and the provincial governments 74% and 26%, respectively. In Canada, the federal government also provides 60% of crop insurance premium subsidies, while the remaining 40% is provided by provincial governments.

The data was surveyed in 2007. Crop insurance has been rapidly growing since 2004 in China, it is expected over 50% premium subsidies from central and local government. The cost of premium subsidies in 2007 was estimated at CNY 1 billion (US\$132 million) for crop insurance. During the development of pilot crop insurance, subsidies have ranged from 20% to 100%, depending on the province, but typically were in the region of 50%. The premium subsidy for crops in 2007 was 25% provided by central government, plus 25% paid by provincial government, and the remaining 50% of crop premiums were payable by farmers. Central government increased its share to a 35% subsidy in

2008, thereby increasing the overall premium subsidy level to 60% for crops. The central government had spent CNY36 billion on agricultural insurance subsidies from 2007 to 2012, local governments also provided subsidies, and it brought rapid growth of agricultural insurance.

The Japanese government has a deep commitment for the development of agricultural insurance. Government support agricultural mutual relief premiums subsidies US\$ 640 million on average per year, and grants to federations US\$ 44 million on average per year. The government provides approximately 50% premium subsidies. The same percentage likes as in South Korea.

Table 3. Top 10 Providers of Crop Insurance Premium Subsidies, 2007 (millions of dollars)

	Premium	Premium subsidy	Administration and operating expense subsidies	Subsidy as percentage of total premiums (%)
United States	8,019.8	3,823	1,458.0	61
Canada	1,089.5	545.7	62.5	56
Spain	514.0	362.0		70
Japan	445.8	229.3	—	51
China	423.0	132.0		31
Italy	381.0	280.0		73
Russian Federation	315.0	156.0		50
Iran, Islamic Rep. of	167.0	82.0		49
India	149.8	7.9	4.4	8
Mexico	123.0	53.0		43
Korea, Rep. of	58.7	17.0	16.1	56
Top 10 Countries	12,023	5,680.0		47
Other 55 Countries	1,508.0	128.0		8
Total	13,531.0	5,809.0	1,540.9	54

Source: World Bank Survey, 2008.

Subsidies on Insurers' Administration & Operating Expenses

American federal government's subsidies have covered the companies' total operating and administrative expenses so far. These subsidies are intended to cover loss adjustment expenses as well. The subsidy paid to insurance companies to administer the federal program has ranged between 20% and 25% of total net premiums in recent years. The new Farm Bill mandates the decrease of this percentage to 18% of total. Administration and operating subsidies are a significant cost to the federal government and have increased from US\$ 0.7 billion in 2001 to US\$ 2.1 billion in 2008.

In South Korea, government subsidizes 100% of the NACF's crop insurance operational expenses. The estimated annual public cost of agricultural insurance including premium subsidies (US\$ 27.9 million) and NACF's administrative and operating expenses (US\$ 15.5 million) are US\$ 43.4 million during the period 2003 to 2007. In Canada, subsidies on insurers' administrative & operating expenses for crop insurance around 7% of total premiums. The subsidies are not very popular as premium subsidies. There are no subsidies to the insurers for administrative costs or loss adjustment costs in China and Spain.

Agricultural reinsurance

Since diversification is difficult to achieve for agricultural insurers, it is important to establish a suitable agricultural reinsurance mechanism. However, not more than twenty reinsurance companies worldwide are currently providing reinsurance capacity for agricultural risks and reinsurance companies might ask more restricted conditions for reinsurance treaties. The public sector plays a role in agricultural reinsurance through PPPs, that is, governments take responsibility where the private sector cannot offer reinsurance at affordable rates. The private sector has proven more cost effective

than the public sector in providing reinsurance for other than catastrophe cover. Iturrioz (2009) points out government offer catastrophe cover effectively through the establishment and administration of catastrophe funds.

