China: Innovations in Agricultural Insurance

Promoting Access to Agricultural Insurance for Small Farmers

May 2007

Sustainable Development, East Asia & Pacific Region
Finance and Private Sector Development
The World Bank

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ACKNOWLEDGEMENTS

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The report benefits greatly from the data and information provided by and/or collected from the pilot insurance companies, provincial line bureaus, agricultural research institutes and universities throughout China, ERS, and the central government agencies.

The authors are grateful to the peer reviewers, Don Larson (Development Research Group, World Bank) and Peter Hazel (Visiting Professor, Imperial College at Wye). This report has been prepared under the overall guidance of Stephen Mink (Sustainable Development, World Bank) and Rodney Lester (Finance and Private Sector Development, World Bank).

Funding support for this study was provided mainly by The World Bank and DFID. Additional support was also provided by the Swiss Government and IFPRI.

ABBREVIATIONS

AAL	Average Annual Loss
China Re	China Reinsurance Company
CIRC	China Regulatory Insurance Commission
CPC	Communist Party of China
CUPIC	China United Property Insurance Company
EASRD	East Asia Sustainable Rural Development
FMD	Foot and Mouth Disease
FPDSN	Finance and Private Sector Development, Financial Markets for Social Safety net
FYP	Five Year Plan
GDP	Gross Domestic Product
GNPI	Gross Net Premium Income
GoC	Government of China
GRC	Group Risk Plan
HRG	Heilongjiang Reclamation Group
IAH	International Association of Hail Insurers
IAIS	International Association of Insurance Supervisors
MoF	Ministry of Finance
MPCI	Multiple Peril Crop Insurance
PICC	People Insurance Company of China
PML	Probable Maximum Loss
SAIC	Sunlight Mutual Agricultural Insurance Company
XPCC	Xinjiang People's Construction Corps
TSU	Technical Support Unit

EXECUTIVE SUMMARY

Context

1. Agriculture's long production cycle makes Chinese rural households particularly vulnerable to natural disasters. More than 20% of the total farmland, estimated at 165 million ha in 2004, was affected by natural disasters on average over the period 1979-2004. The major cause of loss is drought, followed by flood. In 2004, it is estimated that China's farmers and economy lost close to US$18 billion worth of crop value due to natural disasters.

2. China has about 328 million people involved in agricultural labor, and a vast majority of them are small and marginal farmers (operating 0.4 hectares on average). While there need not always be a direct correlation between landholding and poverty, it is likely that a significant proportion of such households are below the poverty line. Further, the vast majority of farmers grow rain-fed crops and are therefore, particularly vulnerable to the vagaries of the weather. In this context, agricultural risk management products like insurance, particularly for the small and marginal farmers, are of critical importance.

3. The agricultural insurance market in China is extremely small. In 2005, the national agricultural insurance premium volume was US$91 million, representing a mere 0.6% of the total Chinese non-life insurance premiums. Various management models of agricultural insurance are being piloted in China. The models range from specialized mutual insurance companies with local government subsidies, to foreign commercial insurance companies with no public subsidies. These pilots are currently under implementation in several provinces: Heilongjiang, Xinjiang, Jiangsu, Shanghai, Jilin, Xinjiang, Zhejiang, Sichuan, and Hainan.

4. In early 2007, the Ministry of Finance approved a new set of pilots in the following provinces: Jiangsu, Jilin, Xinjiang, Hunan, Sichuan, and Inner Mongolia. The Ministry has allocated a budget of RMB1 billion (US$125 million), equivalent to that allocated by the selected provincial governments. The RMB 2 billion (US$250 million) subsidy program aims to finance 50% of the agricultural insurance premiums in the selected provinces. This budget allocation comes on top of RMB700 million (US$87.5 million) already allocated by CIRC.

5. In that context, the challenge for policy makers is how to develop agricultural insurance that will be accessible by small farmers at an acceptable cost. Multiple peril crop insurance (MPCI) products have been overemphasized in China. MPCI products are extremely challenging to design and administer in a cost-effective fashion, particularly in countries dominated by small farm households. World experience for MPCI has demonstrated that these programs either pay very high administrative costs or the products have extremely poor actuarial performance. Given the costly nature of developing MPCI products, most countries chose to subsidize these products. For example, if China followed the path of the United States in product design and subsidies, the total cost could approach US $10 billion.

6. The report explains why agricultural insurance is expensive to deliver to small farm households. This backdrop coupled with the detailed risk assessment in four provinces leads to a key finding that China should put more resources in developing products that are more suited to an agricultural economy that is dominated by small farm households. In particular, named peril and index-based crop insurance products could be developed for less cost than MPCI products. The report discusses the important role of government in supporting the legal and regulatory

environment, access to data for new product development, risk sharing, and broader education of all stakeholders about the benefits of agricultural insurance. It also explains why this form of subsidy could provide improved incentives versus a direct subsidy for farmer premium.

7. The Government of China (GoC) recognizes the importance of revitalizing the agricultural insurance industry to better meet the needs of farmers throughout China. Under the 11th Five-Year Plan (FYP) and various other Government policy document, the Chinese government has reiterated its commitment to agricultural and rural development. In this regard, the Government, through its Ministry of Finance, requested the World Bank to conduct a comprehensive assessment of its agricultural insurance industry and provide recommendations for its future development.

Objectives & Methodology

8. The objectives of the study were agreed through extensive consultation with central and provincial government authorities, insurance companies, agricultural insurance policyholders, farmers and other stakeholders throughout different parts of the country. The study intended to assist the Government of China in the development of a forward-looking strategy for promoting access to agriculture insurance for small farmers.

9. An operational framework for the development of agricultural insurance was developed. It clearly identifies the key operational functions of the insurance companies with consideration of the multiple stakeholders:

1) Product delivery and product development are key functions. Named peril and index-based insurance products should be key products if small farmers are to be served in a cost effective fashion. Further, bank and financial intermediaries should be involved in selling agriculture insurance to further reduce delivery costs.
2) Technical assistance should be national in scope in order to take advantage of the learning that takes place in many different regions of China. While Central government can be involved, it is more appropriate to try to create a service entity using, for instance, the Insurance Association of China. This entity could sell services to all firms and bring the knowledge, data, software, and other services together in a much more cost effective fashion than insurance companies performing these services on their own.
3) The insurance regulatory service deserves a special function. In this case, only one primary entity is involved in facilitating that activity – China Regulatory Insurance Commission.
4) Risk financing is where this chapter begins and where it ends. The chapter introduces multiple ideas about how to assure that extreme losses can be paid. These ideas involve both Central and Provencal government as well as international reinsurers.

10. The study focused its analysis of the industry on the following four target provinces: Hainan, Heilongjiang, Shanghai[1], and Xinjiang. These target provinces were selected based on their spatial coverage of China, the differing agro-ecological conditions, the divergent agricultural risk profiles, and varying experiences with both government and non-government supported agricultural insurance.

[1] It should be noted that Shanghai is a municipality and not a province, however, for the purposes of simplicity, the report uses the phrase ‘pilot or target provinces’ to refer to Hainan, Heilongjiang, Shanghai, and Xinjiang.

11. The study was divided into three successive phases: i) Phase 1 focused on agricultural, weather and insurance data collection at both the national and provincial level. This data collection was coordinated mainly by the provincial finance bureaus and CIRC offices, in close collaboration with the relevant line bureaus and insurance companies; ii) Phase 2 focused on the detailed technical analysis of the data collected by a multi-disciplinary team of economists, insurance and financial sector specialists, legal and regulatory specialists, and researchers; and iii) in Phase 3, the draft report and findings were presented and discussed with all relevant stakeholders, namely central government agencies, provincial line bureaus, insurance companies, reinsurance industry, among others, to gain feedback before finalizing the report.

Lessons from International Experience on Agricultural Insurance

12. Agricultural insurance is challenging under any circumstances. It is even more challenging when farm units are small, markets are not well-developed, regulations are unclear, and data and information are limited. International experience has been mixed for many types of agricultural insurance. Governments have become increasingly involved in agricultural insurance, in some cases as a direct insurance provider, in others, via public-private partnerships.

13. Central to the development of a sound and sustainable agricultural insurance program, is application of sound actuarial principles to determine the cost of agricultural insurance (i.e., insurance premium). It is therefore important that any agricultural insurance program takes into account the pure cost of risk (expected annual loss), the operating costs (i.e., delivery costs, loss adjustment costs, etc.) and the reserve load (i.e., cost of holding reserves or cost of reinsurance).

14. The cost of insurance can greatly vary across different product designs. Three types of insurance products can be considered, with their benefits and limitations:

- *Named Peril Insurance*. Named peril insurance products (e.g., hail) have been the first crop insurance products offered in many countries. The cost of offering named peril insurance is significantly less than the cost of offering multiple peril insurance: it is easier to conduct risk assessment for a single named peril than for multiple perils; risk classification is easier so the potential for adverse selection is greatly reduced; and the loss adjustment costs are usually lower;
- *Multiple Peril Crop Insurance (MPCI)*. Multiple peril crop insurance was first developed in the USA, and is now predominantly adopted in the US, Canada and Spain. MPCI is an attractive product where the damage to crops is complex (for example, many perils interacting, such as rainfall and disease). Furthermore, it provides a guarantee to the farmer of an indemnity if the actual realized yield is less than an agreed percentage of the average yield established for the farm. Despite the advantages of MPCI to the farmer, individual farmer-MPCI has proved highly problematical for insurers because it is very expensive to administer and farmers (and especially smallholders) are usually unwilling to pay premiums that are sufficient to cover the insurer's cost of providing MPCI. Thus, all MPCI programs (except in South Africa) have large premium and/or administrative subsidies paid for by government. Nonetheless, given the implicit subsidies provided, it may be financially feasible for insurers to continue providing MPCI to state farms. However, the potential for offering MPCI outside of state farms, especially for smallholders, may be quite limited;
- *Index-based insurance*. Because index insurance indemnities are based on the realized value of a pre-determined index rather than farm-level losses, the operating costs of providing index insurance are less than the operating costs of indemnity-based insurance: limited moral hazard because the farmer cannot

influence the likelihood or magnitude of an indemnity; no farm-level loss adjustment; and simpler enrollment process since there is no need to establish and verify average farm-level yield.

15. Even when these best practices are followed, the cost of delivering and loss adjusting MPCI policies will likely be excessive for smallholders. There are a number of ways for the government to provide subsidies that reduce the costs of providing various types of crop insurance, for example through the development of risk market infrastructure.

16. *Legal and Regulatory Framework*: Among the most important functions for government in facilitating agricultural insurance markets is the establishment of an enabling legal and regulatory framework. Agricultural insurance is a special class of insurance business that has characteristics that are somewhat different to other classes of general insurance, such as automobile or property and casualty insurance. It is important that the insurance law and the regulatory system account for these differences. For example, index insurance creates some unique legal and regulatory challenges as indemnities are not based on the actual loss incurred. Thus, even when strong legal and regulatory systems are in place, it is likely that modifications will be required.

17. *Enhancing Data and Information Systems*: To develop any crop insurance product, insurers require reliable, impartial data on agricultural production. As much of the data required for crop insurance has public good characteristics, it is unlikely to be collected, cleaned, and archived by private sector companies. Therefore, the government should provide this kind of data. Crop insurance companies in China currently make extensive use of the National Bureau of Statistics data on hectares planted and production of various crops as well as the data on hectares covered by, and affected by, various natural disasters. Further government investments in collecting, cleaning, and archiving relevant data as well as ensuring that this type of data is easily available to insurance companies, could further stimulate the development of the agricultural insurance market in China.

18. *Public Awareness and Capacity Building*. Government should be actively engaged in public awareness and capacity building during the early stages of crop insurance market development. Very often crop insurance, or even general insurance, is not very well understood by rural farmers and therefore these kinds of efforts are critical to ensure that farmers understand the advantages and disadvantages of different crop insurance products.

19. *Catastrophe Reinsurance/Risk Sharing.* Crop insurance is highly subject to spatially covariate risks such as drought or extreme temperatures. This implies that, in any given year, indemnities can be very high relative to premiums collected. Insurers must have access to large amounts of ready capital to pay these indemnities. Reinsurance is the most common means that insurers use to gain access to additional financial capacity. However, reinsurance can be expensive. Governments often provide subsidized reinsurance for MPCI policies. In the USA, the federal government provides a highly subsidized reinsurance contract for insurance companies that sell MPCI policies. In Spain, the consortium of insurance companies is mainly reinsured by the public reinsurance company Consorcio de Compensacion de Seguro.

20. To date, the experience on weather index insurance is limited. However, it is likely less costly to obtain private-sector reinsurance on index insurance products than on MPCI. Some weather variables are less spatially covariate than MPCI losses. More important however, is that compared to MPCI, index insurance products are simple, transparent, and less susceptible to adverse selection and moral hazard problems. This reduces the reinsurers cost of due diligence so

they can provide reinsurance on index insurance at more favorable terms than reinsurance on MPCI.

21. *Public Subsidies*. In almost all MPCI insurance programs (including those in China), the government subsidizes the premium cost to farmers. By way of contrast, government premium subsidies have rarely been applied to named peril insurance products such as hail insurance. This is because the costs of providing named peril insurance are low enough that farmers can afford to pay the premium. Premium subsidies may make MPCI more affordable for farmers, however, do not address the underlying high costs of providing MPCI (i.e. adverse selection, moral hazard, and high loss adjustment, delivery, administration, and reinsurance costs). Furthermore for a fully scaled-up MPCI insurance program, the costs of public-sector premium subsidies can be prohibitively costly. In 2006, the US government paid US$2.7 billion in crop insurance premium subsidies despite numerous studies documenting widespread adverse selection and moral hazard problems with the MPCI program in the US. If China adopted a similar program, the annual cost of the subsidy program to the Government could be as high as US$10 billion).

22. Premium subsidies can also create perverse behavioral incentives. Premium subsidies are typically calculated as a percentage of the commercial premium (e.g., a subsidy equal to 50 percent of the commercial premium). Farmers producing the most risky crops or producing in the highest risk areas, who should be charged the highest premiums, get more subsidies (in value terms). Government premium subsidies can also encourage farmers to produce a high-valued but risky crop in a region that is not well-suited to produce that crop, thus assuring greater losses in the future.

23. If governments wish to provide crop insurance subsidies, it is likely far better to focus those subsidies on developing risk market infrastructure, such as the items mentioned earlier (i.e. product development, catastrophic risk financing, an appropriate legal and regulatory framework, high quality data, public awareness and capacity building, etc).

Key Challenges Facing Agricultural Insurance Industry in China

24. ***National agricultural insurance uptake is low.*** In 2005, the agricultural insurance premium volume approximated RMB729 million (US$91.1 million), that is less than 0.6% of national non-life insurance. On the supply side, agricultural insurance is only available in a few provinces. On the demand side, the majority of Chinese farmers lack awareness and education related to insurance in general and crop/livestock insurance in particular.

25. ***Insurance is not currently geared towards small farmers***. The majority of the present insurance premium is derived from farmers insured in former military reclamation areas, and where individual grower crop MPCI programs are feasible because of the unique features of the reclamation areas, large farm structure and the organization of agriculture. These MPCI products are not well suited to wide-scale replication with small farmers outside the reclamation areas.

26. ***China's crop risk profile shows great differences in risk across crops and geographic areas.*** Risk exposure for small and geographically concentrated crop insurance companies can be high because of the high level of covariate risk like droughts, floods and typhoons. However, pooling agricultural risks across the country can significantly reduce the peak risk exposures.

27. ***Insurers have limited financial capacity to deal with catastrophic losses***. Domestic insurers are exposed to catastrophe risks and have limited opportunity to diversify their portfolios.

28. ***Limited agricultural insurance products offered by insurance industry.*** Crop insurance products currently available are mainly multiple-peril crop insurance products (MPCI) which present numerous challenges for the insurance industry to develop successfully and are not fully appropriate to meet the insurance needs of the agriculture sector.

29. ***Inadequate agricultural risk assessment capacity***. The risk assessment conducted under this study shows that domestic insurers tend to under-estimate the underlying crop yield risks and, therefore may under-price their products.

30. ***Domestic insurers have limited access to technical services and international agricultural insurance expertise.*** Provincial insurers have limited access to technical insurance services in specialist in areas such as product design, ratemaking, underwriting, and loss adjustment.

31. ***Government support is not geared to providing insurers with incentives to improve their operations and expand their services to small farmers.*** Public support to agriculture insurance is mainly through direct premium subsidies. This does not create incentives for agricultural insurers to provide better services to existing insured farmers and to offer new products tailored to small farmers.

32. ***Ambiguous legal and regulatory framework for agricultural insurance***. The present insurance law includes no specific provisions for agricultural insurance; therefore insurers operate without a clear legal framework.

Principal Recommendations

Product Development

33. ***'One size does not fit all'.*** No single product solution will meet China's needs, due to the very wide range of climatic and farming conditions. A variety of appropriate crop insurance products is required in each province. As a result, a mix of existing crop insurance products and index products is recommended to allow for the expansion of crop insurance. A structure whereby products are developed within each province will increase the likelihood that tailored agricultural insurance products will be developed to match the great diversity of agriculture in China.

34. ***New crop insurance products should be specifically developed for small farmers***. These products should offer effective and affordable insurance to small farmers and should focus first on the financing of catastrophic losses.

35. ***Insurers should perform a formal portfolio risk assessment.*** Insurers should conduct a formal assessment of the catastrophic risk exposure of their portfolio of insurance business. This would allow them to identify peak exposures in their portfolio, to rebalance their portfolio and to structure cost-effective risk financing strategies (including risk retention, pooling and reinsurance purchasing), leading to an increased capacity to sustain catastrophic losses.

36. ***Agricultural insurance ratemaking techniques should be revisited in the light of international best practice.*** Insurers must consider using actuarially sound rating techniques consistent with international best practice and with Chinese conditions.

Risk Financing Strategy

37. ***The government should contribute in the financing of losses that cannot be transferred to the private market at acceptable costs***. The government should focus on catastrophic losses, acting as reinsurers of last resort, when the financial resources of the domestic insurance industry are scarce and the access to international reinsurance markets is limited.

38. ***Fostering commercial agricultural reinsurance capacity.*** The provincial and central governments should further promote access to agriculture insurance to local reinsurer (e.g., China Re) and international reinsurers in order to increase commercial agricultural reinsurance capacity.

39. ***The role of the central government and provincial governments in the financing of catastrophic risks in agriculture should be clarified.*** If central government wishes to offer a subsidy to local insurance companies, the central government could offer free stop loss reinsurance at an agreed proportional level above certain extreme levels to the provincial government or the provincial insurance companies. The central government could also sell stop loss reinsurance for the remaining proportion. The provincial government could buy this stop loss reinsurance for their local insurers.

Institutional Capacity Building and Technical Assistance

40. ***A Technical Support Unit should be established as a central agricultural insurance service provider***. This unit should have support from the Central Government and linkages to the Provincial Governments, insurers and reinsurers. This center of expertise would provide market services for a fee to support rapid development and scaling-up of agricultural insurance.

Legal and Regulatory Framework

41. ***An appropriate legal and regulatory framework should be developed to support agricultural insurance***. Although there are some differences between agricultural insurance and other forms of general insurance, the principles governing the regulation and supervision of general insurance, and insurance contracts, are largely applicable to agricultural insurance. Given the considerable overlap, it is recommended that the Insurance Law is applicable to agricultural insurance, but enabling different provisions to be made for agricultural insurance, where appropriate, through regulations made under the Insurance Law.

Government Support and Public Subsidies

42. ***The Government should facilitate the pooling of agricultural risks***. Provincial agricultural co-insurance pools, like those established in Hainan and Zhejiang, should be supported by the provincial governments in order to help local companies reduce their risk exposure.

43. ***On-going pilot initiatives on agriculture insurance should be better coordinated***. The Central Government, through the Ministry of Finance, and the provincial governments, through their finance bureaus, are piloting a series of agriculture insurance initiatives. These pilots should be better coordinated and be implemented as part of a national policy framework for the development of agriculture insurance.

44. ***A public subsidy program should be developed to create incentives for agricultural insurers to expand their services to small farmers.*** Public support should focus on the

development of risk market infrastructure and public goods that will give agricultural insurers incentives to offer affordable and effective insurance to farmers, and particularly small farmers.

45. ***Targeted premium subsidies could support marginal farmers as a social tool.*** Premium subsidies could be targeted to marginal farmers under a social program. However, they should be combined with the promotion of risk mitigation activities (e.g., drought resistance seed, etc.).

46. ***Government reinsurance should complement private reinsurance.*** Public subsidies for reinsurance should be made available for risk layers that cannot be transferred to the reinsurance market at acceptable costs or for which reinsurance capacity is unavailable. This is usually the case for top (catastrophic) layers where the government could act as a reinsurer of last resort.

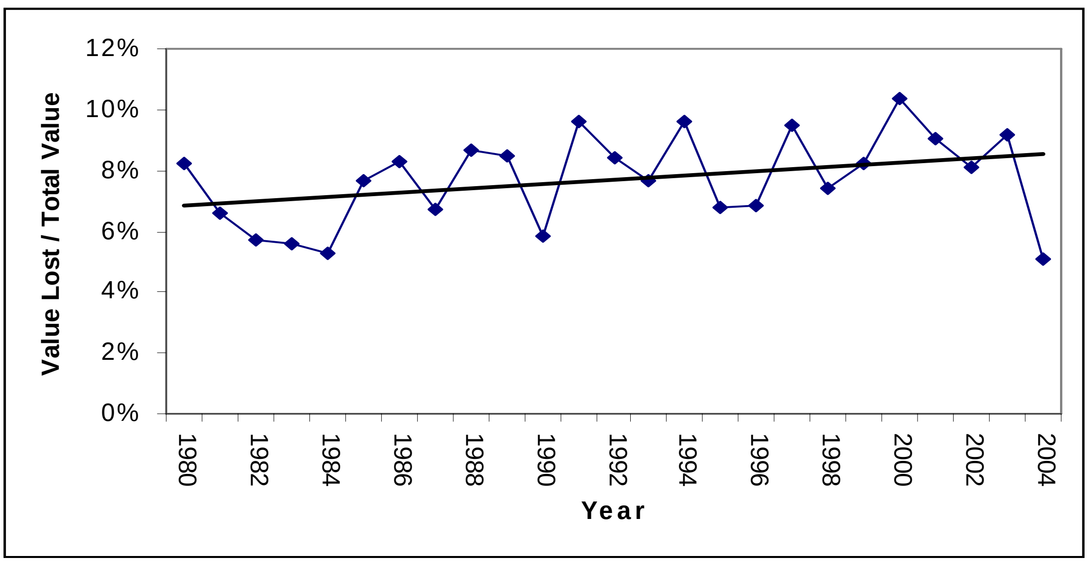
Chapter 1: Introduction

1.1. China is the world's most populous country and one of the largest producers and consumers of agricultural products. It produced crops and livestock valued at $366 billion in 2004, about 50 percent more than the U.S. total. Despite limited supplies of land, water, and other natural resources, China grows most of its own food and is a major exporter of many agricultural commodities. China ranks number 1 in the world in rice paddy production with over 40 percent more production than India which ranks number 2. Importantly, China also ranks number 1 in the world in fresh vegetable production with 4 times more production than India which ranks number 2 again. China is also the largest wheat producing country in the world. In total, China ranks number 1 in the world in the production of 45 agricultural commodities (FAO, 2005).

1.2. Agriculture policy reforms in 1978 transferred land use, crop and yield ownership rights from farm collectives to individual households. Most planting and other production and marketing decisions became the responsibility of households. Since that time the trends in agricultural productivity have been quite impressive.

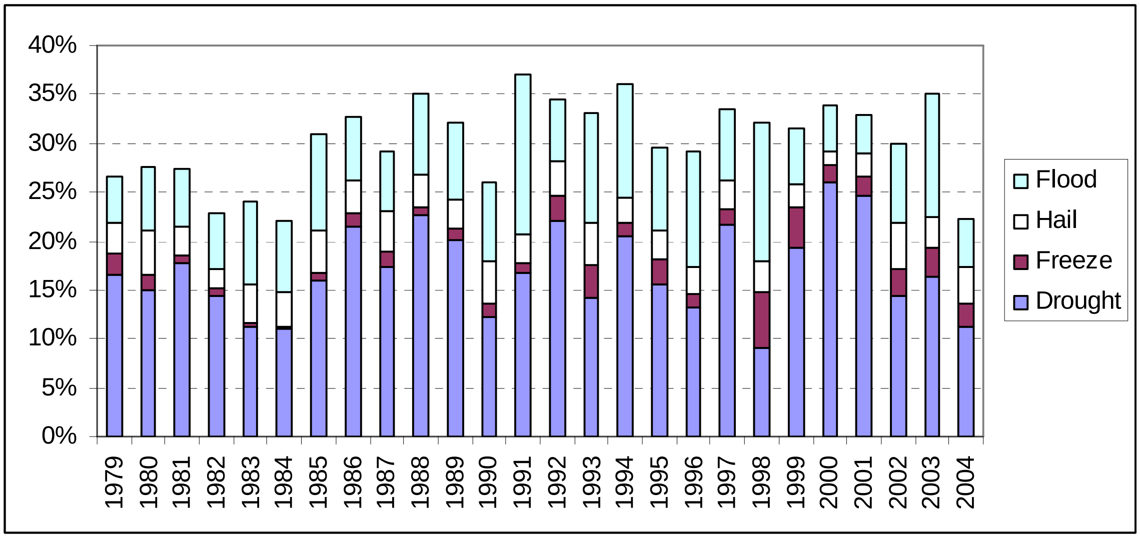
1.3. When estimating the value lost per year relative to the total crop value, a distinct national can be identified (see Figure 1.1). The average value has gone from about 7 percent in 1980 to about 8 percent in 2002. This could be caused by a number of factors. For example, more marginal land that is also more vulnerable to natural disaster has been brought into production over the last years. This somewhat troublesome trend has been confirmed by several stakeholders (including insurance companies).

Figure 1.1. Trend in losses for crops in China from 1980 to 2002



1.4. Compared with other industries, agriculture's long production cycle makes rural households particularly vulnerable to natural disasters. More than 20% of the total farmland, estimated at 165 million ha in 2004, was affected by natural disasters on average over the period 1979-2004 (see Figure 1.1b). The major cause of loss is drought, followed by flood. The average annual loss of grain output caused by natural disasters in China was estimated at about 5%, roughly 25 million tons 2004, which is more than 70% of the Chinese grain imported in the same year.

Figure 1.1b. Farmland affected by natural disasters in China (% total farmland)



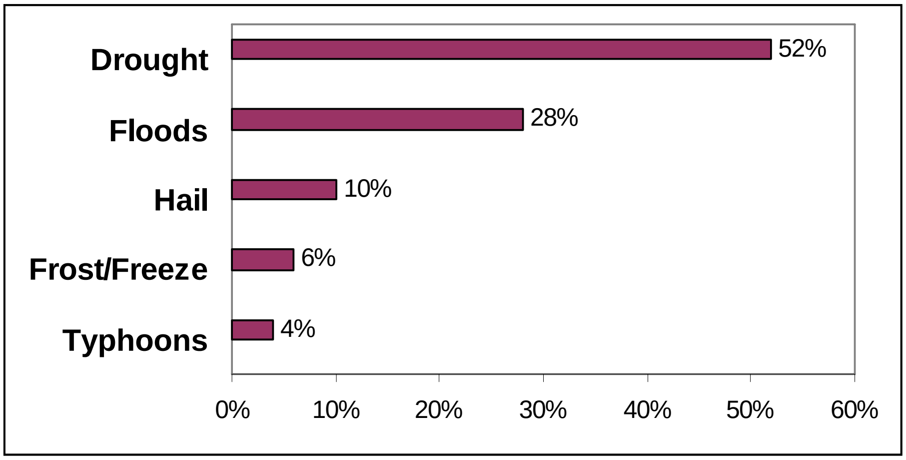
Source: China Statistical Yearbook, 2005.

1.5. Access to formal risk financing instruments, such as insurance, can help Chinese farmers transfer excessive losses to a third party (e.g., insurance companies), thus stabilizing household income, facilitating their access to credit and ultimately enhancing their livelihoods.

1.6. The 11th Five Year Plan (FYP) highlights the shift in government focus to rural and agricultural development. The Plan outlines major financial and policy support to improve rural households' standard of living through changes such as the elimination of agriculture taxes and additional investment in rural infrastructure. In particular, policy stimulus has been proposed to encourage insurers and enterprises to support the development of agricultural insurance (see Box 1.1).

1.7. Between 1982 and 2002, 24 percent of all hectares had losses of 10 percent or greater across China. Over half of the losses come from drought and another 28 percent come from flood. Hail losses are 10 percent of the share. Frost and freeze losses are around 6 percent (see Figure 1.1c)

Figure 1.3 Share of all losses by cause of loss using 2004 crop values



Box 1.1: State Council's Opinion on Developing Agricultural Insurance

The State Council of China has expressed opinions on the development of an agricultural insurance model that suits Chinese conditions (No.1 Document). The central and local governments, insurance companies, dragon-head companies and farmers are encouraged to play an active role. The agricultural insurance legislation should be developed to encourage farmers' participation and facilitate the coordination between stakeholders.

No.1 Document also recommends shifting from the current model of post disaster relief to a new model based on agricultural risk prevention and subsidized insurance. An agricultural reinsurance program, with fiscal support from the central and local governments, should be promoted to facilitate risk diversification and risk transfer.

Various forms of agricultural insurance organizations, such as mutual insurance, should be developed. Insurance companies should get technical assistance to develop low-cost products and easy-to-understand policies. Delivery channels suitable for agricultural insurance should be explored.

1.8. The Government of China (GoC) recognizes the importance of revitalizing the agricultural insurance industry and has undertaken a series of pilot projects to test different models of insurance. These pilots are currently under implementation in several provinces: Heilongjiang, Xinjiang, Jiangsu, Shanghai, Jilin, Xinjiang, Zhejiang, Sichuan, and Hainan. The China Regulatory Insurance Commission (CIRC) has also approved the launch of specialized agricultural insurance companies in Shanghai, Jilin and Heilongjiang provinces.

1.9. Five management models of agricultural insurance are being piloted in China. The models range from specialized mutual insurance companies with local government subsidies to foreign commercial insurance companies. Wide variations in cropping and livestock farming systems across different climatic regions of the country pose significant challenges to the design, development and policy support of agricultural insurance products, as well as offer opportunities for risk diversification.

1.10. In this context, the Ministry of Finance requested the World Bank to conduct a comprehensive assessment of the agricultural insurance industry in China and provide recommendations for its future development. This work aims at providing an overall framework for the development of market-based agricultural insurance. It relies on the following components:

- *Agricultural risk assessment*. Agricultural risks faced by farmers/herders are identified and quantified, based on risk layering, (i.e., decomposition between low frequency/high severity losses such as droughts or cyclones) and high frequency/low severity losses.

This assessment is instrumental for developing appropriate risk financing strategies for the provincial/national governments and insurance companies.

- *Technical, financial and operational review of insurance companies*. The current insurance practices (insurance products, reinsurance, underwriting, loss assessment, financial statements, etc.) are reviewed and discussed based on international experience.
- *Options for public-private partnership in the financing of agricultural risks*. The role of the government and the private insurance sector in the financing of agricultural risks is discussed, with a particular focus on the financing of natural disasters in agriculture.
- *Institutional capacity building*. Support the government in creating an economic and legal environment that facilitates the emergence of a competitive insurance market and provides farmers with the incentives to engage in risk financing strategies. This includes efficient data management systems, appropriate regulatory and legal framework, effective information and education programs, and the development of national and provincial technical expertise.

1.11. The highly technical and specialized nature of the work proposed required numerous experts in agricultural risk management and insurance. The Bank is among the few international institutions, and maybe the only one, which has strong internal expertise in this area and which can bring together, adequately supervise and provide the required technical inputs and oversight to this work. To this end, this work was jointly managed by EASRD and FPDSN.

1.12. The report consists of five chapters, starting with this Introduction. Chapter 2 provides a review and a diagnosis of the current agricultural insurance industry in China and lays out the key challenges. Chapter 3 presents guiding principles in the design of an agricultural insurance program, based on international experience. Chapter 4 discusses options and recommendations for the future development of agricultural insurance in China. Chapter 5 contains the conclusions and suggestions. The report ends with six technical annexes, which are provided for reference purposes. Stand alone documents for each of the five insurance companies involved in agricultural insurance are also included.

Chapter 2: Agricultural Insurance in China: Review and Diagnosis

2.1. This chapter provides a review of the current agricultural insurance market in China. It first presents the agricultural insurance pilots and lists some key challenges that will have to be overcome in order to make agricultural insurance successful in China. It then offers a detailed risk assessment in selected provinces and highlights the benefits of risk pooling among crops, risks and provinces. Finally, it provides a technical and operational assessment of the agricultural insurance and reinsurance markets in China.

Agricultural Insurance in China: Context

Government Policy

2.2. Growing concerns over income inequality and equitable economic growth have shaped the government's rural development agenda. Although agriculture's contribution to GDP and employment represents a declining share of the economy and population, the industry still employs 45% of the total population and remains a key sector in China's development. In 2005, the per capita income ratio between urban citizens and rural residents was estimated at 3.2 to 1. Recognizing the importance of improving rural incomes and decreasing income disparity, the government has issued policy priorities that underscore its concern. Influential decrees such as the No. 1 document issued by the Communist Party of China (CPC) Central Committee in January of 2003 explicitly focused on improving rural incomes and reducing inequality. This marked a significant shift in the focus of the No. 1 document to rural development. The Fifth Plenum of the 16th CPC passed the 11th Five Year Plan (FYP) in October of 2005. The government's rural development policy until 2011 is summed up in the slogan of 'building a new socialist countryside' and 'extracting less, putting more back in.' Specific initiatives include increased investment in rural infrastructure and agriculture technology, reducing the tax burden and improving public services. The FYP and the No. 1 documents from 2003-2007 are leading policy reforms to improve rural development (see Box 2.1).

2.3. One important change in policy towards rural areas and agricultural development was the rural fees and tax reform introduced in 2001 to reduce peasant burden. This reform marks a significant shift in attitude as it removed a 2,000 year-old agricultural tax. In 2003, China's National Bureau of Statistics reported agricultural tax revenue, specialty crop revenue, and herding tax revenue of RMB 42.7 billion ($5 billion). The estimated reduction in financial burden on peasants is as high as 40-50% nationwide. The World Bank (2006) Rural Public Finance Report discusses the details and impacts of the rural fee reduction and agricultural tax reform.

2.4. In addition to the plan to eliminate of agricultural taxes, in 2004, the central government announced direct subsidies to farmers for grain production. Direct agricultural subsidies from the center are primarily provided to grain farmers based on the number of acres planted. In Heilongjiang and Shanghai, farmers are given subsidies through Bank of China branches. In Shanghai, farmers can receive a debit card to obtain their subsidy. In the first year of this subsidy program, the Ministry of Finance allocated RMB11.6 billion (US$1.5 billion) in direct grain subsidies with the majority of this subsidy, RMB10.3 billion (US$1.3 billion), going to 13 major grain producing provinces (Jilin, Liaoning, Hebei, Henan, Shandong, Jiangsu, Anhui, Hunan, Hubei, Sichuan, Jiangxi and Inner Mongolia Autonomous Region). The net increase in income per family is estimated to be approximately RMB75 (US$9.4).[2] Central government subsidies are often supplemented with provincial funds resulting in different levels of subsidies across provinces. In Heilongjiang, improved soybean and corn seed subsidies were RMB10 and RMB15 per mu for rice.[3] The total subsidy per household was approximately RMB55. In 2006, MoF increased the subsidy by allocating RMB14.2 billion (US$1.8 billion) in direct grain subsidies to 30 provinces and autonomous regions.[4] Other agricultural subsidies include support for seeds and machinery.

2.5. The reform and development of agricultural insurance represents an important example of the government's commitment to rural development. Agricultural insurance in China first began in the 1950's but was abandoned towards the latter part of the decade and was not reintroduced until 1982. During the 1980's and 1990's the state-owned People's Insurance Company of China (PICC) was the main crop, livestock, forestry and aquaculture insurer, operating at a national level in the major agriculture provinces of China. In addition, two provincial-level agricultural insurance programs were initiated by the military during this period. One was in Xinjiang Province, the Xinjiang Production and Construction Corps Agricultural Insurance Company (today privatized as China United Property Insurance Company - CUPIC), and the second was in Heilongjiang Province, the Heilongjiang Reclamation Group. The agricultural insurance division of the later was privatized in 2004 to form Sunlight Mutual Agricultural Insurance Company (SAIC). Until 2003, these three companies were the only players in the Chinese agricultural insurance market.

Box 2.1. Agriculture and Rural Development Policy Reforms

Rural Fee and Agricultural Tax Reform	Rural Fee Reform was launched in 2000 and rolled out from 2002-2004. As a second step in rural fee reform, the phased removal of agricultural taxes was announced to take place over five years from 2004. In 2006, the effort to removal of agricultural taxes and fees was launched nationwide. According to official estimates, the central government allocated RMB108 billion (US$13.5 billion) in 2006 for transfers to provinces and autonomous regions to support local government operations.
Direct Subsidies	Direct payments to grain farmers started in 2004, based on historical area planted. Direct subsidies are designed to prevent leakage for overhead expenses transferred bypassing some layers of government. Subsidies are also provided for high quality seeds and machinery.
Land Tenure Rights	According to the Rural Land Contract Law of 2003, land tenure rights are supported for 30 years. This is designed to prevent non-agriculture or corrupt appropriation of farmland and to facilitate the transfer of temporary usage rights.
Rural Infrastructure	Increased investment to improve irrigation, roads, electricity access Total investment in public goods construction including roads, irrigation, drinking water, schools etc increased from an average 77 RMB per capita to 217 RMB per capita from 2000 to 2004.[5]
Financial Institutions	MORE The new Postal Savings Bank to offer both credit and savings services opened in March 2007. Agricultural lending has increased significantly. Rural Credit Cooperatives' agricultural loan balance increased

[2] Ministry of Finance
[3] 1 mu = 1/15 hectare.
[4] Ministry of Finance Press Release. Available at: www.mof.gov.cn/news/20060412_2115_14227.htm
[5] For additional details, please see World Bank, 2006. Rural Public Finance Report.

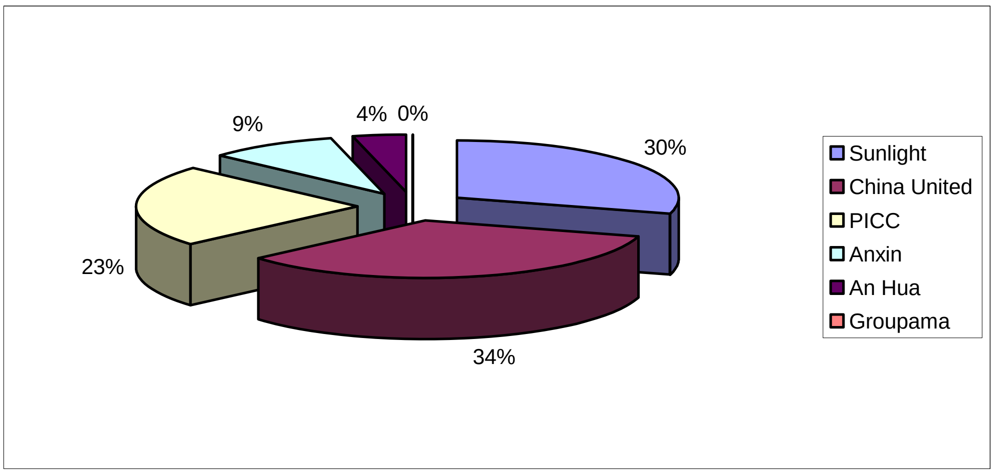
by 48% from 2001-2005.

Source: *http://english.gov.cn/special/rd_rr.htm*, *USDA ERS http://www.ers.usda.gov/publications/WRS0601/WRS0601.pdf*

Agricultural Insurance Pilots

2.6. The agricultural insurance market in China is extremely small. In 2005, the national agricultural insurance premium volume was RMB 729 million (about US$91.1million) representing a mere 0.6% of the total Chinese non-life insurance premiums of RMB 123 billion (US$15.4 billion). This represents a decline on the peak year 1992 when agricultural insurance premiums reached RMB 817 million (US$102.1 million). The split of 2005 premium volume is shown on Figure 2.1.

Figure 2.1: 2005 Distribution of Agricultural Insurance Premiums, by company



2.7. Under the 11th FYP the Chinese government reiterated its commitment to agricultural and rural development. Within this framework, the government is actively promoting the development of agricultural insurance through a variety of models and different support mechanisms. CIRC has since 2004 approved the formation of four specialist agricultural insurance companies:

- *Sunlight Mutual Agricultural Insurance Company* (SAIC) in Heilongjiang. SAIC is the first mutual insurer to receive CIRC approval in China. SAIC is a regional agricultural insurer, which is primarily involved in underwriting traditional Multiple Peril Crop Insurance (MPCI) and it is backed by premium subsidy support from the provincial government;

- *Anxin Agricultural Insurance Company* (former PICC regional branch) is a regional insurer underwriting both crop and livestock in Shanghai Municipality. Anxin is China's largest insurer of epidemic disease cover for livestock and poultry and the company receives a high level of local municipality government financial support in the form of premiums subsidies and catastrophe excess of loss protection for crops and livestock;

- *Anhua Agricultural Insurance Company* in Jilin Province is a commercial company formed by 7 local enterprises with initial capital of RMB200 million (US$25 million). In

2005 Anhua insured 6 pilot programs for corn, tobacco, strawberries, dairy cattle, pigs and poultry. This program attracts high levels of premium subsidies from government;

- The French insurer *Groupama* was granted a license to commence offering agricultural farm-package insurance products to farmers in Sichuan Province in 2005.

2.8. In addition, the local governments in several provinces work closely with PICC (China's largest property insurer with two thirds of the property premium) and CUPIC (4th largest property insurer in China with 8% market share) to develop and pilot a series of new public-private sector crop and livestock products and programs.

2.9. CUPIC (China United) has commenced underwriting agriculture in several other provinces of China since 2003. In Huai'an City, Jiangsu Province, CUPIC implemented a pilot project for rice, wheat and barley insurance in 2003. In 2004, aquaculture insurance and personal accident insurance were added to the program which is being implemented in 10 counties/districts of Huai'an. The local finance bureau is providing 50% premium subsidies. CUPIC is involved in a livestock insurance project in Sichuan and tobacco leaf insurance in Chongqing. CUPIC along with PICC has the potential to develop agricultural insurance at a national level throughout China.

2.10. PICC currently has nine new pilot agricultural insurance projects either under development or in implementation. In 2006, a PICC-led agricultural coinsurance pool was launched in Zhejiang Province to underwrite crops, forestry, livestock, poultry and aquaculture, supported by premium subsidies. This is the first program in China where government through the local finance bureau is providing formal catastrophe reinsurance protection to the pool coinsurers for losses between 200% and 500% loss ratio. In addition, international reinsurers are providing layered stop loss treaty protection to the pool on their net retentions. In Hainan Province, PICC, CIRC and the Finance Bureau are finalizing plans for the early 2007 launch of pilot insurance programs for banana, rubber, pigs and local fishermen which is closely modeled on the Zhejiang public-private sector model with government providing a combination of premium subsidy support and catastrophe reinsurance protection.

2.11. Suzhou City, in Jiangsu Province, represents another pilot agricultural insurance project which started up in 2006. PICC won the tender on this government commissioned pilot project to provide insurance for rice, seedlings, swine, fish farming, and poultry. For rice insurance, a priority for the city government, the premium subsidy is 60% (20% from the city government and 40% from the county/district government). By August 2006, a total of 250,000 mu of crops has been insured, with total insured value of RMB166 million (US$20.8 million) and RMB2.49 million (US$310,000) in premium. It is estimated that the premium received from rice insurance alone will amount to RMB7 million (US$875,000) in 2006.

2.12. The Ministry of Finance approved early 2007 a new set of pilots in the following provinces: Jiangsu, Jilin, Xinjiang, Hunan, Sichuan, and Inner Mongolia. MoF has allocated a budget of RMB1 billion (US$125 million), which is matched by the same amount from the selected provincial governments. The RMB2 billion (US$250 million) subsidy program aims to finance 50% of the agricultural insurance premiums. This budget allocation comes on top of RMB700 million (US$87.5 million) already allocated by CIRC.

Challenges in developing agricultural insurance

2.13. China is facing key challenges in the development of agricultural insurance. These challenges are also faced by other countries who want to promote market-based agricultural insurance as part of their agricultural policy. They can be overcome over time through an appropriate agricultural risk management framework relying on a strong public-private partnership.

2.14. *Low national agricultural insurance uptake*. Penetration of agricultural insurance in China is low. On the supply side, agricultural insurance is only available in a few provinces. The history is dominated by prior agricultural insurance activities, which were heavily influenced by public sector interventions.

2.15. *Insurance is most developed in farming sectors which are not representative of most of Chinese agriculture*. The majority (64%) of the present insurance premium is derived from farmers insured in reclamation areas (HRG, Heilongjiang Reclamation Group, and XPCC, Xinjiang People's Construction Corps), which offer special advantages to an insurer, such as low insurance delivery costs and loss adjustment costs. The challenge for insurers is to find products, and operational and distribution solutions which can allow scaling up.

2.16. *Lack of national framework for agricultural insurance*. The development of agricultural insurance activity is strongly decentralized, with diverse business models, products and linkages in each province. Whilst this approach has many benefits of promoting local initiative, adaptation, and activity, it provides limited opportunity for central exchange of technology and best practice. In addition, the roles of the central government and provincial governments in the development and implementation of agriculture are not clearly defined.

2.17. *Lack of appropriate legal and regulatory framework for agricultural insurance.* The present insurance law makes no provision for agricultural insurance; hence insurers operate without a firm legal framework.

2.18. *Low insurance awareness and education*. The majority of Chinese farmers lack awareness and education related to insurance in general and crop/livestock insurance in particular.

2.19. *Insurers have limited financial capacity*. Domestic insurers are exposed to catastrophe risks, and only have limited opportunity to diversify their portfolios. In mitigation of this constraint, several Chinese insurers have been successful, through reinsurance brokers, in attracting the interest of international reinsurers.

2.20. *Agricultural insurance products*. A key product offered at present is individual grower Multiple Peril Crop Insurance, MPCI, which is enabled by the close linkages to HRG and XPCC. International experience shows that this product has many shortfalls. Further, the history of PICC underwriting at the time of highest expansion in China was based on MPCI. Named peril crop insurance is also offered in China on a limited basis.

2.21. *Data availability*. Agricultural insurance is data reliant. Availability of quality, long term time series data on crop production and yield is a challenge faced in developing adapted crop insurance products. Data on hectares planted and tons produced of various commodities are available at the township level, state-farm level of team level, although issues on data quality and consistency have been identified.

2.22. *Limited access to technical services*. Provincial insurers have limited access to technical insurance services in specialist areas such as product design, ratemaking, underwriting, loss adjustment, etc.

2.23. *Lack of exposure to international agricultural insurance technology*. Chinese insurers have had little contact with the international insurance and reinsurance community, to share experiences in program and product design, and for technology transfer.

Risk Assessment

Data and Methodology

2.24. China has great differences in risk across crops and geographic areas. Two types of data are used to emphasize these differences. The first is data on tons produced and hectares planted for major crops in selected pilot counties and state farms in the four study provinces/municipalities (Heilongjiang, Xinjiang, Shanghai, Hainan). The second is cause of loss data for all provinces in China.

2.25. Using the first data set, township or team level annual yield per hectare is calculated for selected crops in three of the four study provinces. In Shanghai, county or district level yield data are used. Statistical procedures are used to adjust the annual yields for trends in productivity. These trend adjusted yield data allow for evaluation of yield loss relative to the expected yield and can be used to compare yield risk for different crops in different regions. A limitation of these data is that they are for large units. Such aggregate data underestimate the yield risks that are present for household farm units.

2.26. The second data set is provincial-level data on hectares impacted by various causes of loss. These data are grouped into three categories: 1) sown hectares with zero to 10 percent damage; 2) sown hectares with 10 to 30 percent damage; and 3) sown hectares with 30 percent or greater damage. Statistical procedures were developed (see Annex 3) to estimate the annual loss by estimating the equivalent hectares with a total yield loss relative to the total hectares sown. Given difficulties of estimating losses for the group with less than 10 percent damage, the annual average losses for these data are estimated at the 10 percent level or higher.