In Canada, the federal government offers a form of stop-loss coverage to provincial crop insurance agencies and many provinces purchase reinsurance in the private reinsurance sector. In China, Reinsurance (quota-share and stop-loss) is provided by the national reinsurer, China Re. Provincial governments may also act as reinsurer or co-reinsurer of last resort for specific programs, in the event that reinsurance limits are exceeded. In order to deal with catastrophe risk, China Agricultural Insurance and Reinsurance Community was set up on November 21, 2014, sponsored by 23 insurers operating agricultural insurance and China Property & Casualty Reinsurance Company Ltd.

In Japan, agricultural insurance scheme starts as the local farmers' cooperative action to establish a joint reserve fund by accumulating the contributions as premium for the purpose of making up for the loss. This is the insurance by the Agricultural Mutual Relief (AMR) Associations or municipal governments. This insurance program is operated as a device of dispersing risk, in which liabilities by the AMR Associations and the municipal governments are reinsured by their prefectural federation, and further, the federations' liabilities are re-reinsured by the national government, that is, 100% of the agricultural insurance liability is reinsured by the Japanese government.

In South Korea, NACF is reinsured on a quota-share basis with local reinsurers. Only the liability in excess of 110% local market loss ratio and up to 180% local market loss ratio is transferred to the international reinsurance market. The government acts as a reinsurer of last resort for all the liability in excess of a 180% local market loss ratio.

In the United States, private sector crop hail insurance is reinsured by commercial reinsurers. The public-sector crop insurance programs are reinsured by proportional and non-proportional reinsurance agreements provided by the government through the Federal Crop Insurance Corporation (FCIC). The Standard Reinsurance Agreement (SRA) is cooperative reinsurance agreements between the FCIC and insurance companies.

Operational systems of crop insurance

Three systems for the delivery of agricultural insurance can be identified: state controlled systems, public-private partnerships, and pure market systems.

1. State controlled systems

Fully intervened systems are characterized by a high level of government support and the existence of a single insurance product which is usually commercialized by a state owned insurance monopoly.

They are characteristic for very intensive support by the government with the existence of one unified insurance product that is usually commercialized through a state-owned insurance company with a monopolistic position. These systems are characterized by a large market penetration due to obligation and good portfolio diversification, but are affected by high fiscal expenses and poor service caused by monopolistic positioning. In this model, the state's roll is key, as it has full control of the insured.

2. Pure market systems

Complete market systems have low to moderate penetration and low levels of risk diversification, and commercial criteria dominate over the technical, with the realization of competitive prices void of fiscal expenses (Manić, 2012). Practically, much in this system depends on the interests of the insurer for dealing with this kind of insurance; and this interest, also, depends on definition of agricultural policy in one country.

Pure market systems are characterized by low or nonexistent government support for agricultural insurance and several insurance companies commercializing different types of products.

3. Public-Private Partnership systems (PPPs)

PPPs systems are the most balanced systems, both in terms of government support and product availability. Most developing countries have witnessed a shift from public to market-based agricultural insurance since the 1990s. In 2011, the FAO reported that the period of 1950 to 1990 saw a major growth in the public sector operating multiple peril crop insurance programs, particularly in Latin America and Asia. This indicates that the public sector subsidized multiple peril crop insurance schemes in Asia and the Pacific region, and have mostly performed so poorly that many of these schemes have either been reformed or replaced by PPPs.

While PPPs are the preferred model for a successful agricultural insurance market, the current high administration and transaction costs translate into high premium levels, which makes insurance unaffordable for many small providers. Public sector participation in supporting agricultural insurance is a key to developing and scaling up agricultural insurance programs, while the participation of the private sector brings skills, expertise, and innovation into the market.