2.27. A risk assessment begins by estimating the probability that losses of various magnitudes will occur. This is the basis for developing insurance premium rates. Insurers also diversify their risk exposure across different agricultural enterprises and geographic regions to reduce the probability of financial ruin. Thus, a complete risk assessment must also examine the characteristics of a portfolio of insurance products.

2.28. For each of the four provinces/municipalities, pilot counties or state farms were targeted for risk assessment. Between 15 and 20 years of yield data were obtained and analyzed for these counties/farms. Yield data analysis forms the only basis for the risk assessment of individual crops. The cause of loss data are used to conduct provincial risk assessment that is not crop specific. In addition supplementary information was obtained through discussions with agricultural experts in each of the provinces/municipalities. No risk data on livestock mortality were available, so the risk assessment focuses exclusively on crop yield risk.

2.29. The available yield data are generally at the township level for counties and at the team-level for state farms. Due to aggregation bias, a risk assessment based on aggregate data will systematically underestimate risk at lower levels of aggregation. One can simulate a multiple peril insurance policy by estimating yield losses relative to the insured yield. For example, if a 30 percent deductible is used, the insured yield is 70% of the expected yield. An insurance indemnity would be paid only when the realized yield is at least 30 percent less than the expected yield. The annual insurance loss can be estimated as the yield loss divided by the insured yield. For example, if one has an expected rice yield of 5 tons per hectare and a multiple peril crop insurance policy with a 30 percent deductible, the policy would pay an indemnity when the realized rice yield on the insured unit was less than 3.5 tons per hectare. For all cases presented in this analysis, it is also assumed that a complete payment would be made if the yield were equal to zero. Thus, if the yield were 1.75 tons the annual insurance loss would be 50 percent.

2.30. If one has a time-series of annual yields, a time-series of annual insurance losses can be simulated for any design of a multiple peril crop insurance program. The average annual loss is the simple average of a long time series of annual loss estimates. This is the starting point for premium rate calculations.

2.31. The risk assessment presented in this report is performed to explore relative risk exposure and volatility. This allows for some insights into relative risk differences across crops and regions. It also allows one to build portfolios and demonstrate how contingent capital requirements change as risks are spread across crops and regions. The analysis presented here is solely for the purpose of demonstrating risk assessment principles and providing some general sense of relative risk differences across crops and regions. As a consequence, insurance companies or other decision makers should not take the quantitative estimates as granted. The township/team level yield data do not allow one to measure yield losses caused by specific perils, or losses at the farm level. Thus, the risk assessment is for all perils. However, this should not be misinterpreted as an endorsement of multiple peril crop insurance.

Provincial Crop Risk Profile

Heilongjiang

2.32. The primary crops produced in Heilongjiang are rice, soybeans, and maize. Drought is the primary peril for non-irrigated crops, particularly maize and soybeans produced in the central and southern parts of the province. Other perils are flood/water-logging, hail, disease, late frost in spring, early frost in autumn and cold summer temperatures. Statistical analysis of the cause of loss data suggests that over half of lost hectares are from drought and about one third are from flooding events. Hail and frost account for about 6 percent each of all causes of loss.

2.33. Table 2.1 presents yield loss exposure for soybeans, maize, and rice in the six pilot counties/farms in Heilongjiang. The first row shows the average annual loss. Subsequent rows show probable maximum losses (PMLs) for various return periods. Thus, the probable maximum loss for a 10 year return period is the maximum loss that one would expect to occur during a ten year period. For soybeans, the average annual loss is 11%. Losses of up to 30% would be expected in 1 out of every 10 years. For rice, the average annual loss is 21% and in 1 out of every 10 years, one would expect average losses of 39%. An extreme 1 in 100 year event would be expected to generate average losses of 42% for soybeans and 56% for rice. The values that appear under the heading “all crops” come from the cause of loss data risk assessment. This should be considered the most ideal portfolio possible as it represents all crops blended together into a perfectly spread portfolio across the province. Even in this case, up to 22 percent of the total crop value of the province can be lost in the extreme case of 1 in 100 year risk assessment.

Table 2.1: Heilongjiang Yield Loss Exposure

	Soybean	Maize	Rice	All Crops
Average Annual Loss	11%	10%	21%	10%
Probable Maximum Loss (10 year return)	30%	24%	39%	15%
Probable Maximum Loss (20 year return)	34%	32%	45%	17%
Probable Maximum Loss (100 year return)	42%	45%	56%	22%

Estimates for specific crops are based on township and team yield data; estimates for all crops are based on cause of loss data

Xinjiang

2.34. Xinjiang has an arid climate. The northern part of the province receives some rainfall in the spring but the southern part receives very little rainfall. Much of the crop production is irrigated. Snowmelt from the mountains is the primary source of irrigation water. The primary field crop produced in Xinjiang is cotton, though significant quantities of wheat and maize are also produced.

2.35. One of the primary crop perils in Xinjiang is dry, hot winds that desiccate crops. These winds sometimes carry sand that also damages crops. Other perils include inadequate irrigation water, cold summer temperatures, hail, disease, early frost in autumn, late frost in spring, and occasional flooding. Statistical analysis of the cause of loss data suggest that nearly half of lost hectares are from drought and about one quarter is from hail events. Flooding and frost/freeze account for about 12 percent each of all causes of loss.

2.36. Table 2.2 presents yield risk exposure for cotton, wheat, and maize in the five pilot counties/farms in Xinjiang. Wheat and maize produced in Xinjiang have lower yield loss exposure than the same crops produced in Heilongjiang. Cotton production in Xinjiang is much riskier than either wheat or maize production. An extreme 1 in 100 year event would be expected to generate average cotton yield losses of 45%. Even more striking perhaps is the finding that even a 1 in 10 year event would generate average cotton yield losses of 33%. The “all crops” column suggests that Xinjiang could have a significantly better spread of risk than Heilongjiang with the “perfectly diversified portfolio” that is represented by the cause of loss data. In this case, the extreme loss is about 9 percent of the province crop value. By comparison, the value for Heilongjiang was 22 percent. However, a caution should be added as the cause of loss data likely do not capture wind damage that is an important factor in Xinjiang.

Table 2.2: Xinjiang Yield Loss Exposure

	Wheat	Maize	Cotton	All Crops
Average Annual Loss	8%	8%	13%	3%
Probable Maximum Loss (10 year return)	14%	18%	33%	7%
Probable Maximum Loss (20 year return)	15%	22%	37%	8%
Probable Maximum Loss (100 year return)	18%	28%	45%	9%

Estimates for specific crops are based on township and team yield data; estimates for all crops are based on cause of loss data

Shanghai

2.37. Shanghai Municipality is located at the mouth of the Yangtze River in southeastern China. It contains three counties and 17 urban districts. Crops produced in Shanghai include rice, wheat, rapeseed, melons, and a variety of vegetables and tree fruit. Vegetables are produced both in fields and greenhouses.

2.38. Typhoon is the primary peril affecting crop production in Shanghai. Typhoons generally occur between June and September. Crop losses are caused by wind damage, flooding, water-logging, hail, drought, and frost or freeze. Typhoon winds can also damage greenhouses. Other perils include prolonged periods of extremely high or low temperatures. Statistical analysis of the cause of loss data suggest that nearly half of lost hectares are from floods and about one quarter are from frost/freeze events. Hail and drought account for about 12 percent each of all causes of loss.

2.39. Yield data were available only at the county/district level (rather than the township level as in other provinces). Table 2.3 presents yield risk exposure for grain and rapeseed in the three pilot counties/districts in Shanghai. Infrequent but catastrophic events may be either underrepresented or overrepresented in the available yield data. Rapeseed is quite risky with a 1 in 100 year PML of 65%. While the "all crops" column suggests that a perfectly spread portfolio could have a significantly reduced maximum exposure, significant care should be taken when interpreting the results for Shanghai. The cause of loss data reflects only the lost hectares relative to the total hectares. If the crops that are lost are heavily weighted to high value crops, such an aggregate analysis will underestimate the loss exposure.

Table 2.3: Shanghai Yield Loss Exposure

	Grain	Rapeseed	All Crops
Average Annual Loss	3%	13%	2%
Probable Maximum Loss (10 year return)	9%	33%	5%
Probable Maximum Loss (20 year return)	18%	50%	10%
Probable Maximum Loss (100 year return)	23%	65%	13%

Estimates for specific crops are based on county and district yield data; estimates for all crops are based on cause of loss data

Hainan

2.40. Hainan Province is an island in the South China Sea off the coast of Guangdong Province. Much of the island has a tropical climate. Colder temperatures and higher rainfall occur in higher elevations – primarily in the central and southeastern parts of the island. Major crop commodities produced in Hainan include rubber, banana, rice, coconut palm, oil palm, betel palm, pepper, sisal hemp, lemon grass, cashew, cocoa, wheat, sweet potato, cassava, taro, maize, Chinese sorghum, millet, beans, sugarcane, peanut, sesame, tea, pineapple, litchi, longan, plantain, citrus, mango, watermelon, parambola and jackfruit. In addition, over 120 kinds of vegetables are grown.

2.41. Typhoon is the primary peril affecting crop production in Hainan. Typhoons generally occur between May and November with a peak in August and September. Crop losses are caused by wind damage, flooding, and water-logging. On average there are 3.1 typhoon landings on the island per year, and, if tropical depression is included, the figures increase to 7.7 per year. Typhoons cause major losses approximately every 5 years. In 2005, Typhoon Dawai hit Hainan causing more damage than any typhoon in the past 30 years. Agricultural losses were estimated at RMB8 billion (US$1 billion). Drought can also cause crop losses in Hainan. Statistical analysis of the cause of loss data suggest that around one third of lost hectares are from drought and about one third are from flooding. Typhoon cause of loss data is only available for a limited number of years. However, between 2000 and 2003, 22 percent of hectares planted had at least 10 percent loss due to typhoon.

2.42. The risk assessment focuses on banana production in Ledong County (located in southwestern Hainan) and rubber production for Nongken Farm. Rubber is produced primarily in the higher elevations in the central and southeastern parts of Hainan. It is important to note that these data only reflect yield loss for bananas and rubber. They do not reflect the value of damage of the rubber or banana trees.

2.43. Yield risk exposure for banana and rubber is presented in Table 2.4. The 1 in 10 year yield PML for bananas is 23% while for rubber it is 18%. However, the 1 in 100 year yield PML is the same for rubber and for bananas. Given the limited years of available yield data and the catastrophic nature of typhoon risk, it was not possible to assess PMLs with a 100 year return period (additional data can be found in the technical annexes). The "all crops" values again reflect the potential for significant risk reduction with the perfectly diversified portfolio of crops that would be spread equally across the province. In this case, the maximum exposure can be reduced to 17% or less than half of the yield loss exposure for the two crops separately.

Table 2.4: Hainan Yield Loss Exposure

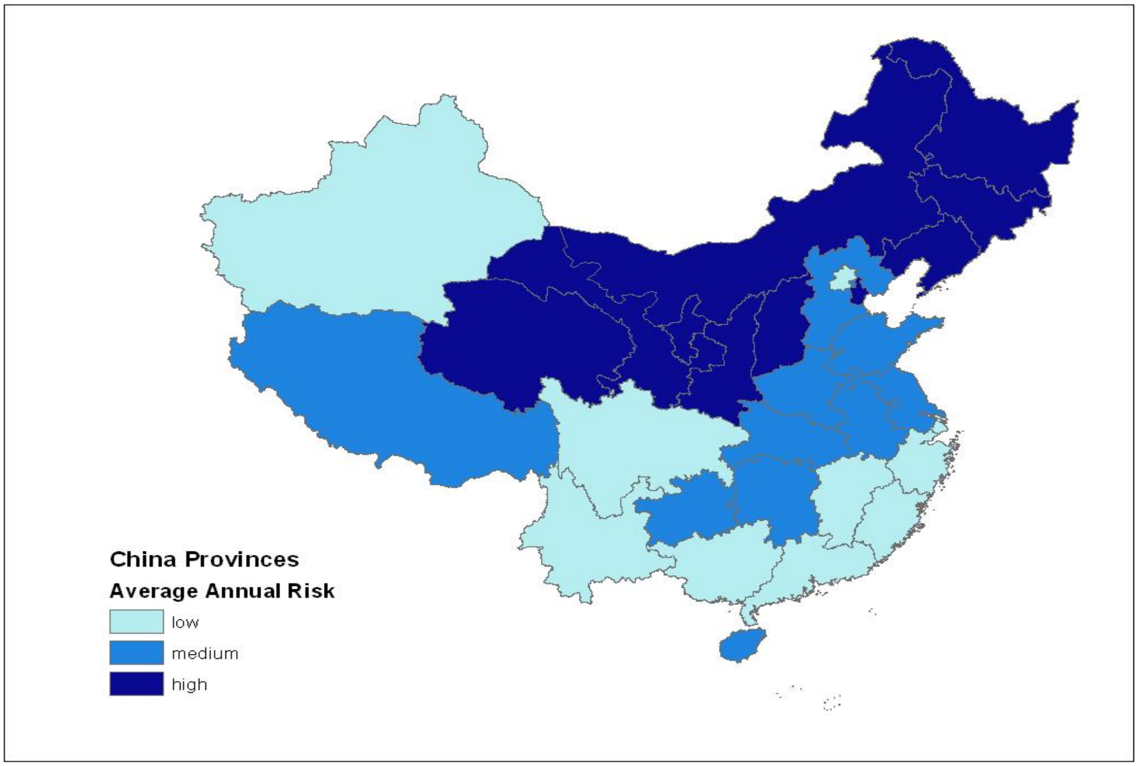
	Banana	Rubber	All Crops
Average Annual Loss	10%	9%	7%
Probable Maximum Loss (10 year return)	23%	18%	11%
Probable Maximum Loss (20 year return)	29%	28%	14%
Probable Maximum Loss (100 year return)	n/a	n/a	n/a

Estimates for specific crops are based on township and team yield data; estimates for all crops are based on cause of loss data

Risk assessment profile of all provinces

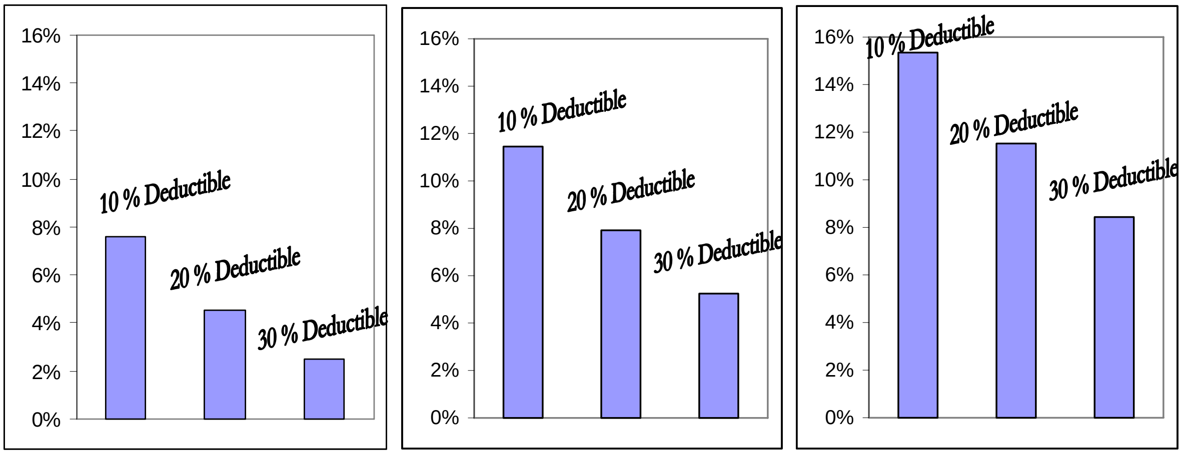
2.44. The cause of loss data are used for all provinces to provide a more complete picture of the great diversity of risks across China. First, the average annual losses are mapped in Figure 2.1. This demonstrates that the north central and north eastern provinces are the most risky in China. The southern provinces appear to be the least risky and the east central provinces are in the mid-risk range. To provide some perspective of how these average annual losses may vary across regions and for different levels of deductible, Figure 2.2 is presented. The 10 percent deductible is presented only for purposes of comparison. Under no circumstances should one sell multiple peril crop insurance with only a 10 percent deductible.

Figure 2.1: Mapping of Expected Annual Average Loss for Multiple Peril Crop Insurance



Note: Mainland China.

Figure 2.2: Differential average annual losses, with respect to relative risk and deductibles



Panel 1: Low Risk Areas *Panel 2: Medium Risk Areas* *Panel 3: High Risk Areas*

2.45. The average annual loss values are only the beginning point for developing premium rates. Many other cost aspects must also be considered. Thus, even for the low risk areas, the beginning point for developing premium rates would be close to 8 percent with a 10 percent deductible. The fully loaded rate would be much greater. Even with a 30 percent deductible, the average annual loss estimates for the high risk areas is extremely high (about 8 percent).

2.46. Table 2.5 presents more detail about the share of cause of loss for the different provinces. The table also arrays the provinces by their share of total crop value in China in 2004. For example, Shandong has over 10 percent of the total crop value in 2004 (RMB185 billion). As Figure 2.1 demonstrates, the relative risk is quite variable across China. The underlying values in the map range from an annual average loss estimate of over 14 percent to as low as about 2 percent. These estimates provide an opportunity to develop a hypothetical national program. To provide a perspective on the magnitude of the numbers, assume that multiple peril crop insurance was sold throughout China with purchases totaling 10 percent of all crop value. China's crop value in 2004 was RMB1,780 billion (US$223 billion). At participation rates of 10 percent, the sum insured would be RMB178 billion (US$22 billion). Given rudimentary estimates of premium rates that may be charged for a properly designed MPCI program, the premium generated from RMB178 billion of sum insured would be approximately RMB13.7 billion (using a weighted average premium rate of 7.3 percent).

2.47. To supplement the information in Table 2.5, maps of the various cause of loss are presented in Annex 3. These data are considered generally acceptable with the exception of typhoons. Again, only a few years of typhoon data were available. To give some national perspective, from 1982-2004, 24 percent of all hectares sown faced some losses where there were at least 10 percent losses or more. Nearly 17 percent of all hectares were impacted at this level by drought, 8 percent by floods, 3 percent by hail, and nearly 2 percent by freeze. Typhoon data were less reliable and are not reported in Table 2.5. When taking the weighted average of the cause of loss and the crop value matrix, drought accounts for 52 percent of all losses, flood 28 percent, hail 10 percent, and frost/freeze about 6 percent. The residual (4 percent) is for the typhoon data that are available. In reality, this value is likely greater than 4 percent.

Table 2.5: Market Share of Crop Value in China with Share of Cause of Loss

	Market	Percent of Average Annual Loss by Cause of Loss			
Province	**Share**	**Drought**	**Floods**	**Hail**	**Freeze**
Shandong	10.4%	71%	15%	11%	3%
Henan	8.8%	63%	24%	9%	3%
Jiangsu	6.9%	36%	40%	12%	10%
Hebei	6.3%	72%	10%	16%	2%
Sichuan	5.4%	52%	32%	11%	4%
Guangdong	5.3%	33%	42%	10%	9%
Hubei	5.1%	43%	43%	7%	6%
Hunan	4.8%	45%	44%	6%	4%
Anhui	4.6%	41%	45%	6%	7%
Guangxi	3.4%	53%	32%	7%	5%
Heilongjiang	3.4%	53%	34%	6%	6%
Liaoning	3.4%	68%	22%	7%	2%
Zhejiang	3.3%	26%	47%	11%	6%
Fujian	2.9%	32%	44%	7%	10%
Yunnan	2.9%	50%	24%	12%	13%
Xinjiang	2.8%	49%	12%	25%	13%
Jiangxi	2.7%	36%	49%	7%	6%
Jilin	2.7%	59%	28%	9%	4%
Shaanxi	2.3%	71%	17%	7%	4%
Inner Mongolia	2.3%	74%	12%	9%	5%
Gansu	1.8%	72%	10%	11%	7%
Guizhou	1.8%	51%	25%	17%	6%
Shanxi	1.6%	80%	7%	8%	4%
Hainan	0.9%	37%	37%	5%	7%
Shanghai	0.6%	12%	47%	12%	25%
Tianjin	0.5%	72%	10%	17%	0%
Beijing	0.5%	69%	8%	21%	1%
Ningxia	0.4%	71%	8%	11%	10%
Qinghai	0.2%	63%	8%	23%	5%
Tibet	0.1%	58%	20%	9%	11%

Source: author's analysis of cause of loss data.

Portfolio Analysis

2.48. To further illustrate some important concepts of risk assessment and insurability, a hypothetical insurance company is assumed for each province. The insurance company starts with a very limited market and then expands to a well-diversified market within the province. Eventually, the case of an insurance company having a diversified market across multiple provinces is considered. A more detailed discussion of the findings can be found in Annex 2 and Annex 3.

2.49. For simplicity, it is assumed that the insurance company can operate at zero profits over the long term and that there are no other costs associated with selling these services. These assumptions simplify the analysis and allow for a conservative estimate of loss ratios. Thus, given a time series of annual insurance losses, one can estimate a time series of pure loss ratios as:

$$Loss\ Ratio_t = Insured\ Loss_t \Big/ \left(\frac{1}{T} \sum_{s=1}^{T} Insured\ Loss_s \right)$$

where t indicates a given year and T is the number of years available. With the time series of loss ratios, it is now possible to determine the probability of various extreme loss ratios. One can also blend any number of crops and regions to generate loss ratios for various insurance portfolios. Within the portfolios the correlations in the empirical data are maintained. Thus, adding new crops or regions to an existing portfolio will reduce the risk and probability of ruin if yield losses for the new crop or region are not highly correlated with those of the existing portfolio. Results are presented using loss ratio PMLs.

2.50. The loss ratios presented here are calculated assuming that crop insurance was purchased by each township or team (county and district for Shanghai) in the pilot regions with no deductible. It is important to note it is not suggested that crop insurance policies be sold with no deductible. This assumption is used because the available yield data are not at the level of the farm household but rather are aggregated at the township or team level. Using aggregate data reduces the yield variability relative to what would be experienced at the level of the farm household. Based on international experience, the loss ratios from assuming no deductible with aggregate yield data are expected be roughly equivalent to loss ratios from using standard 20-30 percent deductibles with farm household level yield data.

Heilongjiang

2.51. Table 2.6 presents insurance loss ratio exposure for a hypothetical insurance company in Heilongjiang. Notice that the more risky crops (in terms of Average Annual Loss, AAL) do not necessarily generate the largest loss ratio PMLs. For example, while yield loss PMLs are larger for rice than soybeans, the opposite is true for loss ratio PMLs. Large rice yield losses are fairly common. Thus, the average annual loss is quite high. For soybeans, large yield losses are less common than for rice, thus, the average annual loss for soybeans is much lower. But when large soybean yield losses do occur, they generate large loss ratios because the premium rate (estimated as the weighted average annual loss) is relatively low.

2.52. Loss ratio PMLs are valuable for insurance companies because they demonstrate the insurer's exposure to extreme loss events. To maintain financial solvency over the long-term, insurers should have reinsurance and/or sufficient financial reserves to pay indemnities from at least a 1 in 100 year loss event. These findings suggest that if the hypothetical insurance company were insuring only soybeans, they should have the capacity to pay indemnities that are in excess of 4 times the amount of premium collected. If the insurance company were insuring only maize, they should have the capacity to pay indemnities that are in excess of 5 times the amount of premium collected.

2.53. Crop insurance companies typically do not insure only one crop. Insuring multiple crops provides for diversification since underwriting losses for one crop might be offset by underwriting gains for another crop. The last column in Table 2.6 shows loss ratio PMLs for a portfolio that consists of soybean, maize, and rice insurance policies. In these six counties/farms (and considering only these three crops) soybeans account for 45% of the expected value of production, maize is 39%, and rice is 16%. In total for the province (and again considering only these three crops), rice is approximately 45% of the expected value of production, soybeans are 37%, and maize is 18%. Thus, relative to the province as a whole, the six pilot counties/farms have more soybeans and maize but less rice. Even, so the portfolio clearly demonstrates how diversifying across crops reduces loss ratio PMLs.

Table 2.6: Heilongjiang township/team level Insurance Loss Ratio Exposure

	Soybean	Maize	Rice	Portfolio
Probable Maximum Loss (10 year return)	2.7	2.6	2.4	2.2
Probable Maximum Loss (20 year return)	3.1	3.7	2.8	2.6
Probable Maximum Loss (100 year return)	3.7	4.8	3.5	3.4

2.54. When the cause of loss data are used to develop a perfectly diversified portfolio for our hypothetical insurance company, the PML for the 100 year return value declines as expected – from 3.4 to 2.2. The 10 year return goes to 1.5 as compared to 2.2 in Table 2.6. It is unlikely that any insurance company would have such a perfectly balanced portfolio. Thus, these values represent a lower bound on PML for even the most successful uptake of insurance across crops throughout Heilongjiang.

Xinjiang

2.55. Table 2.7 presents insurance loss ratio exposure for a hypothetical Xinjiang insurance company with loss ratios calculated as described earlier. In these five pilot counties/farms cotton accounts for 84% of the expected value of production, wheat is 9% and maize is 7%. In total for the province, cotton accounts for 64% of the expected value of production, wheat is 23% and maize is 13%. Thus relative to the province as a whole, there is more cotton and less wheat and maize in the five pilot counties/farms. Even so, the insurance portfolio that includes some wheat and maize reduces the loss ratio PMLs relative to insuring cotton alone. Despite the fact that cotton accounts for 84% of the portfolio, the 1 in 100 year PML for the portfolio is 3.6 relative to 4.0 for cotton alone.

Table 2.7: Xinjiang Insurance township/team level Loss Ratio Exposure

	Wheat	Maize	Cotton	Portfolio
Probable Maximum Loss (10 year return)	2.0	2.2	3.0	2.7
Probable Maximum Loss (20 year return)	2.3	2.8	3.3	3.0
Probable Maximum Loss (100 year return)	2.7	3.7	4.0	3.6

2.56. When the cause of loss data are used to create a perfectly diversified portfolio for the hypothetical insurance company, the PML for the 100 year return value declines from 3.6 in Table 2.7 to 2.2. The 10 year return loss ratio goes from 2.7 to 1.7. Although it is unlikely that any insurance company would have such a perfectly balanced portfolio, these values represent a lower bound for even the most aggressive and successful marketing campaign across crops throughout Xinjiang.

Shanghai

2.57. Table 2.8 presents insurance loss ratio exposure for a hypothetical Shanghai insurance company with loss ratios calculated as described earlier. Since grain is an aggregate category that contains different crops, it was not possible to calculate a portfolio based on value of production. The catastrophic nature of typhoon risk is revealed in these loss ratio PMLs. The Shanghai yield loss PMLs are roughly similar to those for Heilongjiang. However, the loss ratio PMLs for Shanghai are significantly higher – especially for extreme 1 in 100 year events. These data suggest that, due to the catastrophic nature of typhoon risk, crop insurers in Shanghai should have the capacity to pay indemnities of between 6 and 9 times the amount of premiums collected.

Table 2.8: Shanghai township/team level Insurance Loss Ratio Exposure

	Grain	Rapeseed
Probable Maximum Loss (10 year return)	3.5	2.9
Probable Maximum Loss (20 year return)	6.9	4.4
Probable Maximum Loss (100 year return)	8.7	5.7

Hainan

2.58. Table 2.9 presents insurance loss ratio exposure for a hypothetical Hainan insurance company. The loss ratio PMLs for bananas are larger than those for rubber. The portfolio is weighted to reflect the relative value of production for these two crops in Hainan (74% rubber and 26% banana). Despite the fact that rubber dominates the portfolio and banana and rubber losses are highly correlated at 74%, the portfolio generates significant reduction in loss ratio exposure – especially for 1 in 100 year loss events.

Table 2.9 Hainan Insurance Loss Ratio Exposure

	Banana	Rubber	Portfolio
Probable Maximum Loss (10 year return)	2.8	1.8	2.0
Probable Maximum Loss (20 year return)	3.5	2.9	2.2
Probable Maximum Loss (100 year return)	4.5	3.9	2.6

2.59. When the cause of loss data are used to develop a new portfolio for our hypothetical insurance company, the PML for the 100 year return value declines as expected – from 2.6 in Table 2.9 to 2.0. This value (2.0) is very likely lower than the actual number given that the typhoon risks are not adequately reflected in the cause of loss data.

Pooling benefits among provinces

2.60. To what extent risk across China can be pooled to improve the position of a hypothetical insurance company? This question is investigated in a model where three of the four provinces are pooled into a single insurance company: Heilongjiang, Xinjiang and Hainan. Because of the limited amount of crop production, Shanghai is not included. The annual risk measures for the cause of loss data are used to create the insurance portfolio. A key insight into the potential pooling effect comes from examining the correlation of the annual risk measures from 1980-2004 for the four provinces that comprise this study. For example, the correlation between Hainan, Heilongjiang, and Xinjiang is quite low. This is to be expected as totally different weather events impact these three provinces. By using the 2004 crop values of these three provinces, a portfolio can be developed that reflects the relative risk, the relative weights of the crop values and the correlation.

2.61. The affect of pooling these three provinces is presented in Table 2.10 The pooled portfolio is obviously less risky. The PML for the 100 year return period is 2.0 compared to 2.3 for the least risky province in the set. When pooling across these provinces, the risk for Xinjiang and Hainan are reduced more than for Heilongjiang. In part this is because Heilongjiang accounts for the largest percentage of the crop value (44 percent of the total among these four provinces).

Table 2.10: Province Wide Insurance Loss Ratio Exposure from Cause of Loss Data

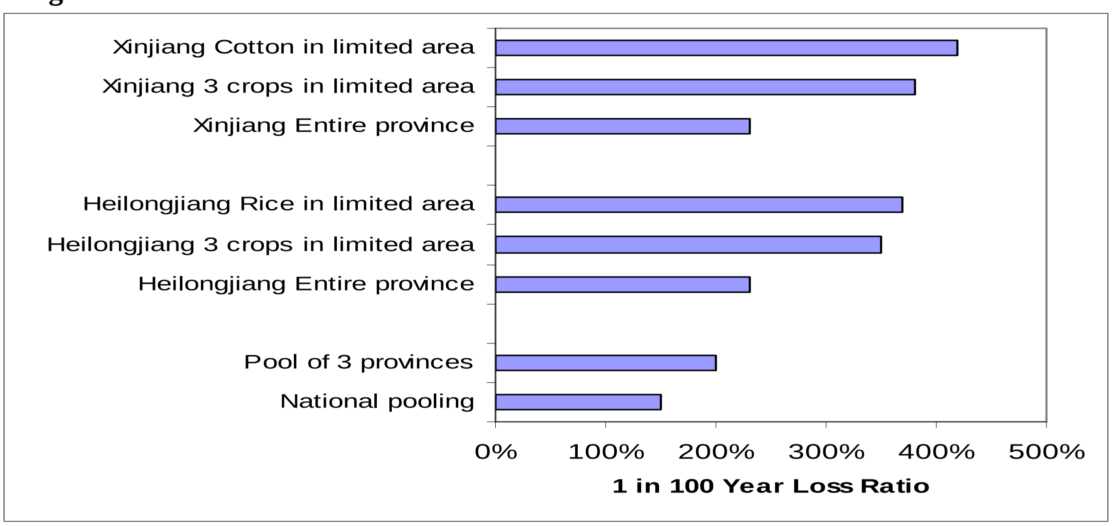
	Xinjiang	Heilongjiang	Hainan	Pooled
Probable Maximum Loss (10 year return)	1.8	1.5	1.7	1.4
Probable Maximum Loss (20 year return)	2.0	1.7	2.0	1.6
Probable Maximum Loss (100 year return)	2.3	2.3	2.5	2.0

Conclusion

2.62. Results in this section support concerns regarding the risk exposure of new insurance companies. The concept of probable maximum loss provides a basis for comparison and understanding how diversification lowers risk exposure. For example, companies having limited markets within a province can have a loss ratio PML in excess of 3 or 4. This implies that indemnities can exceed 3 or 4 times the premium in bad years. This is likely the position of many of the emerging crop insurance companies in China. As companies diversify across crops and spread out over the province the loss exposure can be reduced by 50 percent or more. Finally, the analysis demonstrates that having a crop insurance company with business in multiple provinces provides even more diversification opportunities. More fundamentally, this type of analysis demonstrates that national pooling of risks can have benefits.

2.63. Figure 2.3 provides a summary of the 1 in 100 year PMLs for various portfolios based on the findings presented in this section. As expected, PMLs decline as an insurer moves from a limited set of offerings to a more diversified set of offerings even if the diversified set is still restricted to the province. If the insurer could create a portfolio that includes Heilongjiang, Xinjiang, and Hainan, the PMLs would decline further. The lowest PMLs are achieved with a national pool. The relative position of the risk measures and the PMLs are likely good indicators of the risk profile for China crop agriculture. There are significant differences in a portfolio of three crops in select areas versus something that may represent a well-diversified portfolio of crops that are spread equally across the province. This type of portfolio would be extremely difficult to obtain as purchases of crop insurance are rarely evenly distributed. Placing the three provinces into a portfolio has some obvious advantages as does a national pool of risk.

Figure 2.3: Relative Position of Various Insurance Portfolios for the 1 in 100 Year PML



2.64. The risk assessment also provides insights into the potential size and risk exposure of a national agricultural insurance program in China. This analysis will be extended in Chapter 4 as policy options are considered. The major point to emphasize is that even with relatively modest participation levels, the sum insured can be very high. At a 10 percent participation level, sum insured can exceed RMB178 billion (US$22.2 billion). The national average premium rate for a multiple peril crop insurance program would likely approach 8 percent. Thus, premiums of RMB14 billion (US$1.8 billion) may be possible once participation at 10 percent is achieved. However, the cost of such expansion must be carefully considered. The risk exposure of this type of expansion is also critical for policy makers.

2.65. Some important themes emerge from the risk assessment: If an insurer tries to develop MPCI products, the risks are quite high and premium rates must reflect the differences in risk by crop and region (price discrimination); Risk exposure for small and geographically concentrated crop insurance companies can be high and risk exposure for even a well-diversified book of crop insurance business within a single province is still relatively high; Pooling risk across provinces or across the nation can reduce risk exposure significantly.

Technical and Operational Assessment

Agricultural Insurance Market

2.66. Under the 11th FYP the Chinese Government is promoting a system of decentralized agricultural insurance development in each province, usually through a single insurance company[6]. The proliferation of different institutional and structural models in each province (e.g., Sunlight Mutual Insurance Company in Heilongjiang, the new 2006 PICC-led commercial company Coinsurance Pools in Zhejiang Province, the proposed PICC-led pool for crops and livestock in Hainan) suggests that future government policy and support to agricultural insurance should continue to be tailored to individual provinces.

2.67. In several instances the provincial governments through their Finance Bureaus are providing financial support to the agricultural insurers in the form of up-front premium subsidies and/or catastrophe reinsurance protection (see Table 2.11). Agricultural crop and livestock premium subsidies are very new in China and with the exception of Shanghai where the government has offered premium subsidies on mandatory epidemic disease cover since the mid-1990's, the premium subsidies now being offered by insurers have only been introduced in the past 2 years. Policy makers justify the provision of premium subsidies as a means of promoting the adoption of agricultural insurance: subsidies enable small farmers to afford cover at the high premium rates which are charged for MPCI of 7.5% to 10% for crops; from an insurer's viewpoint, subsidies are important to permit them to charge actuarially sound rates. Another significant development in China since 2006 has been local government's decision in Zhejiang and Hainan Provinces to budget for and provide formal catastrophe reinsurance protection as opposed to the more ad hoc disaster compensation funding provisions which have operated in most other provinces in the past.

2.68. National and provincial governments need to study carefully the financial implications of premium subsidy support as their provincial agricultural insurance programs expand, to avoid the huge economic costs of the highly subsidized mature agricultural insurance programs in countries such as the USA, Canada, Spain, Mexico and India (see Annex 1).

[6] PICC which traditionally underwrote crop and livestock insurance in most provinces had by 2005 significantly reduced its operations due to a combination of poor results and changed priorities under its public listing. The only other company which is currently underwriting in several provinces in China United Property Insurance Company (CUPIC), with head office in Xinjiang Province.

Table 2.11: Government financial support to agricultural Insurance in China, 2006

Province/ Municipality	Insurance Company	Premium Subsidies	Premium Subsidy level	Government Disaster Compensation	Formal Government Reinsurance for Insurers
Heilongjiang	Sunlight	Yes	35%	Yes	Yes
Xinjiang	China United	No	none	No	No
Xinjiang	PICC	No	none	No	No
Jiangsu	China United	Yes	50%	Unknown	No
Shanghai	Anxin	Yes	40% - 50%	Yes	Yes
Jilin	An Hua	Yes	33% - 100%	Unknown	Proposed for 2006
Zhejiang	PICC Pool	Yes	35% - 50%	No	Yes
Hainan	PICC Pool	Yes	20% - 30%	No	Yes
Jiangsu	PICC	Yes	20% - 50%	Unknown	Unknown

Insurance products

2.69. A wide range of crop insurance products and policies is offered by the insurers in each province, which mainly reflects the geographical variation in catastrophe risk exposures.

2.70. The most common form of crop insurance in China is Multiple Peril Crop Insurance (MPCI) which acts as a loss of yield guarantee against all climatic perils including the catastrophe perils of drought and flood and uncontrollable pests and diseases. Comprehensive MPCI crop insurance including drought is extensively underwritten by SAIC in Heilongjiang Province and by CUPIC in Xinjiang Province. Other companies which underwrite MPCI loss of yield policies include PICC in Xinjiang Province and Anxin in Shanghai Province, but in these cases, the companies specifically exclude drought.

2.71. In Hainan Province, typhoon is the key catastrophe exposure and PICC has traditionally offered coverage against the single peril of wind under a conventional damage-based insurance and indemnity policy. Anxin and PICC also offer named-peril damage-based indemnity policies in some crops and specialist Greenhouse Insurance Cover. Finally several companies offer basic fire cover in forestry (standing timber).

2.72. Some drawbacks of the MPCI programs currently underwritten in China include:

- Insured yields are set on the basis of township-level average yields or in the reclamation-areas, regimental farm-level average yields, while losses are adjusted and indemnified on the basis of actual yield at the individual farmer or field level. This leads to potential adverse selection problems.

- On most of the MPCI policies reviewed a simple sum insured is established for each crop on the basis of the input costs of production and this is offered to each grower. As such an insured yield is not established for each insured farmer at the time of policy inception. In the event of loss, yield shortfall or loss is usually calculated by comparing the township/regimental farm 3-5 years average yield with the actual yield for the affected farmers' field and then converting this into a percentage yield loss. A percentage deductible is then applied to the calculated percentage yield loss and the net loss is applied to the sum insured to calculate the value of the indemnity due to the insured;

- In most cases a 20% yield deductible is applied to losses. However, CUPIC uses a 20% qualifying franchise and if this is exceeded, losses are indemnified from the ground-up in full. Qualifying franchises may not be appropriate on MPCI yield shortfall policies. Furthermore there may be a need to introduce much higher deductible and rate options in areas where yields exhibit high variability. For example in the USA, for individual grower MPCI, deductible levels vary from a minimum of 20% (80% coverage level) up to a maximum of 50% (50% coverage levels);

- Crop sums insured are set at extremely low levels, often representing no more than 30% to 40% of the costs of production. This is due to the following constraints; low profitability of agriculture and thus farmer's resistance to paying higher premiums for a higher sum insured, and equally important, insurers concern over the catastrophe potential of crop insurance and lack of willingness to offer higher levels of indemnity for crops. This practice is termed "low sum insured, low premium and low indemnity" in China.

2.73. Livestock insurance is a relatively minor class generating about RMB55 million premiums (US$6.9 million) or less than 8% of total 2005 agricultural insurance premiums of RMB729 million (US$91.1 million). Several companies including Anxin, Shanghai, CUPIC, Xinjiang, SAIC, Heilongjiang, and PICC Xinjiang are underwriting individual animal livestock policies for cattle, pigs, sheep and goats. Anxin also offers poultry and aquaculture insurance. Anxin is the only company which currently underwrites livestock on a large scale and in this case under an agreement with the Shanghai Municipality government it is offering compulsory epidemic disease cover and government slaughter for all commercial cattle, pig and poultry farms in the municipality[7]. Anxin's average rates for epidemic disease cover are about 1% for poultry and pigs and 2% for dairy cattle. Although Anxin reports an average loss ratio of only 54% over the past 6 years, this result is a reflection of the fact that there have been no major disease outbreaks during this period and the catastrophe loading for epidemic disease outbreak is inadequate. The rates may not be, therefore, technically sustainable.[8] The Anxin livestock program is not formally reinsured, but Anxin has an agreement with the Municipality government to compensate catastrophe losses arising out of any epidemic disease outbreak in livestock (See Box 2.2). CUPIC also underwrites livestock epidemic diseases and government slaughter order, but in this case charges much higher average rates of about 6%.

2.74. It appears that neither Anxin nor CUPIC have conducted any formal modeling of their epidemic disease exposures. In Shanghai, Anxin currently writes a livestock portfolio of about RMB3.1 billion (US$388 million) and in the event of a major epidemic disease, international experience from neighboring countries such as Malaysia and Thailand has shown that it is very possible to incur huge financial losses. While it is accepted that livestock sanitation and vaccination standards are extremely high in Shanghai Municipality it is not inconceivable that under an epidemic disease outbreak Anxin could lose between 10% and 20% of their insured livestock through enforced culling. This would represent a major loss of between US$ 39-78 million. It is not known how readily the Municipality government could compensate Anxin for such high losses.

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[7] For Government Slaughter Order, Anxin only indemnifies losses which are not otherwise compensated by government. This may take the form of top-up compensation for the difference between the market value of the animal and the government payment.

[8] Anxin are currently reviewing their livestock products and may amend them to bring them into line with international standards.

Box 2.2: Economic Implications of Epidemic Disease in Livestock

CHINA - TAIWAN 1997. Foot and Mouth disease outbreak in pigs. Failure to identify the initial outbreak, intentional contamination of herds by pig owners and absence of a proper vaccination program led to the national herd being infected and culling (obligatory government slaughter) of over 3.8 million head of pigs in an attempt to stamp out the disease. The estimated cost to this outbreak was US$ 6.9 billion.

MALAYSIA 1999. The Malaysian swine (pig) industry was devastated by a previously unknown and highly contagious virus named Nipah Virus. In order to stamp out the disease, culling was ordered by government on a total of 829 farms and a total of 1.07 million pigs were eradicated or 45% of the national swine herd. The direct losses to the Malaysian swine industry were estimated at RM 1.1 billion (US$ 300 million) and upwards of 1 million upstream and downstream jobs in the industry were lost or effected.

Risk assessment and ratemaking

2.75. While it was not possible to conduct a detailed review of the risk analysis and rating methodologies adopted by the insurance companies, it appears that most companies are currently offering single rates for each crop type with little or no differentiation according to regional risk exposure and results. Average 2005 rates are reported in Table 2.12, and are reviewed in detail in the individual company reports. SAIC and CUPIC are charging high average rates for their crop MPCI programs of about 8%. The other companies which do not insure drought charged much lower average rates of between 2.1% Anxin and 4.2% PICC Hainan on their crop programs in 2005. For livestock, PICC Xinjiang and SAIC charged average rates of between 3.6% and 3.9% for individual animal mortality cover and which specifically excludes diseases and government slaughter. Conversely, in 2005, Anxin charged an average rate of 1.1% on its livestock epidemic disease policy.

Table 2.12: Average Premium Rates 2005

Average Commercial Rates charged by selected Agricultural Insurers in 2005

Province	Heilongjiang	Xinjiang	Xinjiang	Shanghai	Hainan
Company	SAIC	CUPIC	PICC	Anxin	PICC
Average rates crops	7.9%	8.1%	3.4%	2.1%	4.2%
Average Rates Livestock	3.9%	5.7%	3.6%	1.1%	n.a.
Overall Average Rate	7.9%	7.8%	3.4%	1.6%	4.2%

Source: Information provided by insurance companies.
Note: rates are prior to any premium subsidy available to the farmer.

2.76. While some companies are adjusting their rates on an actuarial basis, in general rates are inadequate to cover the long-term average claims and to generate adequate levels of return on equity. There is also a need for a formal review of the terms and conditions of the insurance contracts, such as deductible level and coinsurance levels.[9]

2.77. Few companies are currently conducting modeling of their catastrophe exposures in order to build a suitable loading into their original gross premium rates and to assist in decisions over their risk retention and reinsurance requirements. There is a major need for the insurers to address this issue.

[9] For example, in the damage-based policies, coinsurances on the amount of loss should be replaced by conventional deductibles.

Distribution channels

2.78. The distribution and marketing channels for agricultural insurance vary widely between each province. In Heilongjiang and Xinjiang reclamation areas, crop insurance is provided respectively by SAIC and CUPIC on an automatic (compulsory) basis for all the farms in the reclamation areas. In Hainan PICC has traditionally marketed crop insurance cover only to large state farms. Elsewhere PICC has marketed cover to the local township governments as opposed to individual farm households. In Shanghai, Anxin has an agreement with local government to provide subsidized insurance to all rice growers and also to all commercial cattle, pig and poultry enterprises. The common feature of all these programs in the past includes (i) most sales have been made to collective organizations as opposed to individual households, (ii) the local entity has been responsible for providing insurance schedules to the insurer along with (iii) the premium due for all farmers in the command area.

2.79. The challenge for the development of agriculture insurance for small farmers will be to scale up the distribution of agricultural insurance at reasonable cost, and on a voluntary basis as required by law, to very large numbers of individual household farms. Servicing agricultural insurance for small farmers has always been a challenge worldwide, as the administrative costs in traditional MPCI programs (including underwriting costs, monitoring, loss adjustment costs, etc.) represent a fixed cost that can be disproportionate compared to the low sums insured of small farmers. Innovative products, such as index-based insurance products, and alternative delivery channels (e.g. through farmers organizations, rural banks input providers) may reduce the operating costs and thus make agricultural insurance affordable and effective to small farmers (see Chapter 3).

Loss assessment

2.80. Given the preponderance of MPCI cover in China, most loss assessment relies on yield-based loss assessment at the time of crop maturity. Loss assessment is conducted at the individual farmer or field level. Loss assessment procedures vary according to whether the loss is a total loss or partial loss:

- Total losses generally require a single visit to verify the cause of loss and to measure the damaged area. The standard procedure is to indemnify total losses against a pre-agreed indemnity scale which relates to the growth stage and the actual costs, or a proportion of the actual costs, invested in the crop at the time of loss.

- Partial losses generally require two separate loss assessment visits,[10] one at the time of inspect and verify the insured cause(s) of loss and then a second visit at crop maturity in order to conduct in field sample measurement of the actual yield in the effected plot or field and to compare this with the Insured Yield to estimate the percentage yield loss or shortfall. Individual farmer and field assessment is very time consuming.

2.81. Currently yield-based loss assessment is provided at highly subsidized cost either by the farmers and the management of the reclamation groups, or by the agricultural technicians from the county/township agricultural services centers. SAIC and CUPIC staff reported that they actively participated in loss assessment, but in the cases of Anxin and PICC their function appears

[10] In Heilongjiang, loss assessment is extremely intensive and involves a "4-tier" system under which farmers and local staff at the local insurance cooperative branch level conduct the original assessment. The loss is then inspected and audited separately by staff from the Insurance Cooperative, then the Branch Office and finally SAIC's HQ adjuster signs-off on the claim before it can be settled.

to be restricted to spot checks and auditing of the assessments provided to them by local authorities.

Agricultural insurance operating costs

2.82. Individual farmer and livestock producer insurance is often expensive to administer and this problem applies especially to crop MPCI insurance with its dependence on in-field yield based loss assessment.

2.83. Table 2.13 provides a summary for selected companies of their 2005 operating expenses expressed as a percentage of total agricultural insurance premiums. There are two distinct expenditure patterns. SAIC and CUPIC write the largest agricultural insurance portfolios with premiums in excess of RMB200 million (US$25 million) and they enjoy economies of scale. The two companies work very closely with the management and staff of the HRG and XPCC farms whom mainly provide their field inspection and loss assessment services free of charge. SAIC and HRG have total operating costs of less than 20% of premium of which between 10% to 12% is allocated to internal operating expenses and 5% to 7% is allocated to external costs including risk prevention measures and handling charges.[11]

2.84. Conversely, the other commercial companies, including PICC, Anxin and Anhua, face much higher operating expenses which average between 25% to 30% of premium. Of this, an average of about 20% represents their internal operating costs. Anhua is a start-up operation with relatively small premium volume and currently high overheads. PICC and Anxin, however, are well established companies which are incurring extremely high operating costs in spite of receiving major assistance from the village townships and agricultural service centers in administering their programs, in premium collection and in loss assessment.