PPPs have high penetration and a good diversified portfolio; the technical criteria takes precedence over commercial, and there is competition in the provision of services as the state reinforces system stability. Also, the private sector provides the knowledge and technology, all with reasonable fiscal benefits

Since the 1990s, governments have promoted agricultural insurance through the commercial insurance sector, often under PPPs. As of 2008, private insurance providers have operated in 54 percent of the surveyed countries, and PPPs were implemented in 37 percent of them. Major growth in public-private partnerships for agricultural insurance has occurred in China¹ and in the Republic of Korea over the past decade. The governments of both countries have provided major support to agricultural insurance in the form of premium subsidies and in reinsurance protection. However, coinsurance pools, which usually rely on PPPs, have been established in middle-income countries to strengthen the supply of agricultural insurance.

PPPs in agricultural insurance tend to improve the efficient operation and financial performance of government support agricultural insurance programs. This may be a consequence of better implementation of insurance principles, such as sound underwriting procedures and better pricing of risk, lower administrative costs, and greater financial discipline of private insurers. Most important is that the loss ratio, which is defined as the ratio of loss payment to premium, seems to be lower when schemes are operated by the private sector. However, PPPs are not the only model to operate agricultural insurance. There are different farm scales in agricultural production, including big farm, small farm, marginal farm, and agribusiness. For instance, agricultural insurance schemes are implemented by state-owned insurance companies in India and the Philippines, which is in contrast to market-based and commercially implemented schemes run by the private sector in Australia and New Zealand.

V. Policy implications

Instead of AMS

Uruguay Round Agreement on Agriculture (URAA) of the World Trade Organization (WTO) requires government expenditures on Aggregate Measurement of Support (AMS) of agricultural products should be eliminated. All measures of AMS, including market price support and product-specific and non-product-specific payments linked to production, are incorporated into Amber Box. It is expected that AMS related measures would neither be sustainable nor effective ways to protect farmers' income. However, in URAA, there is a Green Box, which waives payments, offering a less distortion measure to compensate farmers. Because government spending on agricultural insurance belongs to one of Green Box measures, agricultural insurance schemes are allowed rather than market price support programs to compensate farmers' loss from production risk in agricultural policy reforms. It also

¹ In China, where the PICC—the former state insurance company—has enjoyed a near monopoly over agricultural insurance since the mid 2000s, the government has promoted a major expansion of private sector led agricultural crop and livestock insurance.

explains why the United States of America has been changing major spending on commodity program into agricultural insurance in farm safety net since 2004 Farm Bill, and South Korea established Crop Insurance Act in 2001.

Complementary to public disaster assistance programs

Public disaster assistance programs intend to compensate income loss from natural disasters, which are not covered by insurance. In Japan, under this law, farmers affected by natural disasters are eligible for a variety of low interest loans with rather generous conditions in comparison with the normal ones. Affected farmers also are entitled to tax reductions or exemptions. In the United States, crop insurance enrollment is a requirement for farmers to be eligible to disaster assistance. However, there is also disaster assistance for non-program crops that are not eligible for insurance. *Ad hoc* disaster payments varied considerably over years, totaling USD 2.9 billion in 2003, reducing to USD 3.1 million in 2005 and rising to USD 5 billion in 2007.

In Taiwan, the government started to offer bailout loans to farmers who suffered from the loss of natural disaster damages since 1989. In 1991, Council of Agriculture (COA) issued Natural Disaster Damage Relief Act to provide related aids and relief compensation to farmers' losses from the dedicated funds. Through the aid of relief, those farmers can then reconstruct the land and rehabilitate farming activities as soon as possible in order to keep on normal livings.

Since the beginning of natural disaster relief in 1991, the Taiwanese government has approved and delivered the relief aid US\$ 50 million per year for damage losses of agricultural production. Compared with the real damage loss averaged US\$ 300 million per year, which was caused by natural disasters in the same period, the relief aid was absolutely too short to aid farmers' income losses. Thus, the natural disaster relief is not an effective system to secure farmers' incomes under potential disaster exposures. However, it can help rehabilitation, as a complementary to crop insurance to make complete safety net of farmers' income protection.

Technical improvement

Agricultural insurance is an area of insurance that is technically demanding. One of the many challenges to the insurance industry is maintaining the skills and expertise at the underwriter, loss adjuster, and reinsurer levels—not only to provide adequate levels of insurance, but also to assist the agriculture industry to improve its risk management practices and enhance production.