Table 2.13: Agricultural Insurance Company Operating Expenses 2005 (% of Premium)

Province	Heilongjiang	Xinjiang	Xinjiang	Shanghai	Hainan	Jilin
Company	SAIC	CUPIC	PICC	Anxin	PICC	Anhua
Total 2005 Premium (RMB Million)	219.8	248.4	30.9	74.8	3.1	27.4
Total Operating Expenses	15%	19%	28%	28%	36%	30%

Source: Individual Company Reports

Profitability

2.85. Table 2.14 reports the long-term average loss ratios at completion of the 2005 season, for the five companies. With the high levels of operating expenses, only one company, CUPIC has consistently generated profits over time. For most of the companies, livestock results are better than for crops, which have historically been under-rated and / or where the deductibles have been set too low.

2.86. In general terms, and based on international norms, these companies should set target loss ratios of no more than 60% to 65%, particularly if in future they intend to seek proportional (quota share) reinsurance support from international reinsurers.

Table 2.14: Crop and Livestock Insurance Results (Long-term Average Loss Ratio) at 2005

[11] The risk prevention measures centre on anti-hail cloud-seeding programs using radar controlled cannons and rockets. SAIC and CUPIC cover the operating costs of these programs.

Province	Heilongjiang	Xinjiang	Xinjiang	Shanghai	Hainan
Company	SAIC	CUPIC	PICC	Anxin	PICC
No years experience	13	20	10	6	10
Crop loss Ratio	90%	73%	70%	86%	77%
Livestock Loss ratio	61%	63%	67%	54%	n.a.
Overall Loss Ratio	90%	73%	70%	74%	77%

Note: Individual Company Reports

Agricultural Reinsurance Market

2.87. Prior to 2002, the Chinese reinsurance market was closed to foreign competition and the market was controlled by the state-owned China Reinsurance Company (ChinaRe). ChinaRe was founded in March 1999 from the former PICCRe. Until 2002 ChinaRe enjoyed a monopoly of the domestic reinsurance market and it prospered from the 20% compulsory cession of direct insurer's premiums which in 2001 accounted for approximately 94% of ChinaRe's premium income. Post WTO membership, the 20% compulsory cession requirement has been gradually phased out reducing to 15% in 2003, 10% in 2004, 5% in 2005 and final abolishment in 2006. Local insurance companies are now free to cede business to ChinaRe as they wish. In 2004, ChinaRe's reinsurance premium income amounted to RMB20.0 billion (US$2.5 billion), of which 29.9% was comprised of commercial reinsurance premiums. In 2004 total assets amounted to RMB 26.4 billion (US$3.3 billion) or an increase of 7.5% on 2003.[12]

2.88. SwissRe and MunichRe were given approval to apply for a full branch license in July 2002 thus ending ChinaRe's monopoly and since 2003 both of these international reinsurers have been granted full national reinsurance branch licenses permitting them to write reinsurance business throughout China. At end 2005 there were six locally licensed professional reinsurers in China: ChinaRe, PICC Property & casualty Re, China Life Re, MunichRe, SwissRe and General CologneRe.[13]

2.89. The compulsory cessions to ChinaRe were phased out in December 2005 and replaced by a series of new regulations beginning 1st December 2005 which require that any direct insurance company wishing to place facultative or treaty reinsurances must first offer at least 50% of the reinsurance to at least two of the locally licensed reinsurers[14] (as listed above). Any balance on the company's retention and the local reinsurance acceptance can be reinsured to reinsurers outside of China.

Chinese agricultural reinsurance arrangements prior to 2004

2.90. During the 1980's and 1990's PICC, SAIC, CUPIC and Anxin implemented their agricultural insurance programs without any formal reinsurance protection. In the case of PICC, agricultural underwriting losses incurred at a provincial level were absorbed by the Property and Casualty division under which agriculture falls.[15]

[12] China Re Annual Report 2004
[13] Other reinsurers who have sought branch approval for branch licenses in Shanghai or Beijing include Transatlantic Re, Employers Re and Lloyd's.
[14] Willis November 2005 – Issue 10, International Alert Reinsurance Rules Tighten in China, November
[15] According to PICC Xinjiang, PICC Group also operates an internal reinsurance program for losses arising out of a single event which exceeded RMB 10 million. It is understood that this cover is applicable to Property & Casualty business.

2.91. In Heilongjiang Province, in the years between 1993 and 2004 prior to the formation of SAIC, there was no formal reinsurance program and in years of catastrophe losses which exceeded the mutual's premiums/claims reserves the following mechanisms were applied: (i) the mutual adjusted down the claims for all farmers on a pro rata basis and/or (ii) provincial government stepped in with disaster relief payments for the excess losses.[16]

2.92. In Xinjiang, CUPIC has operated for 20 years without external financial and reinsurance support. The company's internal risk management measures applicable to its agricultural insurance business include:

- in the event of severe disasters, if the premium of the year is insufficient to cover claims, it will be supplemented by risk funds accumulated from past years;
- If this is still insufficient, 30% of CUPIC's profits from commercial P&C business in that year can be allocated to pay for the agricultural insurance losses;
- Finally, if this is still insufficient, funds will be financed by the XPCC farms and regiments to aid the affected farmers. CUPIC has established an agricultural risk fund with XPCC where the premium shall be reserved at the ratio of 3:7 between XPCC and the company.

2.93. According to CUPIC, during their 20 years of operation, underwriting losses (claims in excess of premiums) were experienced in 4 years, 1986, 1989, 1999 and 2001 and underwriting profits were generated in 15 years. The company also reports that up to end 2005 approximately RMB100 million (US$12.5 million) of risk funds have been accumulated to pay for catastrophe losses.

New reinsurance arrangements since 2004

2.94. The agricultural reinsurance market has been opened up since 2004 and several companies are now involved in the purchase of international stop loss reinsurance and/or co-reinsurance arrangements with local government. International Crop Stop Loss Reinsurance Treaty protection has been purchased by SAIC and by Anxin on their crop portfolios in 2005 and 2006. In both cases these local insurers buy very small layers of stop loss reinsurance equivalent to approximately 50% excess 90% GNPI. This level of stop loss cover is unlikely to be adequate to protect against the catastrophe PML exposures (drought and flood in the case of SAIC; typhoon in the case of Anxin) on their crop programs and they therefore remain very exposed to major losses. It is understood, however, that provincial governments will continue to provide ad hoc (ex-post) compensation for losses excess of their Stop Loss Reinsurance limits.

2.95. The livestock reinsurance market is much more restricted than the crop reinsurance market in terms of specialist leaders and following market capacity providers. Currently neither SAIC or Anxin are purchasing international reinsurance on their livestock programs. The SAIC livestock policy is a standard individual animal accident and mortality product which is likely to attract reinsurance support if required. Anxin, however, underwrite livestock epidemic diseases as well as government slaughter order and it is highly unlikely that international reinsurers will accept to reinsure these perils at all, or only with major restrictions.

2.96. In Zhejiang Province the new 2006 PICC led agricultural co-insurance pool is also buying international Stop Loss Reinsurance protection on its combined crop, livestock, forestry and aquaculture portfolio, in this case for losses excess 100% up to 200% GNPI and which is part

[16] According to Sunlight, the provincial government compensated excess losses on 3 occasions in the 11 year period namely 1994, severe water-logging, 1998, flooding, 2002 low temperature and frost losses and that the total excess of loss payments amounted to RMB280 million.

of a carefully structured and layered reinsurance program involving both private and public sector reinsurance.

2.97. CIRC has been promoting pool coinsurance programs led by PICC in several provinces including Zhejiang since 2006, and Hainan, which is planned for 2007, under which the local provincial governments / financial bureaus have agreed to provide reinsurance protection under a co-reinsurance arrangement for losses excess 200% GNPI up to 500% GNPI.[17] In these provinces, government has accepted between 50% and 67% share on the reinsurance programs. In Zhejiang it is understood that by agreement of CIRC, government and the PICC led coinsurance pool, that losses will be capped at 500% loss ratio. In Hainan, government's liability is capped at 500% loss ratio, and liability for losses excess 500% loss ratio will revert to the Pool Coinsurers. This public-private risk financing represents a very significant development in the Chinese agricultural insurance and reinsurance market in 2006 and merits further analysis on a province by province basis.

2.98. Full details of the public and private international stop loss reinsurance arrangements are presented in Annex 6.

[17] Government reinsurance protection is provided free of charge.

Chapter 3: Guiding Principles Drawn from International Experience

3.1. Agricultural insurance is challenging under any circumstances. It is even more challenging when farm units are small, markets are not well-developed, regulations are unclear, and data and information are lacking. International experience has been mixed for many types of agricultural insurance. Governments have become increasingly involved in agricultural insurance. In some cases this is as a direct provider of the insurance, in others, it is via a public-private partnership. These cases generally involve relatively heavy premium subsidies that neglect to address some of the underlying issues that are critical to a properly designed agricultural insurance program. Annex 1 provides an overview of some of these country experiences. While it is beyond the scope of this document to review these cases in detail, it is useful to draw from them and attempt to develop guiding principles that may assist policy makers and those involved with the emerging agricultural insurance market in China.

Agricultural Insurance Products: Overview

3.2. Much of the global agricultural insurance premium is generated in North America (58 percent) and Western Europe (28 percent). Asia accounts for about 4 percent and Latin America has 3 percent. The rest of the world comprises the remaining 6 percent.[18] World-wide most agricultural insurance is for crops – representing 71 percent of the global premium for agricultural insurance (hail crop insurance is 22 percent and multiple peril crop insurance is at 49 percent). Only about 12 percent of global premium is for livestock (not including sporting or companion animals). This chapter focuses exclusively on various types of crop insurance products.

3.3. Most agricultural insurance is traditional insurance that pays an indemnity when the farm household incurs a loss. To pay indemnities, the insurance provider must make estimates of the loss incurred for each farm that makes a claim. There are two dominant types of crop insurance: Named peril and Multiple peril. Named peril insurance involves assessing losses that occur due to a specific peril. Hail insurance is the most common form of named peril insurance. For well over one hundred years, hail insurance has been available in a number of countries (mostly in North America and Europe). Once loss adjustors are properly trained, hail damage is easily identifiable and special procedures have been developed to make field assessments of the degree of damage. Further, hail losses are typically localized rather than widespread. For these reasons, hail insurance has been offered in most countries in the private sector without government subsidies. Named peril crop insurance can also be offered on other perils such as freeze or windstorm. The loss adjustment process attempts to estimate the specific damage created by the insured peril. These estimates are done on a percentage basis. The percentage of damage (minus any deductible) is multiplied by the sum insured to calculate the indemnity.

3.4. Drought is rarely covered under traditional named peril insurance. It is nearly impossible to isolate how much loss of yield is due to drought versus other factors, including potentially bad management. These issues become even more problematic when offering yield- based multiple peril crop insurance. If one is insuring for multiple perils, it is very difficult to first identify the "set of perils" that may have created the losses and then perform a loss assessment that attempts

[18] All global data on agricultural insurance in this paragraph comes from "Agriculture Market Review 2004", Dr Kasten & Partner, in ICMIF World October 2004. 50: 12-13.

to separate the actual loss by peril. It is often difficult to tell whether the loss was due to a weather event or to poor management practices.

3.5. Agricultural index insurance products are now offered in several countries. These products pay indemnities based not on farm-level yield shortfalls but rather on realizations of an index that is highly correlated with farm-level yield shortfalls. An example is area yield index insurance which pays indemnities based on estimates of the area yield. A threshold is established that is less than the expected county yield (e.g., 80% of the expected county yield). Indemnities are paid whenever the realized area average yield (e.g. county average yield) is less than the threshold. These products date to the 1950s with products offered in Sweden. Some regions in Canada have offered such products since 1977. Since 1992, area yield index insurance (called the Group Risk Plan or GRP) has been included among the various agricultural insurance products available to U.S. farmers.[19]

3.6. India also has a long-standing national crop insurance program that is based on area yields with its first area yield insurance program introduced in 1985. In fact, if one considers only the number of farmers insured, India has the largest crop insurance program in the world with about 18 million farmers in 2005. The Indian area yield insurance program is delivered directly with farm loans, even including provisions to add a premium charge to the loan and make the payment to the bank to pay all or part of the loan. While suitable for small farm households, the Indian program has had numerous problems. The program has mixed social and market goals and the actuarial performance is quite poor (average loss ratios exceed 400 percent). Since it takes time to develop the area yields, payments can be delayed to the extent that the insurance is not useful for the next crop season. To address these issues, Government of India has proposed to move to an actuarial regime for crop insurance. Premiums would be charged on a commercial basis and Government's support, where necessary, would provide up-front premium subsidies (though not for commercial/ horticultural crops) differentiated by the economic category of farmer. This will help address the issue of delayed indemnity payments being made to farmers since Government contribution, which currently leads to considerable delays in settlements, would be made up-front. Such a sound financial and actuarial approach will also result in introducing more discipline to the Indian crop insurance program and more efficient targeting of subsidies for poorer farmers. The World Bank is currently helping the Government of India to move to this proposed actuarially-sound regime.

3.7. Weather index insurance is another type of index insurance. This product pays indemnities based on realizations of some weather variable (e.g., rainfall or temperature) measured at a local weather station. The insurance can be structured so that it pays whenever rainfall or temperature is so high or so low that it is likely to cause crop yield losses. Weather index insurance is currently being tested on a pilot basis in several countries including India, Mexico, and Malawi.

3.8. For both area yield index insurance and weather index insurance, there is no need for farm-level loss adjustment. This and other factors associated with these products make them significantly less costly to deliver. These products can offer a sound basis for an agricultural insurance program. However, they require accurate, consistent, and secure measures of the underlying index (weather variable or area yield). Also, since indemnities are based on the realized value of the index rather than on the policyholder's actual losses, it is possible that the insurance payout does not exactly match the actual loss (basis risk).

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[19] A description of MPCI and Area Yield Insurance features is provided in http://www.ag-risk.org/NCISPUBS/Training/insplancomp.pdf)

Box 3.1: Summary Various Types of Agricultural Insurance Products

Traditional Crop Insurance

Damage Based Indemnity Insurance (Named Peril Crop Insurance). Damage based indemnity insurance is crop insurance where the insurance claim is calculated by measuring the percentage damage in the field, soon after the damage occurs. The percentage damage measured in the field, less a deductible expressed as a percentage, is applied to the pre-agreed sum insured. The sum insured may be based on production costs, or on the expected revenue. Where damage cannot be measured accurately immediately after the loss, the assessment may be deferred until later in the crop season. Damage based indemnity insurance is best known for hail, but is also used for other named peril insurance products (e.g., frost and excessive rainfall).

Yield Based Crop Insurance (Multiple Peril Crop Insurance, MPCI). Yield based crop insurance is insurance where an insured yield (e.g., tonnes/ha) is established, as a percentage of the historical average yield of the insured farmer. The insured yield is typically between 50% and 70% of the average yield on the farm. If the realized yield is less than the insured yield, an indemnity is paid equal to the difference between the actual yield and the insured yield, multiplied by a pre-agreed value of sum insured per unit of yield. Yield based crop insurance typically protects against multiple perils meaning that it covers many different causes of yield loss. This is because it is generally difficult to determine the exact cause of loss.

Index Crop Insurance

Area Yield Index Insurance. Area yield index insurance is insurance where the indemnity is based on the realized average yield of an area such as a county or district. The insured yield is established as a percentage of the average yield for the area. An indemnity is paid if the realized yield for the area is less than the insured yield regardless of the actual yield on a policyholder's farm. This type of index insurance requires historical area yield data.

Weather Index Insurance. Weather index insurance is insurance where the indemnity is based on realizations of a specific weather parameter measured over a pre-specified period of time at a particular weather station. The insurance can be structured to protect against index realizations that are either so high or so low that they are expected to cause crop losses. For example, the insurance can be structured to protect against either too much rainfall or too little. An indemnity is paid whenever the realized value of the index exceeds a pre-specified threshold (e.g., when protecting against too much rainfall) or when the index is less than the threshold (e.g., when protecting against too little rainfall). The indemnity is calculated based on a pre-agreed sum insured per unit of the index.

Traditional Livestock Insurance

Mortality insurance for individual animals is the basic traditional product for insuring livestock. It is very costly for an insurer to provide insurance for individual animals, especially where herd size is small. Premiums are set based on normal mortality rates within the permitted age range, plus risk and administrative margins, and are generally quite expensive. Further, as mortality is, to a considerable extent, influenced by management, the product suffers from-anti selection by the highest risk farmers.

Herd insurance is a variation on individual animal mortality cover, for larger herds. A deductible is introduced, where a certain number animals, or a percentage of the animals, must be lost before an indemnity is paid.

Epidemic disease insurance is offered in only a few countries, most notably Germany. Insurance of government ordered slaughter or quarantine is normally excluded. Epidemic disease insurance carries major and infrequent catastrophic claims exposures necessitating a high reliance on reinsurance for risk transfer. Due to the difficulties of modeling epidemic disease spread and financial exposures, it is difficult to develop this type of insurance and to obtain support from international reinsurers.

Index Livestock Insurance

Index insurance for livestock has been applied for mortality in Mongolia where there is a high correlation of livestock losses due to extreme weather, and for some pasture and rangeland products in Canada and the U.S.

Cost of Agricultural Insurance

3.9. The cost of agricultural insurance (i.e., agricultural insurance premium) is decomposed and analyzed from the standard cost equation below. It explains how these cost components vary across different agricultural insurance products, different legal and regulatory environments, and different agricultural structures (large-scale versus small-scale agriculture).

Insurance Premium = Expected annual Loss
+ Expense Loads
+ Cost of Capital

Expected Annual Loss

3.10. If insurance is not priced according to the underlying risk, it is doomed to failure. Thus, a critical function for any insurer is to estimate the cost of the risk being insured. This is done through a risk assessment. If the insurance product has been in existence for many years, historical loss costs (indemnities/sum insured) can sometimes be used to estimate the cost of the risk. However, historical loss cost data may not be adequate for estimating future indemnities if the insurance product covers losses from extreme but infrequent events such as devastating typhoons. For new insurance products, historical loss cost data will not be available. Thus, actuaries will attempt to use other data sources (e.g., historical yield data, weather data, etc.) to simulate what the loss cost would have been had the insurance product been sold in previous years.

3.11. A sound risk assessment relies on a quantitative analysis, as shown in Chapter 2 and Annex 2. However, insurance companies will always supplement such quantitative analysis with expert judgment. This is particularly true when the insurance product insures against losses from highly infrequent but potentially catastrophic loss events. The following are some of the primary questions that are addressed in a risk assessment:

- Are there one or more natural perils that are known to directly undermine the welfare of farm households or that impede the delivery of critical services to rural areas? Events likely to meet this condition include well-defined extreme weather events such as droughts, excessive rainfalls, floods, freezes, excessive temperatures, deficit sunlight, etc.
- How frequently do losses occur? For any insurance to be successful, extreme loss events must occur frequently enough to be recognized by individuals as a significant risk. However, they should not occur too frequently, or else premium rates would be prohibitively high. As a rule of thumb, major loss events, should occur at least once every 15 years, but not more than once every 7 years.
- When loss events occur, what is the magnitude of loss? Will the loss event cause severe economic distress for farm household?
- How spatially correlated are agricultural production losses? Are losses generally localized or are they widespread over a large area?

Expense Loads

3.12. A number of expense factors that must be carefully addressed. Each of these factors adds to the expense of developing and implementing an effective and sustainable agricultural insurance program. Understanding these cost factors also provides significant insight into *guiding principles* for developing agricultural insurance

Cost of information to control anti-selection

3.13. Data and information are critical to any agricultural insurance program. As was just discussed, quality data are required to conduct a risk assessment. Data are also needed to conduct risk classification of potential policyholders. An insurer will attempt to classify potential policyholders according to their risk exposure and charge higher (lower) premium rates to those whose agricultural production is more (less) risky. Such classification requires information on the risk exposure of the potential policyholder relative to other agricultural producers. To understand why this is important, suppose that the insurer is not able to accurately classify potential policyholders according to their risk exposure. Those who have been misclassified to their benefit (i.e., charged premium rates that underestimate the true cost of their risk) will be more inclined to purchase insurance. Those who have been misclassified to their detriment (i.e., charged premium rates that overestimate the true cost of their risk) will be less inclined to purchase insurance. The pool of insurance purchasers will then consist disproportionately of those who have been misclassified to their benefit. As a result, the insurer will pay larger indemnities than had been anticipated. The high level of indemnities will cause the insurer to increase premiums in subsequent years. However, this only compounds the problem since only those persons who have been most severely misclassified to their benefit will choose to purchase the insurance at the higher premium. This phenomenon, known as "adverse selection" will eventually destroy an insurance market and can only be corrected with more and better information with which to conduct risk classification. If there is no risk classification and policyholders are all charged the same premium rate, severe anti-selection problems will almost always emerge.

3.14. Often it is very difficult to conduct farm-level risk classification because information on farm-level yields or losses is not available. Comprehensive local data on weather or area crop yields are also often difficult to obtain unless such data have been systematically organized and archived in useable formats. Without these data, it is very difficult for an insurer to even determine which crops or regions of the country are relatively more prone to losses – much less conduct farm-level risk classification. Public investments in quality data are often needed to facilitate development of agricultural insurance.

Cost of monitoring to control moral hazard

3.15. Moral hazard occurs when, as a result of purchasing insurance, individuals change their behavior in ways that increase the likelihood and/or the magnitude of losses. Moral hazard can be something as simple as irrigating less or using less pesticide as a result of having purchased crop insurance. It can also be a deliberate attempt to defraud the insurer and collect more indemnity than is really due. Insurers attempt to control moral hazard in part through product designs that include deductibles and co-insurance. These designs ensure that the policyholder shares in any losses so there is less incentive to engage in riskier behavior. Insurers also attempt to monitor the behavior of policyholders to make sure that they use widely accepted best management practices and do not utilize production practices that are expressly forbidden by the insurance policy.

Cost of loss adjustment

3.16. When an insured loss occurs, the magnitude of the loss must be calculated to determine the amount of indemnity due the policyholder. For named peril and multiple-peril crop insurance products, this requires that a trained loss adjuster visit the farm, determine whether the loss occurred due to an insured peril, and, if so, estimate the magnitude of yield loss. The cost of loss adjustment can be quite high. For multiple-peril crop insurance, this is especially true when a high proportion of policyholders experience a loss due to a widespread event such as a drought.

Since loss adjustment must be conducted for each insured farm, the cost of loss adjustment also increases greatly when a large percentage of the policyholders are smallholders.

3.17. The cost of loss adjustment is much lower for index insurance products because there is no need for farm-level estimates of loss. Indemnities are based solely on the realized value of the index relative to the threshold. Once the realized value of the index is determined, indemnities can be calculated without ever visiting the insured farm.

Cost of delivery

3.18. The cost of selling crop insurance policies can also be quite high. Trained sales staff must travel to remote rural areas, meet with farm-level decision-makers to explain the insurance policies, obtain signatures on sales contracts, and eventually collect premiums. As with loss adjustment, the cost of delivery is much higher when a large percentage of the policyholders are smallholders. The cost of delivery is also higher for more complex insurance products like multiple-peril crop insurance as compared to more simple products like named-peril or index insurance.

3.19. Sometimes the cost of delivery can be reduced if crop insurers can form relationships with organizations such as input suppliers or lenders who already have sales staff in the countryside. Also farmer mutuals or cooperatives can sometimes serve as an important insurance distribution channel. An example of a linkage to lending is provided by the Philippines Crop Insurance Organization.[20] The majority of farmers insured are recipients of a supervised credit program. The French agricultural mutual insurance program Groupama has been involved in similar practices for well over 100 years. Groupama is now operating in parts of China. In India, farmers taking loans from state supported lenders are forced to purchase crop insurance that is packaged with the loan. Premiums are collected by the lender. Any insurance indemnity is applied first to paying the loan balance. If the indemnity exceeds the loan balance, the difference is put into a bank account for the policyholder.

3.20. In a well-developed insurance market, insurance sales agents often also sell various types of farm supplies and production inputs. They use point-of-sale laptop computers for entering relevant information and can often issue insurance policies while meeting with the farmer. This reduces the number of trips that sales agents must make to remote rural areas to meet with farmers. Obviously, a sophisticated information technology system is required to support such efforts. Similar systems have been developed in India by Basix – a rural services organization that has developed index insurance products for small scale farmers (see Box 3.2).

3.21. Where a crop is being grown for export or for processing, and a single export or processing channel exists, it may be possible to provide crop insurance in an automated way to all contracted farmers. An example is Windward Island Crop Insurance Ltd, a company protecting banana growers in four Caribbean islands against hurricane and localized wind damage. Another example is Mauritius Sugar Insurance Fund Board, which provides protection for sugar growers against a variety of perils, but particularly cyclone and rain. Linkages to cotton processors could perhaps offer similar opportunities in China.

[20] See http://pcic.da.gov.ph/

Administrative costs

3.22. In addition to information, monitoring, loss adjustment, and delivery costs, there are other costs of administration associated with selling and servicing insurance products. These would include everything from the cost of skilled actuarial, underwriting, legal, and management information system personnel to the cost of maintaining computers, vehicles, buildings, etc.

Product development costs

3.23. Developing new agricultural insurance products is an expensive activity which involves product design and actuarial pricing. The insurer would expect some kind of fixed mover advantage that would enable excess returns to be generated for a period in order to recover the sunk development losses incurred earlier.

Cost of Capital

3.24. The third major component of cost for any viable insurance company is the cost of ready access to capital. Companies writing agricultural insurance must consider making a reasonable rate of return on the risk capital. Economic capital is also required to reduce the probability of ruin. Insurers must have access to sufficient capital to pay all indemnities in full that might occur in a given year with a high probability (e.g. 99%). A thorough risk assessment must also provide some indication of how large the insurer's loss ratio could be in any given year. This is often referred to as the loss ratio probable maximum loss (PML). The larger the loss ratio PML, the more the insurer will need access to ready sources of capital. The amount of contingent capital required can be particularly high for multiple peril policies that cover spatially covariate perils. For example, a widespread drought can generate massive losses in a single year. By selling insurance for different crops or in different regions, an insurer can diversify its portfolio of insurance policies. Such diversification reduces the insurer's loss ratio PML and thus, the insurer's contingent capital needs.

3.25. When insurance is being regulated according to international standards, having proof of sufficient access to contingent capital is a requirement. Some of the necessary capital may come from the insurer's accumulated reserves. However, taxation and regulatory structures often make it cost prohibitive for insurers to accumulate large reserves. Further, an extreme loss event could occur before sufficient reserves are accumulated. Thus, most insurers purchase access to contingent capital through reinsurance. The larger the loss ratio PML, the higher will be the insurer's cost of obtaining sufficient access to contingent capital.

Product Development

3.26. For any proposed insurance product, the insurer must ask whether the cost of risk can be accurately estimated. The insurer must also consider how the costs of information, monitoring, loss adjustment, delivery, administration, and access to contingent capital vary across different product designs. These questions are explored by focusing on named peril crop insurance, multiple-peril crop insurance, and index insurance.

Named Peril Insurance

3.27. The cost of offering named peril insurance is significantly less than the cost of offering multiple peril insurance. It is easier to conduct risk assessment for a single named peril than for multiple perils. Risk classification is easier for a named peril than for multiple perils so the potential for adverse selection is greatly reduced. It is much easier to monitor for moral hazard with named peril insurance than with yield-based multiple-peril insurance. For most named peril insurance products, it is fairly easy to determine whether the yield loss was due to the insured peril. The cost of ready access to capital is also much lower for named peril insurance since the perils insured (e.g., hail) tend to be localized rather than spatially covariate. For these reasons, named peril insurance products have been the first crop insurance products offered in many countries.

3.28. Named peril hail insurance is an extremely well-established product in most developed countries with temperate climates, where hail is normally a significant hazard. The risk assessment presented in Chapter 2 demonstrates that hail risk is a significant hazard in many parts of China. There is a substantial body of hail insurance experience in the international insurance and reinsurance marketplace, and amongst associations of insurers. It is a major class of insurance throughout Europe (e.g. Germany, Spain, France, Italy, Poland, and Eastern Europe), Canada and the USA, South America (e.g. Argentina, Chile, and Brazil), Australia and New Zealand. The viability of hail insurance can be attributed to several features:

- It can be sold as a commodity product, requiring only limited skills from sales agents;
- It is a standardized and simple policy, with variations only in the loss adjustment processes which are adapted to each crop type and growth stage;
- Field loss adjustment can be carried out by persons who have received basic training but are not necessarily agricultural specialists;
- Hail (and associated wind) is a clearly identified peril occurring with sudden-onset and causing physical damage to crops;
- Hail is a localized (rather than spatially covariate) risk;
- Farmers generally cannot affect the extent of losses due to hail.

3.29. Other named peril crop insurance products are sometimes offered, often as a supplement to a hail insurance policy. Examples are: hail and spring frost on grapes; hail, wind and frost on field crops; hail and excess rain on tomatoes grown for processing. These supplemental perils are often more technically difficult for the insurer to underwrite than hail alone, but are still considered feasible.

Multiple Peril Crop Insurance

3.30. Multiple peril crop insurance was first developed in the USA, by the government, and the USA and Canada remain the only countries where MPCI is widely adopted. The yield-based approach to loss measurement is attractive to farmers, and to financing institutions lending to farmers, as it captures all causes of yield variation. It provides a guarantee to the farmer of an indemnity if the actual realized yield is less than an agreed percentage of the average yield established for the farm. MPCI is an attractive product where the damage to crops is complex (for example, many perils interacting, such as rainfall and disease); and for drought, which develops gradually over a crop season.

3.31. Despite the advantages of MPCI, individual farmer-MPCI has proved highly problematical for insurers. Key difficulties associated with MPCI have been extensively documented and can be summarized as follows:

- Because it protects against multiple perils, the cost of risk for MPCI is higher than for named peril insurance.
- MPCI tends to be highly susceptible to anti-selection. A great deal of information is required to classify the risk exposure of potential policyholders. Generally, the insured farmer knows much more about his/her real risk exposure than the insurer. Those who

perceive that they have been misclassified to their benefit (i.e., charged a premium rate that underestimates the true cost of the risk exposure) will tend to purchase insurance while those who have been misclassified to their detriment will not.

- MPCI tends to be highly susceptible to moral hazard. It is practically impossible for the insurer to monitor the behavior of all policyholders. Thus, it is often difficult to know whether yield losses were the result of some unavoidable peril or just poor management.
- Loss adjustment is difficult and costly. Highly skilled loss adjusters must try to determine whether the yield loss was due to an insured peril and, if so, the magnitude of the loss.
- Delivery costs are quite high. The farmer must provide historical data on hectares planted and tons produced. The sales agent must be able to verify that these data based on objective third-party sources.
- MPCI is data intensive, requires highly skilled underwriters, and involves monitoring of policyholder behavior. Thus, the administrative costs are quite high.
- Among the perils that are typically covered by MPCI are spatially covariate perils such as drought. This implies that loss ratios in any given year can be extremely high so the insurer must have access to large amounts of contingent capital. Obtaining access to this contingent capital can be extremely expensive.

3.32. By considering each of these cost components one can see why the cost of providing MPCI is very expensive. In addition, the information, monitoring, loss adjustment, delivery, and administrative costs of MPCI generally do not vary much with the size of the policy. Thus, the cost of providing MPCI insurance to smallholders is even more expensive. International experience has shown that farmers (and especially smallholders) are unwilling to pay premiums that are sufficient to cover the insurer's cost of providing MPCI. Thus, most MPCI programs have large premium and/or administrative subsidies paid by government.

3.33. It is important to note that currently in China most MPCI is being sold by insurance companies that service large state farms such as the HRG and the XPCC. This is noteworthy because the state farms, through their highly developed local infrastructure support, effectively pay much of the costs associated with controlling anti-selection and moral hazard, loss-adjustment, delivery, and administration, and (in some cases) even provide access to contingent capital. In other words, the state farm implicitly subsidizes the insurer. In contrast, insurers who attempt to sell MPCI in areas outside of state farms must bear all of these costs. Thus, it is not surprising that the People's Insurance Company of China (PICC) has been largely unsuccessful in its efforts to sell MPCI to farmers who are not part of state farms.

Index Insurance

3.34. Because index insurance indemnities are based on the realized value of the index rather than farm-level losses, the costs of providing index insurance are much less than the costs of providing MPCI. In general, index insurance (either area yield index insurance or weather index insurance) has the following cost advantages relative to MPCI:[21]

- Since indemnities are based on the realized value of the index rather than farm-level losses, there is no need to classify an individual policyholder according to his/her risk exposure. Further, there is little reason to believe that the farmer has any better information than the insurer regarding the risk of the underlying index (e.g., area yields, rainfall, or temperature). Thus, there is little potential for anti-selection;
- Since indemnities are not based on farm-level losses, the farmer cannot influence the likelihood or magnitude of an indemnity. Thus, there is no need to monitor for moral hazard.

[21] See Annex 5 for a detailed discussion on index-based insurance.

- Since indemnities are not based on farm-level losses, there is no need for farm-level loss adjustment. This greatly reduces the cost of providing index insurance relative to the cost of providing MPCI. It also creates opportunities to insure crop or livestock enterprises which might otherwise be uninsurable.
- Although extension and farmer education remains essential for index products, the actual delivery cost is reduced relative to MPCI. The enrollment process is less complex since there is no need to establish and verify an average farm-level yield. As a result, the product can be sold by less skilled personnel.
- While there are administrative costs associated with any insurance product, the simplicity of index insurance products greatly reduces administrative costs relative to MPCI.

3.35. Basis risk is the most important disadvantage of index insurance. Basis risk refers to variability in the relationship between the value of the index and losses experienced on the farm. With index insurance it is possible for the farmer to experience a loss and yet not receive an indemnity. It is also possible that the farmer may receive an indemnity and yet not experience a loss. These events are possible because the indemnity is based solely on the realized value of the index. If the index and farm-level yields are highly correlated, basis risk should be very small. If the index and farm-level yields are not highly correlated, basis risk may be quite high suggesting that the index insurance may not be appropriate for that farm. Basis risk occurs due to spatial variation in weather variables (particularly where there are local micro-climates) as well as differences in management practices, soil quality, or crop varieties. Careful insurance product design can reduce (but not eliminate) basis risk. In particular, it is important that the index reflect spatially correlated loss events such as drought or extreme temperatures. Index insurance should be designed to assure that farmers will receive some payments during the very worst years. Annex 5 provides more detail about how to make index insurance operational and also how to mitigate the basis risk problem. Localized perils such as hail or frost (which may also be affected by topography) are not well suited to index insurance.

3.36. The cost of capital for index insurance is likely higher than for named peril insurance because index insurance products, by design, protect against spatially covariate losses such as drought. However, it is likely less than for MPCI because reinsurers recognize that index insurance products are much less susceptible to adverse selection and moral hazard than MPCI policies. Further, because index insurance is simpler and more transparent than MPCI, it is less costly for reinsurers to assess the risk that they are assuming when they reinsure index insurance policies. An insurer that is selling index insurance products can also reduce the cost of access to ready capital by diversifying across different index insurance products and/or index insurance products offered in different geographic regions (e.g., different provinces).

3.37. In practice, it is often more feasible to develop weather index insurance rather than area yield index insurance. This is because the meteorological bureaus in many countries have long time-series of accurate, consistent, and secure weather data for various weather stations across the country. It is far less common to find long time-series of accurate, consistent, and secure measures of area average yield. Both India and Mexico have introduced forms of weather index insurance.

3.38. In any discussion of area yield index insurance it is important to clarify a common point of confusion. With area yield index insurance area yield data are used both to establish the yield guarantee and to adjust losses. A common mistake in MPCI insurance programs is to use area average yields to establish the yield guarantee but then adjust losses based on farm-level yields. This practice is inherently flawed since it effectively provides more (less) insurance protection to those whose expected yields are less (greater) than the area average yield. The result will be anti-selection where those with the lowest (highest) expected yields will be most (least) inclined to purchase insurance. Some agricultural insurance programs in China are currently using this flawed method of establishing MPCI yield guarantees.

3.39. In conclusion, both named peril crop insurance and index insurance are easier to develop and less costly to operate than MPCI. The information, monitoring, loss adjustment, delivery, and administrative costs of MPCI are very high – especially if the insurer is selling to smallholders. To cover these costs, insurers must charge premiums that often exceed what farmers are willing and able to pay. Thus, it seems reasonable that any insurer wishing to enter the agricultural insurance market should first offer named peril or index insurance products. There is a logical sequence of insurance products that should be introduced. Ideally, insurers would offer MPCI only after they have gained experience with named peril or index insurance products and only after careful consideration of how they can minimize information, monitoring, loss adjustment, delivery, and administrative costs.

Government Role in Developing Risk Market Infrastructure

3.40. In many countries, governments do not consider the role that insurance markets can play in coping with exposure to weather risks. Instead, they tend to focus on the provision of government aid following an extreme weather event. The expectation of post-disaster government aid reduces the demand for agricultural insurance. It is therefore important that governments focus on those areas in which their resources can be most efficiently utilized. Careful consideration of the various cost components has implications for the appropriate roles of government in facilitating the development of crop insurance. Far too often, governments have chosen direct premium subsidies as their primary role. Government efforts at providing the proper environment for risk markets can be more significant. Given the nature of the risk, governments can facilitate risk financing in a fashion that will 'crowd-in' more market development. Furthermore, there are some important 'public good' roles for government to play in data management, product development, and capacity building with an agricultural insurance industry. International experience has demonstrated that governments do not properly separate the social function versus the market function for agricultural insurance, thus generating a program that is attractive neither for farmers nor for insurance companies.

Legal and Regulatory Framework

3.41. One of the most important functions for government in facilitating agricultural insurance markets is the establishment of an appropriate legal and regulatory framework. This requires not just the enactment of appropriate laws and regulations, but also encouraging and, where appropriate, putting in place the necessary legal and regulatory infrastructure.

3.42. There are two principal elements to the legal framework: The laws necessary to enable the proper regulation of insurance business, and the laws that govern the contractual relationship between the parties.

3.43. The laws that govern the contractual relationship between the parties may, and in Civil Law countries such as China, will be codified in legislation enacted by Parliament. Sometimes, as in China, one law covers both the contractual relationship between the parties and the regulation of insurance business. Although the law governing the contractual relationship may need to be adjusted to some extent for agricultural insurance, particularly with respect to index-based insurance, the general principles applicable to insurance contracts should generally also apply to agricultural insurance.

3.44. International standards for the regulation of mainstream insurance business, as promulgated by the International Association of Insurance Supervisors (IAIS), are reasonably well developed. However, standards continue to evolve and in some areas, such as the regulation of microinsurance, standards have not yet been developed. This is an important consideration as agricultural insurance when sold to small farmers may well be classified as microinsurance.

3.45. Furthermore, agricultural insurance is a special class of insurance business that has characteristics that are somewhat different to other classes of general insurance, such as automobile or property and casualty insurance. Some of the well-established regulatory standards applicable to general insurance may not be fully appropriate to agricultural insurance. It is important that the Insurance Law and the regulatory system account for these differences. An example would be minimum capital requirements. As indicated earlier, MPCI and index insurance are highly exposed to spatially covariate losses. Thus, for these products, regulators need to make sure that insurers have access to sufficient capital to cover loss ratios that can be much higher than would be expected in other lines of insurance.

3.46. Index insurance also creates some unique legal and regulatory challenges. Since indemnities are not based on the actual loss incurred, index insurance is quite different to traditional insurance products. Thus, even when strong legal and regulatory systems are in place, it is likely that modifications will be required to accommodate index insurance contracts. This is discussed further in Annex 4.

3.47. A number of countries have well-established agricultural insurance programs (e.g., the U.S., Canada, Spain, India, and Mexico). However, these programs are established under specific legislation which is not necessarily appropriate for a country, such as China, which is considering the development of a general agricultural insurance law. Reference has also been made in this report to Mongolia, which has established a program to pilot test index-based livestock insurance. For the purposes of the pilot, the regulatory challenges have been addressed through the design of the pilot program. Work on developing an appropriate regulatory framework for the roll out of the program on a national basis has not yet commenced.

3.48. In other country cases of agricultural insurance, the legislation is usually product specific rather than of general application. For example, last year the Grand National Assembly of Turkey enacted a new Law on Agricultural Insurance. However, despite the broad title, the Law is actually limited to the establishment and operation of an Agricultural Insurance Pool. Thus, while there is international experience and precedent of countries developing a legal framework for specific types of agricultural insurance programs, very little work has been completed on the development of regulatory frameworks that are tailored to general agricultural insurance.

3.49. The Government also has a role to play in the development of a court system that enables the regulator to take legal action against insurers, if necessary, with respect to regulatory breaches and the parties, whether an insurer or a policyholder, to enforce their rights under the contract. Particularly in countries where the insurance market is not well understood, the principles of insurance law may not be well understood by judges. If erroneous judgments are made, this may also erode confidence resulting in a reluctance on the part of insurers to sell insurance and on the public to purchase it. Although applicable to all insurance products, there is a greater potential for damage with respect to agricultural insurance, particularly given the diversity of possible products, the differences between agricultural insurance and other classes of insurance and the fact that it is likely to be purchased by small farmers who are unlikely to have a sophisticated knowledge of insurance products. An adequate procedure for arbitration is also important at the local level, to allow smaller policyholder disputes to be settled.

Enhancing Data and Information Systems

3.50. Data and information are critical to insurance provision. In particular, data are absolutely necessary for any quantitative assessment of the cost of the risk. To develop any crop insurance product, insurers require historical data on the types of crops produced in an area, the hectares planted for each crop, and the tons produced. To offer named peril insurance products, insurers need region-specific data from which to develop a probability distribution of losses caused by the named peril. To offer weather index insurance products, insurers need data (normally daily data) on various weather variables for a number of meteorological stations. They also need historical crop yield data so they can determine which weather variables, measured over which time periods, are most closely correlated with crop yield losses. To offer area yield index insurance, insurers need crop- and region-specific historical data on area average yields. MPCI requires historical farm-level yield data from which to establish average yields. As indicated earlier, the other data and information requirements needed to control adverse selection and moral hazard make MPCI the most data-intensive of the crop insurance products discussed here.

3.51. Much of the data required for crop insurance has public good characteristics. Thus, it is unlikely to be collected, cleaned, and archived by private sector companies. Governments generally must provide data on hectares planted and production for various crops, yield losses due to natural disasters, and weather variables measured at various locations. Crop insurance companies in China currently make extensive use of National Bureau of Statistics data on hectares planted and production of various crops as well as the data on hectares covered by, and affected by, various natural disasters. Further government investments in collecting, cleaning, and archiving relevant data as well as making these data easily available to insurance companies, could further stimulate the development of crop insurance markets in China.

Education and Capacity Building

3.52. In the early stages of crop insurance market development, it is important that farmers be educated about crop insurance. If insurance is not commonly available in the countryside, general education about insurance and risk management will likely be necessary. As the market develops and various crop insurance products are offered, it is important that potential insurance purchasers fully understand the advantages and disadvantages of the different crop insurance products. While insurers will provide some information as part of their sales efforts, farmers also need balanced information from an objective source. Thus, it is important that governments invest resources in educating farmers about the advantages and disadvantages of various insurance products. This is particularly true, if index insurance policies are offered. While index insurance generally has lower premiums than MPCI, farmers need to understand that it is possible to experience a yield loss and yet receive no indemnity from an index insurance product.

3.53. When insurance companies begin offering new lines of insurance such as agricultural insurance, they often need capacity building opportunities to develop expertise within the company. Even after the insurance products have become well established there is a need for continuing education and training of insurance professionals. In some countries, these activities are conducted by industry associations (e.g., National Crop Insurance Services, NCIS, in the USA and International Association of Hail Insurers, IAHI, in Europe). Governments can facilitate capacity building by directly providing education and training opportunities or by encouraging industry associations to provide these opportunities. Regardless, it is important that capacity building reflect internationally-recognized best practices for providing agricultural insurance.

Research and Development

3.54. One of the challenges associated with private sector development of new insurance products is the ease with which they can be copied and replicated by others. This “free rider” problem prevents most companies from making the initial investments in new product developments, especially in underdeveloped markets. Thus, some level of government support for product development may be justified. These investments should be targeted at feasibility studies and developing pilot tests of new products with the involvement of local private-sector partners. Every attempt should be made to assure that the knowledge and technology for new product development will be passed on to the private sector insurance companies as soon as possible.

Catastrophe Risk Sharing

3.55. Both MPCI and index insurance are highly subject to spatially covariate risks such as drought or extreme temperatures. This implies that, in any given year, indemnities can be very high relative to premiums collected. Insurers must have access to large amounts of ready capital to pay these indemnities. Reinsurance is the most common means that insurers use to gain access to large amounts of capital.

3.56. Non-proportional reinsurance treaties make payments to insurers whenever loss ratios exceed some pre-determined level. These reinsurance payments provide the capital that insurers need to pay indemnities to policyholders. Reinsurance is offered by large international firms that pool risks into a portfolio that contains different lines of insurance offered in different regions of the world. However, reinsurance can be expensive. Any reinsurer will want to know the details of how an agricultural insurance program is being implemented. Obtaining this information is often referred to as “due diligence.” Due diligence requires significant time and resources, and is normally an investment undertaken by the reinsurer and by reinsurance brokers. The reinsurer will normally only make such an investment in anticipation of adequate future business volume. Any agricultural insurance development in China must address the need for large amounts of contingent capital due to the potential for very large loss ratios.

3.57. Because they are subject to spatially covariate risks, the cost of reinsurance is much higher for MPCI and index insurance than for named-peril insurance. For this reason, governments often provide subsidized reinsurance for MPCI policies. In the USA, the federal government provides a highly subsidized reinsurance contract for insurance companies that sell MPCI policies. In Spain, the consortium of insurance companies is mainly reinsured by the public reinsurance company *Consorcio de Compensacion de Seguro*.

3.58. To date, the experience on weather index insurance is limited. However, it is likely less costly to obtain private-sector reinsurance on index insurance products than on MPCI. Some weather variables are less spatially covariate than MPCI losses. More important however, is that compared to MPCI, index insurance products are simple, transparent, and less susceptible to adverse selection and moral hazard problems. This reduces the reinsurers cost of due diligence so they can provide reinsurance on index insurance at more favorable terms than reinsurance on MPCI.

Public Subsidies

3.59. In almost all MPCI insurance programs (including those in China) the government subsidizes the premium cost to farmers. By way of contrast, government premium subsidies have rarely been applied to named peril insurance products such as hail insurance. This is because the costs of providing named peril insurance are low enough that farmers can afford to pay the premium.

3.60. Premium subsidies make MPCI more affordable for farmers but they do not address the underlying high costs of providing MPCI. MPCI is expensive because of adverse selection, moral hazard, and high loss adjustment, delivery, administration, and reinsurance costs. Premium subsidies make MPCI more affordable for farmers but for a fully scaled-up MPCI insurance program, the costs of these subsidies can be astounding. In 2006, the U.S. government paid US$ 2.7 billion in crop insurance premium subsidies – and the crop sector in the USA is significantly smaller than in China. In addition to these premium subsidies the USA also subsidizes the delivery and reinsurance costs for MPCI. But premium subsidies do not address any of the underlying problems with MPCI. For example, numerous studies have documented widespread adverse selection and moral hazard problems with the MPCI program in the USA. Premium subsidies simply mask these problems by making MPCI more affordable for farmers.

3.61. Premium subsidies can also create perverse behavioral incentives. Premium subsidies are typically calculated as a percentage of the unsubsidized premium (e.g., a subsidy equal to 50 percent of the unsubsidized premium). But if proper risk classification is being done, farmers producing the most risky crops or producing in the highest risk areas should be charged the highest premiums. Thus, when the percentage premium subsidy is applied, the largest premium subsidies will be paid to the highest risk farmers. So the government is disproportionately subsidizing those who choose to produce the riskiest crops or produce in the riskiest areas. As a result, government premium subsidies can encourage farmers to produce a high-valued but risky crop in a region that is not well-suited to production of that crop. If there is no loss, the farmers benefit by earning higher returns. If there is a loss, the farmers are protected by highly subsidized insurance. Many experts now believe that in certain regions of the USA farmers choose to produce specific crops based largely on MPCI premium subsidies. Ironically, the MPCI program, that is designed to help farmers manage risk, now causes many farmers to take on even more risk because of the premium subsidy.