Loss assessment

The loss assessment has been performed by local farmers living in regional areas, but these farmers, participating as the appraisers in crop insurance, do not possess expert knowledge on damage assessment. To obtain valid and reliable statistics for loss evaluation, the government needs to establish systematic and comprehensive assessment procedures, including professional training programs, a monitoring system, and a statistical database associated with loss appraisal.

Reasonable Indemnity

The compensation scheme for crop damages has a tendency to underestimate the value of crops since it does not reflect on the market conditions. Farmers under crop insurance are not able to fully recover from the financial losses incurred. Such a problem provides some implications applicable to policymakers. To maintain the soundness and sustainability of crop insurance, the government needs to fill the gap existing between the insurance market and policy goals.

Insurance supply meets with demand

There is no one single universal insurance product that meets all the demands of producers. Each

agricultural insurance product is suitable for a certain set of conditions. The assessment of the suitability of any agricultural insurance product has to consider the production system, the type of asset to be covered, the key peril to which the insured is exposed, the risk location, data availability, farmer size, distribution channels, and delivery and loss adjustment needs.

Crop insurance is not everything

We might consider the role of agricultural insurance as one risk management tool. It highlights the fact that agriculture is subject to a very wide range of risks, only some of which can be dealt with under a crop insurance policy. A frequent mistake of policy-makers is to regard agricultural insurance as a silver bullet for risk management and climate adaptation and to opt for insurance without conducting a systematic supply chain risk assessment to determine whether agricultural insurance is the most appropriate or most cost-effective risk management tool. Supply chain risk includes weather related risks, natural disasters (including extreme weather events), biological and environmental risks, market related risks, logistical and infrastructural risks, management and operational risks, and policy and institutional risks, etc.

Penetration rate

One of the most significant problems is that the farmers' participation in the insurance program, especially single farming households, have not been improved. That is, over half of this entire farming community has not been enrolled in crop insurance, since these farmers still have reservations about the possible impact on their farming economy. The government has to attempt to facilitate the insurance program by focusing on increasing the numbers of the target products. However, the quality of such a program is likely to depend more on the accurate estimation of insurance demands for particular products, farmers' demands, affordable insurance premiums, and the range of products covered by crop insurance.

Scaling up

Scaling up crop insurance is to increase penetration rate. However, there are four main problems to be firstly resolved in many developing countries: lack of clarity over the respective roles of the public and private sectors, lack of the risk market infrastructure necessary to foster crop insurance, lack of technical capacity in domestic insurance providers, and lack of adequate tools and indicators to monitor and evaluate crop insurance programs. The Agricultural Insurance Development Program (AIDP) builds on World Bank experiences at agricultural insurance programs that have achieved a scale by supporting countries in implementing sustainable, cost-effective public-private partnerships in agricultural insurance that increases the financial resilience of rural households (Villalobos, 2013).

Affordable insurance premium

Considering the income level of the agricultural industry and the seasonality of income streams, most of the farmers tend to perceive an insurance premium (a lump-sum payment) to be relatively high, thus, serving as a burden to increase a subscription rate of crop insurance. For farmers, insurance premiums may be too high to afford, eventually discouraging them to participate in the program. To solve such problems, both the government and regional states should play an important role in lowering farmers' financial burdens by increasing a share of contribution to the insurance premium.

Premium subsidy is not a long-run efficient way

The spectacular growth in crop insurance penetration rates in China in recent years has by-and-large been fuelled by the very high levels of premium subsidies provided by national and provincial governments. Similarly, the expansion of agricultural insurance over the past five years in South

Korea has been stimulated by government's decisions to introduce 50 percent premium subsidies, and this also applies to the rapid growth of crop weather index insurance (CWII) in India. Governments in these countries have been able, so far, to fund the rapidly increasing levels of premium subsidies, but the question is whether they will be able to sustain the exponential increases in agricultural insurance premiums and premium subsidies into the future. Furthermore, it is questionable whether other poorer countries in Asia and the Pacific region that are only now introducing agricultural insurance will be able to afford similar levels of agricultural insurance premium subsidies.