3.62. If governments wish to provide crop insurance subsidies, it is likely far better to focus those subsidies on developing risk market infrastructure, such as the items mentioned above. This may also include some level of subsidy for the catastrophic risk financing as more fully developed below. Government investments in establishing an appropriate legal and regulatory framework reduce the cost of administering crop insurance programs. Government investments in providing data and information can reduce the cost of risk assessment, risk classification, and monitoring. Government investments in education and capacity building can reduce the cost of delivering crop insurance products as better informed potential buyers of insurance are more likely to make the purchase. Government investments in research and product development can lead to new and improved insurance products, such as index insurance, which can be offered at lower cost.

3.63. Governments may also want to subsidize crop insurers access to contingent capital – particularly, for low probability, high consequence events. Evidence suggests that those at risk tend to ignore the probability of the most extreme and infrequent loss events. But insurers do not ignore these events and must consider the probability of such catastrophic losses in setting premiums. This creates a gap between what buyers are willing to pay and what sellers are willing to accept for protection against very infrequent but catastrophic losses.

3.64. Some provincial governments in China are implicitly subsidizing crop insurers access to contingent capital by recapitalizing the companies following excessive losses. The problem with this practice is that there is likely moral hazard in the relationship between the provincial government and the insurance company. The provincial government cannot effectively monitor the activities of the insurance company to make sure that the company is following best management practices. If central or provincial governments want to subsidize crop insurers' access to contingent capital for extreme loss events, there are several ways that this can be structured without undermining incentives for insurance companies to use best management practices.

Box 3.3: Public Insurance

The government may have limited comparative advantage to reduce risk, compared to the private insurance industry. The risk aggregation function, through the law of large numbers, performs well with relatively small sample when individual risks are independent. In this context, the government's size and scope is not required for the risk aggregation function to perform well.

Insurers control adverse selection by segregating the individual risks. Low insurance premiums are offered to low-risk producers, while higher premiums are charged to high-risk producers as a signal of their true risk exposure. The insurance industry thus plays a central role in discovering the true cost of risk. However, segregation is often viewed as socially unacceptable because it does not meet some social and solidarity objectives. As a consequence, public insurance is likely to engage low efforts to control adverse selection through risk pool segregation and to offer some average premium to all parties. Under voluntary insurance, this absence of segregation leads to the death spiral of adverse selection. In this case, compulsory insurance may be viewed as a solution to adverse selection as it forces low-risk producers to stay in the insurance pool. However, this is not a risk reducing effect but a wealth redistribution effect from the low-risk agents, who over-pay their premiums, to the high-risk agents, who under-pay their premiums.

The ex ante control of moral hazard is based on risk sharing through coinsurance and deductibles, and exclusions on insurance coverage. This limited coverage is usually inconsistent with the government's willingness to offer farmers universal coverage against all sources of risk. As in the case of adverse selection, social objectives may prevent the government from controlling efficiently moral hazard problems.

However, the government can have a comparative advantage to absorb catastrophic losses that are beyond the financial capacity of the insurance industry because it is able to spread these losses across generations and to implement the solidarity principle through an appropriate wealth transfer mechanism.

Conclusion

3.65. International experience has demonstrated that the cost of providing MPCI is very high relative to named peril insurance or index insurance. This is particularly true in countries like China where a large proportion of farmers are smallholders. Among the primary *guiding principles* that can be gleaned from international experience is the compelling need to carefully consider the development process of agricultural insurance. Starting with named peril or index insurance is quite logical given the contrast in the cost of these products versus MPCI.

3.66. Given the implicit subsidies provided, it may be financially feasible for insurers to continue providing MPCI to state farms. However, the potential for offering MPCI outside of state farms, especially for smallholders, may be quite limited. Regardless, if MPCI is offered, it is important that certain best practices be followed. Among these best practices for MPCI are:

- Risk classification should be implemented. Ideally risk classification would occur at the level of the policyholder. However, at the very least, is must reflect differences in risk for different crops (and varieties), different regions, different production practices (e.g., irrigated versus non-irrigated production), and different soil types. If all producers are offered coverage at the same premium rate, anti-selection will almost certainly develop.
- Premium rates should reflect farmers' risk exposure.

- Appropriate deductibles and/or co-insurance should be applied to reduce the potential for moral hazard. In addition, insurers should implement monitoring procedures to make sure that policyholders are following best management practices.
- The yield guarantee should be established at the level that loss adjustment will be conducted. If the loss adjustment is at the level of the farm household, then the yield guarantee should also be established at that level. If the loss adjustment is at a village level, then the yield guarantee should also be established at that level. A common mistake in MPCI insurance programs is to use area average yields to establish the yield guarantee but then adjust losses based on yields at the farm household level. This practice is inherently flawed since it effectively provides more (less) insurance protection to those whose expected yields are less (greater) than the area average yield.
- Regulators should ensure that insurers have access to sufficient amounts of ready capital. MPCI loss ratios can be much higher than those for other lines of insurance – especially when there is potential for spatially covariate losses caused by events such as drought or typhoon. Capital requirements should be based on a thorough risk assessment that determines loss ratio PMLs.

3.67. Even when these best practices are followed, the cost of delivering and loss adjusting MPCI policies will likely be excessive for smallholder agriculture. There are a number of ways for the government to provide subsidies that reduce the costs of providing various types of crop insurance through the development of risk market infrastructure. Among these are government investments in: 1) establishing an appropriate legal and regulatory framework; 2) providing data and information; 3) education and capacity building; 4) research and product development; and, 5) providing contingent capital for infrequent but catastrophic loss events. However, direct premium subsidies for the existing MPCI products simply mask the high cost of providing MPCI, without addressing the underlying causes. Even more troublesome, they can generate incentives for farmers to actually take on more risk.

Chapter 4: Developing Agricultural Insurance: Options and Recommendations

4.1. The recommendations in this chapter are predicated on an assumption that the Government of China wishes to devote some financial resources to expanding agricultural insurance services to the extent possible. Furthermore, the contention of this evaluation is that given the great diversity of agriculture in China, it is suggested that agricultural insurance products be developed within the local context. This means that both the central and provincial governments will likely be involved in the further development of agricultural insurance in China.

4.2. China has a growing agricultural sector and a keen desire to seek policy options that will increase incomes for the many lower income households involved in agriculture and other related economic activities. However, fundamental questions can be raised regarding the relative costs versus benefits of using agricultural insurance to achieve this goal. It is possible to give insights into the potential costs of supporting agricultural insurance given the current trends in China. Chapter 3 describes the various cost components for providing agricultural insurance in the light of international experience. That presentation makes clear that it will be quite expensive to deliver multiple peril crop insurance (MPCI) to the many small farm households that dominate Chinese agriculture. Chapter 2 documents the various pilot programs that are already developing MPCI programs in China. If increasing the incomes of rural households is the ultimate policy objective, then policy-makers and analysts in China need to seriously consider whether agricultural insurance is the right tool to achieve this objective. There are likely other policy tools that are better suited to improving the incomes of rural households.

4.3. Premium subsidies are generally provided for MPCI. While these subsidies are being provided on a limited basis and mostly by provincial governments, it is important to assess the potential cost of premium subsidies for a scaled-up MPCI program in China. It is possible to provide these estimates using the macro risk model developed in Chapter 2 (see also Annex 3). Four items are needed to estimate the cost of premium subsidies for a scaled-up MPCI program: 1) the value of crop production in China; 2) the assumed percentage of the crop value that would be insured; 3) the rate of premium subsidy; and 4) country-wide average premium rates. In 2004, China produced crops valued at approximately RMB1,780 billion (US$222.5 billion) – or almost double the value of all crops produced in the USA. To develop an initial estimate, assume that 10 percent of the crop value, or RMB178 billion (US$22.2 billion), would be insured under the scaled-up MPCI program. If the premium subsidy is 50 percent and the average premium rate is 8 percent (from the risk assessment in Chapter 2), the cost of the premium subsidy would be more than RMB7 billion (US$875 million).

4.4. What if China were to adopt an MPCI program similar to that in the USA? In 2006, roughly 50 percent of the total crop value in the USA was insured. The average premium rate was 9 percent and the average premium subsidy was 59 percent. Applying these percentages to the RMB1,780 billion crop value in China implies that the cost of the premium subsidy would be RMB47 billion (US$5.9 billion). The USA also has subsidies for delivery cost (about 22 percent of premium) and risk sharing (about 15 percent of premium). If China extended their program to include something similar, the additional subsidy cost would be RMB30 billion (US$ 3.8 billion) for a program that insured 50 percent of the value of crop production. It seems highly unlikely that China wants to spend RMB77 billion (US$ 9.6 billion) per year on crop insurance subsidies. These cost comparisons are also likely a low end estimate as the size of farms in the U.S. are much larger than those in China. This means that the delivery cost in China would be significantly higher. Further to the concern, it is unlikely that an expanded MPCI program in

China will be effective in protecting small farmers. Finally, it is also important to note that, thus far, the U.S. has very little livestock insurance. In contrast, some provinces in China are expanding sales of livestock insurance. Insuring livestock will further increase these cost estimates.

4.5. These estimates of subsidy costs are offered to help inform the policy dialogue in China. They also motivate the recommendations that are presented below. These recommendations are based on knowledge of the Chinese agricultural insurance market, knowledge of international experience and the various cost components of providing agricultural insurance and the belief that the Chinese government wants to support diverse product development for agricultural insurance by using limited government resources to their highest and best use.

4.6. It is recommended that, rather than adopting a single choice for risk financing, the Government of China may wish to facilitate each of the choices in some fashion. At some level of aggregation, risk financing should be facilitated by pooling of agricultural insurance risks. However, as will be developed further, high transaction costs will likely impede any national pooling of agricultural insurance risks. The central government and the provincial governments play an important role in supporting the development of agricultural insurance.

4.7. The World Bank has focused on risk management models that are based on key economic and social metrics such as government fiscal exposure, safely nets for the poor, and investments in risk mitigation (Gurenko and Lester, 2004). This framework, which has been extended to agricultural natural disasters (Gurenko and Mahul 2004, Mahul 2005), also informs much of what is presented in this chapter. The policy framework involves four main pillars: 1) developing clarity about market-based insurance versus social insurance; 2) assessing agricultural production risk; 3) financing agricultural production risk and, 4) institutional capacity building.

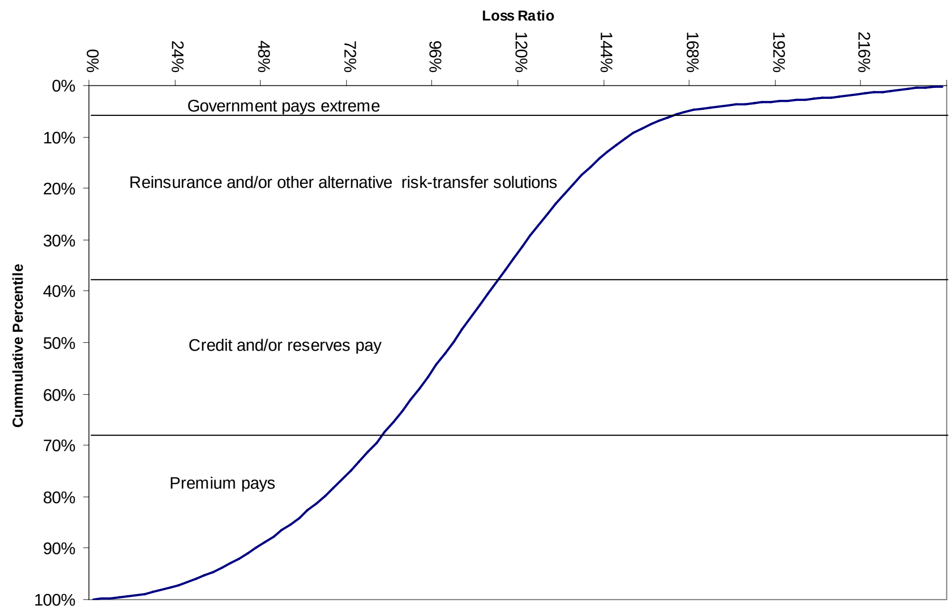
4.8. A common problem with many agricultural insurance programs is the lack of clarity regarding the objectives of the public intervention. This lack of clarity creates considerable inefficiencies. If the policy objective is to increase the incomes of rural households or to create a social safety net that assures some minimum level of income for farm households, agricultural insurance is a very blunt and inefficient instrument. Generally, these types of social policies involve direct transfers of wealth from the government to rural households. Insurance can be an effective risk management tool but it is generally not an effective tool for transferring wealth to economically disadvantaged rural households. Again, this is especially true for smallholders due to the high cost of risk classification, monitoring, loss adjustment, delivery, and administration for agricultural insurance. Insurance should be market-based and oriented toward profitable businesses that can afford to pay actuarially sound premiums. For these farm businesses, agricultural insurance can provide protection against insurable natural perils.

Agricultural risk Financing

4.9. Risk assessment is critical to understand the probable maximum loss and then *ex ante* risk financing to assure that adequate capital is organized to cover the worst case scenario. The focus of this section is on how to finance the risk where losses exceed premium income and the ability of the agricultural insurer to borrow or use insurance reserves to finance these losses.

4.10. Figure 4.2 provides general guidance regarding who should pay for different levels of risk. This figure represents the estimates for the loss ratio for Shanxi province from the risk assessment in Annex 3.[22] The hypothetical insurance company should be in a good position to retain lower levels of loss via insurance premiums. Given this figure, the lower losses that are occurring about 35 percent of time will have loss ratios where losses are less than 75 percent of the premium. The agricultural insurer generally should organize credit or insurance reserves for the next layer of losses where losses are between 75 and 110 percent of premiums. Beyond the 110 percent of premium, it is likely that reinsurance or other forms of risk transfer should be organized. Finally, for the most extreme losses (likely something less than 1 in 25 years and in this case around 200 percent of premium income), the government may serve as the reinsurer of last resort paying for the most extreme and infrequent levels of catastrophic loss. Diversification of the sales of insurance across crops and regions and increasing premium rates are mechanisms that can be used to change the frequency of losses that exceed premium income.

Figure 4.2 Risk Layering



4.11. Figure 4.3 illustrates the financing structure in a different format than what is presented in figure 4.2.

Figure 4.3 Financing the Different Layers of Risk

200% loss ratio and above	Government pays for losses
110-200% loss ratio	Reinsurance and/or other alternative risk transfer solutions pay losses
75-110% loss ratio	Credit and/or reserves pay losses

[22] Loss ratios referred to in this chapter in relation to layers of risk financing are intended to reflect typical “gross” premiums of insurance companies, which include an allowance for overhead and other costs (see chapter 3). The data presented in Figure 4.2 reflects indicative pure loss ratios, i.e. premiums prior to allowing for such costs.

0-75% loss ratio	Premiums pay losses

4.12. Since losses over 110 percent of premium income should be infrequent for a well developed and well priced agricultural insurance portfolio, this is a common level for many reinsurers to offer stop loss[23] coverage. However, for many agricultural insurers in China, it seems that these types of losses are going to be relatively frequent until they can scale up their business and increase the premium rates that they are charging. Still, estimating these layers of loss is subject to large differences among insurance underwriters and global reinsurers. There is some level of ambiguity regarding the most extreme losses as well. Added to this ambiguity is the need for any global reinsurer to understand the nature of the insurance business prior to being willing to actually absorb significant amounts of these risks. This type of due diligence adds to the cost of reinsurance premiums as well. Thus, the cost of transferring the most infrequent and extreme events can be five to ten times the expected annual average loss for those events. Additionally, as has already been demonstrated in China, the agricultural insurers are less likely to purchase this type of insurance because of a common tendency to underestimate the exposure to catastrophic risks.

4.13. There are many alternatives for dealing with risk financing of the upper layers of losses. Generally, the choices fall into four categories (not mutually exclusive):

- Risk transfer via traditional reinsurance in the global markets
- Risk transfer by government provision of reinsurance
- Risk transfer via other mechanisms that will be referred to as macro indexes
- Agricultural insurance pooling

Traditional Reinsurance

4.14. International reinsurers are demonstrating a keen interest in China (see Annex 6). Nonetheless, this is a recent phenomenon and it is too early to know how significant this activity may become in the future. It is a new experience for both Chinese agricultural insurance companies and global reinsurers. At this point, the reinsurers are likely testing the new markets that are emerging. Furthermore, the layer of risk that they are taking is not the extreme risk. These layers are often for 50 percent above 90 percent of premium income (see Annex 6). In Figure 4.2, this would be for layers between 90 and 140 percent of the loss ratios appearing on the horizontal axis. The risk assessment presented in Chapter 2 suggests that across individual provinces the loss ratio probable maximum loss (PMLs) values are considerably in excess of 140 percent of premium income. This seems to be true for almost any localized agricultural insurance company that is operating in China. It also appears that a major reason that some agricultural insurers are not purchasing reinsurance for extreme layers is likely an explicit or implicit understanding that central government or the provincial government will recapitalize the insurer in the event of large losses.

4.15. International reinsurers will bring the discipline needed to the emerging market for agricultural insurance in China. These reinsurers also have much international experience that could be useful for agricultural insurers in China. These are important contributions. However, there are concerns. International reinsurers will provide significant amounts of reinsurance only

[23] "Stop loss" coverage is the type of non-proportional (excess of loss) reinsurance normally used for protection of agricultural portfolios, in layers where the excess point and limit are defined in terms of the loss ratio.

if China's agricultural insurance products are transparent and reflect internationally-recognized best practices. Further, reinsurers will want to see that China's legal and regulatory systems are adequate to facilitate agricultural insurance markets. Finally, international reinsurance markets tend to be cyclical. If reinsurers experience large losses in a particular market (e.g., agricultural insurance in China) they generally respond by reducing the amount of reinsurance they are willing to offer in that market and/or significantly increasing reinsurance premiums.

Other Forms of Risk Transfer

4.16. Innovative alternative risk transfer products have been developed recently by capital markets. These include macro index insurance, catastrophe bonds, catastrophe options, and contingent debt. Global reinsurers are experimenting with some of these instruments. Given the experimental nature of these alternatives, they should not be considered as a core element of any plan for agricultural insurance in China. However, they have some potential and could be considered on an experimental basis for agricultural insurance in China.

4.17. While many of these risk transfer instruments may best be left to the market, it may also be useful for the central government to facilitate agricultural insurance by selling macro index reinsurance products to agricultural insurance companies. For example, the government could sell a province or sub-province level area yield reinsurance based on National Bureau of Statistics crop yield estimates for individual crops. The central government would be selling these macro insurance products and pooling the risk at a national level. The advantage of this approach, in comparison to a government provided stop loss, is that the central government would not need to perform any due diligence on each of the insurance companies. The central government could simply put these instruments up for sale and the insurance companies would have to sort out how to use them to transfer their catastrophic risk. Another advantage of having the central government sell such macro index reinsurance is that the central government would be pooling the risk at a national level. The diversification benefits of such pooling could reduce the premiums charged to agricultural insurers for the index reinsurance. If interest in index reinsurance develops, the government may consider offering the reinsurance only for extreme thresholds and allow global reinsurers to offer index reinsurance for thresholds closer to expected values.

4.18. For these types of macro index instruments to provide effective reinsurance protection, the agricultural insurance companies would need to understand the nature of their risk exposure and, in particular, what events are likely to create extreme insurance losses. The appropriate index might be based on a weather event such as cumulative rainfall over a period or an area yield. It might also be based on the cause of loss data at the province or sub-province level. Agricultural insurers would need to determine exactly which index is most closely correlated with their insurance losses. Even, if insurance companies do not purchase index reinsurance, it would likely be insightful for them to determine which indexes would provide the best reinsurance protection. This type of risk assessment would allow them to better understand what events are likely to cause extreme insurance losses. In short, simply considering macro index reinsurance alternatives would likely enhance the knowledge of various stakeholders. Thus, there is an inherent value to simply allowing the market to develop these products even if there are no purchases in the short-term. The other advantage in having some central government entity working to develop and offer macro index insurance instruments in the market is that these types of indexes could be used for other purposes beyond risk transfer for agricultural insurance companies. For example, in some cases they could be used by provincial and local governments for *ex ante* contingent financing of government costs associated with extreme catastrophic weather events. There is some precedent for such an approach with the FONDEN of Mexico (see Annex 1).

4.19. The macro index instruments can be based on a wide range of indexes. Among these are indexes based on satellite images as have been used to provide reinsurance for pasture and rangeland in both Canada (province of Alberta) and Spain (see Annex 1). Generally, the amount of risk transferred with these innovative instruments must be large enough that the premium income is sufficient to cover the fixed cost of developing the instrument. Thus, the use of these alternatives in the near future is likely quite limited.

Government Provision of Reinsurance

4.20. An alternative to direct premium subsidies is for the government to play a more direct role in risk financing. This type of activity is now occurring and in some cases there is a significant structure to the activity (see Annex 6). For example, in Zhejiang and Hainan government reinsurance is offered on a co-insurance basis for losses in excess of 200% up to 500% loss ratio and then the local government assumes 100% liability for catastrophe losses above a 500% loss ratio. It is not recommended to depend solely on the provincial government to finance catastrophe losses. Given the value of risk pooling across provinces, the Central government or some central business entity could potentially perform these services more efficiently. Of course, the government must proceed carefully in how they choose to do this.

4.21. A structured, government provided, stop loss reinsurance would be superior to *ad hoc* recapitalization of insurance companies following large losses. The current limited use of commercial reinsurance by agricultural insurers in China may be partially due to an expectation that the province insurance company will be recapitalized by the either the provincial or the central government should large losses occur. For agricultural insurers, uncertainty regarding government recapitalization is not desirable. Such uncertainty can result in serious mistakes and the potential to not have proper financing organized. More structure and transparency is recommended. This would both help facilitate more development of agricultural insurance and assure that needed capital is actually available for even the most extreme losses. There have also been previous instances where farmers had to be paid on a pro-rata basis when extreme losses occurred and the insurer could not pay the full indemnity due to inadequate access to capital. Such experiences will undermine farmer confidence in agricultural insurance.

4.22. Another advantage to having government assume a clear role in offering stop loss reinsurance for agricultural insurance companies is that global reinsurers would be in a better position to know precisely how much reinsurance they should provide. This could result in an increase in their role in providing protection against extreme losses. Nonetheless, there is a delicate balance between what the government can do for risk financing and how much these actions may crowd out the global reinsurance market. Once again, an objective should be to use the government in such a fashion to expand agricultural insurance while *crowding in* the global reinsurance market.

4.23. Either the central or provincial government could offer stop loss reinsurance for agricultural insurance companies. It is also possible that both levels of government could be involved. For example, the central government could offer a proportional stop loss for losses beyond 200 percent of gross insurance premium. If the proportion were 50 percent, then it would be up to provincial or local governments to determine if they were going to offer the other 50 percent or require the insurance companies to seek global reinsurance for this catastrophic risk. In either case, there would be clarity and such actions would send a clear message that this is the extent of government support for agricultural insurance – the government is not going to recapitalize insurance companies that fail to obtain adequate access to contingent capital. These structures would also more clearly guarantee that policyholders would receive the full indemnity due, even following extreme loss events.

4.24. Central government could offer the stop loss reinsurance either at no cost to the insurance companies or with some insurance premium rating principles applied. Focusing on the extreme risk levels does give better incentives to insurance companies to design appropriate products and perform the needed underwriting to control moral hazard and adverse selection. However, fixing the stop loss at the same levels for every region would generate larger government transfers for higher risk regions than for lower risk regions if the stop loss reinsurance were offered at no cost. One of the aggregate analyses that are performed assumes that the central government provides stop loss reinsurance for each province at 150 percent (see Annex 3). This means that all indemnities greater than 150 percent of premium collected would be paid by the government. If 10 percent of the crop value were insured, the estimated annual cost for this type of stop loss reinsurance would be around RMB550 million (US$68.8 million). However, in the event of extreme losses, the cost could exceed RMB3 billion (US$375 million). The value of the stop loss reinsurance would vary across provinces from just under 1 percent of the total premium for the lowest risk province to over 20 percent for the highest risk province. This occurs because the loss ratio PMLs are quite different across the various provinces (see Annex 3). Some careful consideration of classifying the risk and thresholds for a government provided stop loss is needed. For example, a target that the threshold should not trigger more than 1 in 25 years may be reasonable.

4.25. The most direct way to deal with the differential benefits of the stop loss reinsurance would be for the central government to charge the insurance companies a reinsurance premium that is based on findings from a risk assessment of each insurance company. The central government would effectively be creating a national risk pool. Furthermore the central government should be able to charge a lower premium than an international reinsurer for this layer of risk. Alternatively, if the stop loss reinsurance is provided at no premium cost, the level of the stop loss could be varied attempting to equalize the benefits across insurance companies. Those operating in lower risk provinces would receive reinsurance with a lower stop loss while those operating in higher risk provinces would receive reinsurance with a higher stop loss. Regardless, the government provided stop loss would be a direct benefit to the agricultural insurance companies as it will limit their maximum loss exposure and reduce the amount of commercial reinsurance that the companies need to purchase. This should, in turn, reduce the premium that agricultural insurance companies would need to charge farm households.