Governments may wish to use carefully targeted premium subsidies to promote agricultural insurance uptake. The World Bank (2009) recommends that they should exercise extreme caution about offering open-ended premium subsidy support that, once introduced, is very difficult to withdraw. The FAO (2011) shows that many of subsidized crop insurance schemes continue to perform very poorly today. In contrast, most of the private crop and livestock insurance programs are operating profitably with loss ratios of less than 75 percent.

It is somewhat problematic for a government to promote agricultural insurance by premium subsidies, or to establish a market-based agricultural insurance system. Theoretically, premium rates would decrease while penetration increases. Premium subsidy is one of measures to promote agricultural insurance. The public sector can figure out others ways to implement agricultural insurance feasibility by increasing penetration through compulsory linkages to credit systems, by joining price support programs, and by integrating subsidies in order to decrease premiums.

Alternatives to promote crop insurance

Governments in Asia and the Pacific region are unable to afford premium subsidies, therefore alternative ways of promoting the introduction and scaling-up of agricultural insurance need to be considered. There is now a wide body of literature suggesting that under PPPs governments can support private commercial insurers. These measures include: providing legal and regulatory support; investing in insurance market infrastructure and in subsidizing the often high start-up costs for a limited number of years; providing free access to data and information, farmer education training and awareness programs; and finally, in some instances, by acting as a reinsurer of last resort.

In countries that have very poorly developed insurance and agricultural insurance markets and a high proportion of small and marginal subsistence farmers, governments may need to consider alternative risk sharing and risk transfer mechanisms, including improved natural disaster compensation programs and/or some form of food security or social safety net.

Revenue insurance

Crop losses from natural disasters, in the United States for instance, are compensated under current crop insurance, but most farmers are still exposed to the price risk, which is not covered by MPCI. From the farmers' perspectives, both the production and price risks should be simultaneously treated to stabilize their farming business. To achieve such a policy goal, crop insurance should further expand to cover price risk and introduce the experience of revenue insurance.

VI. CONCLUSION

Because of climate change and eliminating domestic support measures under URAA, most countries around the world have realized that crop insurance is an important instrument to protect farmers' income and manage production risk since the 1990s. However, the government subsidy on insurance premium and service related costs is one of key factors to implement crop insurance. It might cause severe financial burden for government to impede crop insurance being realized, such as the policy considerations in Taiwan.

Crop insurance schemes are not independent of farmers' income support program. To avoid overlapped payments and risk covers, crop insurance schemes can be complementary relationship with income support programs and public disaster assistance programs. In other words, crop insurance

provides additional payment for the gap between individual expected income and government offering basic income support or relief aids. It shifts government expenditures from domestic support programs to crop insurance premium subsidy, such as the case from the United States' experience.

Scaling up crop insurance is another key factor to ensure sustainable and cost-effective operation in crop insurance. Premium subsidy is not the only way to increase penetration rates. There are many ways to promote crop insurance. For instances, it can be promoted by compulsory requirements under Insurance Act, linking to credit system and qualify for domestic support programs, and public disaster assistance programs. Of course, the accurate estimation of insurance demands for the particular insurance policies, farmers' demand, affordable insurance premium, and the scope of products covered by crop insurance. They are all important to increase penetration rates.

The resolution to secure farmers' income from disaster losses, therefore as we propose here, should be delivered by agricultural insurances. Not just for disaster damage loss coverage, agricultural insurances in fact can be used as an effective tool for risk management in the agricultural production sector. Compared with many other developing and developed countries already with agricultural insurances for crops, the trail of the crop insurance in Taiwan is right on the way started from 2015. The late start of a more complete agricultural safety net, however, is still expected to stabilize farmers' incomes and agricultural production in aligning with the existing natural disaster relief system operating in the recent decade.

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