Insurance Pooling

4.26. The value of scaling up agricultural insurance was demonstrated in Chapter 2 by showing how much the PML might decline as an insurance company creates a larger insurance business within the same province and across multiple provinces. If this cannot be done by a single insurance company, it may be possible to create a pool of insurance companies that would have the same affect of lowering the aggregate PML. This would allow the pool of insurance companies to retain part of the agricultural risk within the country. An insurance pool could both improve the risk profile of the participating companies and serve as a vehicle for further collaboration on technical assistance and capacity building. The pool could approach the global reinsurance market with a greater volume of business and obtain reinsurance on the aggregate results after pooling.

4.27. Agricultural insurance pools could insulate this line of business, thus protecting the other lines of business against agricultural catastrophic losses. This “ring-fencing” is particularly important as the non-life insurance market in China is under development and its growth should not be jeopardized by excessive agricultural losses.

4.28. The problems with creating a pool are that each insurance company must fully trust the business practices of all participating members. This would require that each company perform due diligence on the other companies. Reinsurers are likely in a much stronger position to perform this activity on a company by company basis. The same affect can more easily be achieved by having the central government provide stop loss reinsurance at the most catastrophic levels. A pooling arrangement would be unlikely to emerge with MPCI given all of the management challenges of making sure that MPCI is implemented in a proper fashion for each participating insurance company. However, a national or regional pool among participating insurance companies in China may be more possible for select index insurance products since they are less prone to the dual problems of adverse selection and moral hazard.

4.29. CIRC has been promoting coinsurance pools in several provinces including Zhejiang since 2006 and Hainan planned for 2007. Under these programs, the provincial governments provide reinsurance protection against catastrophic losses. PICC and CUPIC are already providing insurance in several provinces, and benefiting from pooling of risks.

Agricultural Risk Financing Options for China

4.30. It is recommended that the central government experiment with a number of the approaches outlined above. It must be strongly emphasized that a combination of approaches will serve the goal of supporting agricultural insurance better than any single approach. One clear role for the central government is to continue to assure that the legal and regulatory environment is in good order to encourage global reinsurers to enter into risk financing arrangements with Chinese agricultural insurance companies.

4.31. There are many variations that can be presented for blending the approaches to risk financing. While it is premature to recommend any particular blending of the approaches, the following options could be considered:

- Central government could offer free stop loss reinsurance at a 50 percent proportion above certain extreme levels. The stop loss levels would be different based on the relative risk of the province and the reinsurance would be offered free. This would be the Central government subsidy contribution to agricultural insurance.
- Central government offers a fully priced stop loss for the other 50 percent proportional value or leaves it to the provincial or local government to facilitate reinsurance protection for the remaining 50 percent. In other words, the decision to provide more subsidies by paying for the other 50 percent of the stop loss layer offered by Central government would be left to the provincial governments.
- Central government could also offer macro index reinsurance products to fill the gap that is left by the base stop loss. These macro index reinsurance products should have better pricing traditional reinsurance and they could be purchased for other layers of risk as well.
- Global reinsurers would continue to fill in the gaps with reinsurance at the lower levels of stop loss.

4.32. This type of structure would modify what was presented in Figure 4.3 to what is presented in Figure 4.4. In this example, the stop loss for central government would begin at 200 percent of the losses above gross premium income. For 50 percent of these losses, the central government would provide the reinsurance for free as their contribution for subsidy. For the other 50 percent of these losses, the central government would either sell the stop loss reinsurance to the agricultural insurance company or to the provincial government that would then offer that portion of the stop loss for free to the insurance company. This could be the subsidy level for the provincial insurance company. These types of subsidies would be less distorting than a flat premium subsidy as the insurance company would have to pay more attention to the product designs and underwriting risks given that they would depend on a global reinsurer to provide reinsurance for the layer of risk below the central government stop loss threshold.

Figure 4.4: One Model for Joint Sharing of Catastrophic Financing Cost between Central Government and Either the Provincial Insurance Company or the Provincial Government

<table>
<tr><td>200% loss ratio and above</td><td>Central Government pays for 50% of catastrophic losses</td><td>Central Government sells reinsurance on the other 50% of catastrophic losses to either the insurance companies or the provincial government if they wish to add subsidies</td></tr>
<tr><td>110-200% loss ratio</td><td colspan="2">Reinsurance and/or other alternative risk transfer solutions pay losses</td></tr>
<tr><td>75-110% loss ratio</td><td colspan="2">Credit and/or reserves pay losses</td></tr>
<tr><td>0-75% loss ratio</td><td colspan="2">Premiums pay losses</td></tr>
</table>

This type of structure would facilitate many of the recommendations discussed in this report. First, this structure clearly facilitates a role for central government to pool and price extreme risk while leaving product development to the agricultural insurance companies. Second, central government or some national market entity would be offering either some extreme reinsurance or macro index reinsurance products for sale and this activity would serve as the mechanism for pooling risk at lower transaction costs than many other pooling alternatives. Third, provinces and local government can both facilitate more subsidies to the local insurance companies and finance these offerings by purchasing the macro index insurance or the stop loss from the central government. Finally, as long as the stop loss offerings are at relatively high levels, these activities should leave plenty of room for global reinsurers to enter the market and provide reinsurance protection for lower stop loss levels.

Product Development

4.33. The crop insurance products currently offered in China include Multi Peril Crop Insurance, and Named Peril Crop Insurance ("traditional products"). There is at present strong interest in index insurance in China.

4.34. The selection of a suitable product for any given circumstance depends on multiple factors: the nature and complexity of the risk(s) to be insured; the costs of risk classification and monitoring; the costs of loss adjustment and delivery (which is related to farm size); the technology level of farmers; the potential for linkages in product distribution and marketing; skills and training required by the insurer and distributor to support the product; and many other surrounding factors.

4.35. No single product solution will meet China's needs, due to the very wide range of climatic and farming conditions which exist throughout China. A variety of appropriate crop insurance products is required in each province. Further, no “retail” insurance product exists at present to insure certain complex risks, such as flood or typhoon. There is a need to segment those risks for which catastrophe disaster management, outside the scope of insurance, is needed, and those risks which can be taken on by the insurance sector. Within this framework, the government may want to assist the insurance sector in the areas of product development and capacity building. Specifically, the roles of crop insurance products in China are the following.

4.36. MPCI insurance is a viable option only for those areas where it is currently in use, which are restricted to the Heilongjiang Reclamation Group (HRG), Xinjiang Production and Construction Corps (XPCC), or other similar circumstances. These are special situations because, through their highly developed local infrastructure support, these state farms effectively pay much of the costs associated with controlling anti-selection and moral hazard, loss-adjustment, delivery, and administration. In some cases, state farms even provide insurers with access to contingent capital. In contrast, the experience of the PICC indicates that, absent such implicit subsidies, MPCI is likely not viable, especially for smallholders. This is consistent with international experience which has shown that MPCI cannot be successful unless heavily subsidized. MPCI is unlikely to be a viable insurance product for most farming areas in China.

4.37. Named peril crop insurance employs simplified systems of loss adjustment, involving measurement of percentage damage, soon after the loss has occurred. Objective procedures can be developed, which allow loss adjustment to be carried out by competent persons who do not always need to be agronomists. Named peril crop insurance holds a very important place in China’s future product mix, to address sudden-onset hazards, such as hail and frost. The main advantage of named peril crop insurance is that it can address those hazards, particularly hail but also frost and excess rain, which may be localized in occurrence, and which would carry a high basis risk from a weather index product. However, traditional named peril crop insurance is not well-suited to insuring against drought.

4.38. Weather index insurance offers some promise at a micro-level (individual farmer) product, but only for selected hazards. The product suffers from a very important drawback of basis risk, which limits the scope of its application. Weather index insurance will not be effective if crop losses are localized or not clearly correlated with a specific weather variable. Also, it is difficult to construct effective weather index insurance if losses occur due to complex interactions between multiple weather variables. For these reasons, it is recommended that the primary focus of micro-level index insurance development in China should be for drought in rain-fed crops. Further, China can build on international efforts to develop agricultural index insurance. These efforts have focused primarily on rainfall deficit index insurance. Whilst this drought product is not applicable to irrigated agriculture, there remain many areas of rain-fed production throughout China where drought is a significant peril. A second focus of weather index product development could be for specific crop types and specific time windows during the growth cycles of vulnerable crops, including prolonged cold conditions in crops such as cotton. Weather index insurance has many of the same cost advantages as named peril crop insurance, and is a highly flexible product. Where weather index insurance is feasible and basis risk is acceptably low, it should be encouraged as it can allow faster scaling up, due to its well documented simplicity of marketing and loss adjustment. It is important to note that, in spite of the interest in this product, index insurance has only targeted applications and does not provide a panacea to all crop insurance needs in China.

4.39. Area yield index insurance is a product which is most suited to those crop and hazard combinations where a peril, or series of more complex perils, simultaneously affects a crop in a particular region. These conditions are most likely to be found in wide-scale and uniform crop production systems, such as in rice production and in field scale crops such as cereals and oilseeds, or cotton. The product allows all perils to be insured. However, the availability of quality historical yield statistics is a pre-requisite to area yield index insurance, and this is a constraint in China. Data on a local scale would require careful assessment on a case by case basis, to determine the integrity of the data and lack of prior biases.

4.40. Internationally, it should be noted that index insurance is a new concept and still highly developmental. Global crop insurance premium is estimated at approximately $6.5 billion and weather index insurance or area yield insurance forms only a negligible proportion of this total.

4.41. The following priorities are suggested as a framework for crop insurance product development:

- A mix of existing crop insurance products and index products is needed to allow the expansion of crop insurance;
- Great care should be taken in considering expansion of MPCI products beyond the special situations where they are currently in place;
- Named peril crop insurance should be an important priority product, particularly for hail insurance and other sudden-onset hazards such as frost and excess rain;
- Index insurance should be prioritized to address drought in rain-fed crops, and as a second priority can be developed for specific weather exposures. It has only a limited range of applications but, because of its advantages, it should be developed wherever its main constraint of basis risk can be overcome. Although Chinese companies have been successful in accessing reinsurance to date, index products are expected to open up further access to capacity in future.

4.42. Considerable gaps remain in finding solutions to China's need for crop insurance products at the micro level (for sale to individual farmers). These gaps are mainly associated with flood and typhoon exposure. Further research into future insurance products for flood could be foreseen. This would require the categorization of China's flood exposure both by province and catchment basin, and by flood type (inundation, flash flood, typhoon originated flood, coastal flood), working with existing specialists in hydrological institutions. Research is in progress internationally to find possible solutions to allow risk transfer from major flood risks. In the case of typhoons, very large differences are found in damage due to variable wind, flood and water-logging associated with typhoons. Thus, basis risk would be quite high for a micro-level typhoon index insurance product. Although typhoons are being indexed at a macro scale, and derivatives developed to address other areas of property insurance, this does not provide a product to address localized damage caused by typhoon. Further research, building on international initiatives, can also be foreseen for China to participate in finding typhoon products adapted to agriculture.

4.43. In common with most countries, the uptake of livestock insurance is very low in China. Currently agricultural insurance companies are offering two very contrasting individual animal products. PICC and SAIC are offering basic animal accident and mortality cover against natural perils. Conversely, in Shanghai Municipality, the cattle, pig and poultry sectors are insured on a mandatory basis against epidemic disease and government slaughter order, and the insurer operates compensation on behalf of the municipal government authorities. CUPIC is also offering comprehensive livestock insurance including epidemic disease and government slaughter order.

4.44. Substantial scaling up of the existing individual animal insurance product is unlikely to be attractive to either clients or insurers. A fundamental difficulty exists in insuring farmers who have only a small number of livestock per household, and where mortality is highly dependent on the management of the livestock by the individual farmer. Further, it becomes very difficult to structure such a product to differentiate between routine mortality, for which insurance is not appropriate, and catastrophe cover. In short, the costs of providing individual animal insurance are likely to be excessive.

4.45. For livestock farms with large size production units (notably pigs and poultry, but also dairy cattle and herders) the option of herd-based deductibles for mortality insurance should be explored further. The introduction of a herd-based deductible (expressed either in terms of a number of heads of animals per event, or as a percentage of herd total sum insured per event) at a level which is designed to eliminate normal frictional losses (i.e., small claims) can allow insurers to offer much lower premium rates and to convert the product into a catastrophe-only insurance.

4.46. It should be noted that internationally livestock epidemic disease insurance in the private sector is very restricted, which reflects the difficulty of managing this risk, and associated catastrophe exposure. Commercial insurers and reinsurers are reluctant to consider such risks without clear understanding of the likely financial exposures from disease outbreak. Further, government slaughter order is specifically excluded in almost all international livestock insurance and reinsurance programs. Decisions surrounding government slaughter order to control the spread of epidemic disease are complex: governments rely on animal health departments to advise whether culling (slaughter order) is the most effective measure to control further outbreak and spread of the disease, or whether compulsory vaccination of all animals in the neighboring areas to the outbreak, would be more effective. Here experience has shown that the livestock industry is often resistant to vaccination as this automatically leads to a ban on the export of meat and livestock products and prefer compulsory slaughter especially where compensation levels for culled animals are high.[24] In view of the conflicting interests, livestock underwriters are naturally reluctant to assume open-ended liability for government slaughter order.

Operational and Technical Assistance

4.47. The future development of agricultural insurance in China will likely be strongly decentralized, building on the strengths of the provincial insurers. Further, there are strong provincial organizations specialized in agronomy, animal husbandry, meteorology, hydrology and statistics which are well placed to service the technical requirements of the agricultural insurers. In each province, there is a strong base to develop risk management solutions, and insurance products, which are adapted to local needs. However, there is a common need, in all provinces, for wider access to technical and operational assistance to support capacity development within the agricultural insurance companies. In particular, there is a common demand for access to international experience in agricultural insurance to allow knowledge transfers regarding best practices. This would, no doubt, facilitate the development of agricultural insurance solutions for China.

4.48. A central service in China, a Technical Support Unit (TSU), should be established in China, in order to provide specialist services to agricultural insurance companies. This unit should have support from the Central Government and linkages to the Provincial Governments, insurers and reinsurers. It would have the following objectives:

- To create a Centre of Expertise within China, able to support rapid development and scaling-up of agricultural insurance in each province and nationally.

[24] The debate over culling or vaccination was a major political issue in the 2001 foot and mouth disease (FMD) outbreak in the United Kingdom and farmers successfully lobbied against vaccination. There is also evidence that some farmers deliberately infected their herd with FMD to obtain the above average market price compensation paid by the government for culling.

- To establish a core staff, able to provide technical support to agricultural insurers, principally in the specific areas of product identification, product design, product pricing and in modeling catastrophe risk exposures for risk financing and rate making purposes.
- To create a centralized data base for China of agricultural crop, livestock, forestry and aquaculture production and yield statistics, production damage loss data and animal mortality statistics and meteorological weather data, with the purpose of making this data available to agricultural insurance practitioners to assist them in the design and rating of new products and policies.
- To create linkages, centrally and for the provinces, to international agricultural insurance organizations and associations, in order to promote exchange of expertise through sharing of information and written materials, and through exchange of technical staff.
- To establish training courses, course materials, and operational manuals.

4.49. External support for the TSU would come from both (a) international agricultural insurance organizations and associations and (b) specialist consultants. In view of the shortage of consultants specializing in international agricultural insurance, the linkages with international agricultural insurers and associations may provide the best method to facilitate the exchange of operational technical experience, and staff able to support training courses.

4.50. The TSU would be intended primarily to promote technical support services, rather than policy framework or reinsurance needs[25] of agricultural insurers. Reinsurance relationships are developing in the private market, which is a strong benefit for agricultural insurers. Whilst reinsurers may be willing to provide some specific advice on subjects such as pricing and product design, most reinsurers are not set up to provide the comprehensive technical support needed in China. Commercial relationships with reinsurers would therefore be bilateral with agricultural insurers, but the TSU would also promote contact with those reinsurers willing and able to support the common objectives for the industry provided by the TSU. Reinsurers would be invited to contribute to training courses, and facilitate contact with international agricultural insurers with whom they have existing relationships.

4.51. Although the focus of the TSU, noted above, is proposed as product identification, product design, and product pricing, the TSU would also be concerned with operational support especially in the design of field-level loss adjustment procedures, and in advising on distribution linkages. These latter functions are an integral part of product identification and design, in planning the feasibility of any agricultural insurance program.

4.52. The TSU should establish a central database of information relevant to its activities. The database would include insurance statistics, official government statistics on crop, livestock, forestry and aquaculture production, production risk, and losses, and meteorological data. It would also establish a library of reference materials able to support its activities.

4.53. The TSU could be housed in an insurance environment. Options could be within the Insurance Association of China. The TSU should be free from any commercial interests, and able to serve any client company. Housing the TSU in an existing organization would allow the sharing of overhead services, and reduce the need for separate infrastructure and cost.

4.54. A manager would be appointed to spearhead the development of the TSU. This is a key position, as the initial development of an effective TSU will be dependent on the skills of this

[25] The specialist international agricultural reinsurance brokers including Aon, Guy Carpenter, Benfield, and Willis are best placed to assist Chinese insurers in the design and placing of structured reinsurance solutions.

person. The manager would report to a small board, to provide direction. He or she would be responsible for establishing linkages with the provincial insurers, reinsurers, consultants and international organizations including agricultural insurers. Staffing (in terms of number of persons, and requisite skills) for the TSU would need to be determined following consultation with CIRC and interested parties. However, it is anticipated that such a TSU could consist of approximately five specialists, reporting to the manager: a crop product design specialist; a livestock product design specialist; a pricing and risk modeling specialist; a training and extension specialist; and a data management specialist.

4.55. International technical assistance would be necessary, especially during the implementation phase of the TSU. The existence of the TSU should not preclude that any provincial insurer could establish their own relationships, bilaterally, with either agricultural insurance organizations, or consultants. The market in China will best expand if private sector activity is permitted to proliferate. However, there should be a strong interest amongst all parties, to acknowledge the need, and the benefits, of a centralized TSU.

4.56. Financing of the TSU could be through central government for core overheads. The budget for specific services could be through charging client provincial insurance companies, who would be free to make appropriate budget arrangements with provincial authorities to co-finance. Further, the TSU could seek international support from the World Bank, or other donors, for start up assistance.

Legal and Regulatory Framework

4.57. China currently has an Insurance Law that serves the dual purposes of governing the contractual relationship between the parties to an insurance contract and providing a framework for the regulation and supervision of insurance business and insurance intermediaries by CIRC. The Insurance Law, which was enacted in 1995, is supplemented by a large number of Insurance Regulations that have been issued by CIRC. These Regulations establish more detailed regulatory requirements for insurers and insurance intermediaries.[26]

Scope and Extent of Proposed Agricultural Insurance Law

4.58. The Insurance Law promulgated in 1995 is currently being reviewed and it is likely that this will result in a significant revision of the Law. However, it is understood that agricultural insurance is not included in the revision exercise. This is perhaps because article 149 of the Insurance Law states that agricultural insurance shall be provided for separately by other laws and administrative regulations and it is understood from CIRC that it is anticipated that the revised Insurance Law will continue to contain this provision.

4.59. It is also understood that, as part of its commitment to the development of agricultural insurance, the Government of China will be considering the development of an appropriate legal and regulatory framework. This may include the development of a new Agricultural Insurance Law and Regulations as envisaged by the new Insurance Law.[27]

[26] It is beyond the scope of this project to undertake a full review of the Insurance Law and all of the Regulations that have been promulgated by CIRC. In any event, the mission has not been provided with any of the Regulations, although some are available in English translation on the CIRC Website. However, some detailed observations and comments on the Insurance Law are contained in Annex 4.

[27] The World Bank team has not been provided with any information concerning the intended scope of the proposed new agricultural insurance law.

4.60. An agricultural insurance law is often enacted for one or more specific purposes, such as to provide for subsidies, to establish an insurance pool or to establish a specific program such as the US Group Risk Plan. It is usual for insurers who are subject to these specific agricultural insurance laws to also remain subject to the general insurance law. This may well be the intention of the China Government. However, the wording of Article 149 of the Insurance Law of 1995 appears, in translation, to envisage a wholly separate Agricultural Insurance Law that will apply to agricultural insurance in the place of the Insurance Law, rather than as a supplement to it and this seems to be also the perception of some insurers. There is, therefore, at the very least, confusion as to the meaning of Article 149.

4.61. Although, there are some differences between agricultural insurance and other forms of general insurance, the principles governing the regulation and supervision of general insurance, and insurance contracts, are largely applicable to agricultural insurance. Given the considerable overlap, there is a strong argument for clarifying that the Insurance Law is applicable to agricultural insurance, but enabling different provisions to be made for agricultural insurance, where appropriate, through regulations made under the Insurance Law or, if considered necessary, through the proposed agricultural insurance law. Given that this would require some amendment to the Insurance Law, and in particular article 149, it is recommended that the overarching objectives of the proposed agricultural insurance law should be considered as part of, or concurrent with, the more general review of the Insurance Law now taking place.

4.62. There are no clear international precedents for a general agricultural insurance law. Therefore, if the central government decides that such a law is necessary or desirable, it would be important to tailor that law given the policy goals of the Chinese government. It would likely be unwise to turn to any other country for ‘model agricultural insurance legislation’ as such legislation simply does not exist.

Policy Objectives

4.63. Where there is a need for legislation, governments are often tempted to treat the development of policy and the development of legislation as part of the same process. This approach is not recommended with respect to agricultural insurance. The purpose of legislation is to give effect to and implement policy. It may be premature to commence drafting legislation until policy has been determined. A significant number of policy options have been presented in this report. The Government should therefore consider whether it is ready to develop agricultural insurance legislation at this stage. If the Insurance Law was to be amended to enable regulations to make specific provision for agricultural insurance where necessary, there would not be an urgent need for specific agricultural insurance legislation, which would provide time for the policy issues to be thoroughly explored and investigated before the drafting process commences.

Framework and Legislation

4.64. Governments are often inclined to prepare detailed legislation in an attempt to provide for all circumstances and contingencies. However, detailed legislation quickly becomes out of date and needs to be brought back to Parliament for amendment as circumstances change. As discussed in Annex 4, the current Insurance Law contains a number of detailed provisions that are no longer appropriate. In most countries, it is a difficult and time-consuming process to amend primary legislation. Parliamentary time has to be allocated, often long in advance, and with competing demands for that time. This deprives the legal framework of flexibility. It would therefore be better for the proposed agricultural insurance law to be developed as framework legislation that sets out the overarching principles, the details being contained in supporting regulations issued by CIRC as the regulator.

4.65. This will enable the regulatory framework to be adapted more quickly. This is particularly important for the following reasons:

- As discussed in Chapter 3, international standards can be expected to evolve further, particularly with respect to microinsurance and index-based insurance. It is important that the regulatory framework can be adapted reasonably quickly to accommodate those changes.
- Given the agricultural diversity in China, it is likely that a number of different agricultural insurance products may need to be developed over time. If the proposed agricultural insurance law is detailed, rather than principles based, there is a risk that the development of new products not currently envisaged may require the amendment of the Law.
- As the agricultural insurance market matures, the regulatory regime will need to be adjusted.

4.66. Great care should be taken to draft laws and regulations that are clear and that can be understood not just by the courts but also by the insurance industry and insured policyholders. A lack of certainty may lead to differing expectations between insurers and policyholders on critical issues such as the liability to pay claims. A lack of certainty will lead to a loss of confidence the market and to a reduction in demand for agricultural insurance.

Index-based Insurance

4.67. The Insurance Law does not specifically provide for index-based insurance. Index-based insurance has certain special characteristics that present legal and regulatory challenges different to those presented by traditional agricultural insurance. In particular, it is a fundamental and universal principle of insurance law that an insurance payment is made to indemnify or compensate for loss. In most jurisdictions, the insured must have an insurable interest in the property insured. The payment made under an index-based insurance policy is dependant upon the underlying index. To that extent index-based insurance is indistinguishable from a derivative. However, there must be a reasonable correlation between the index and the loss sustained by the insured for an index-based product to be classified as an insurance product. However, the correlation between the index and the insured's loss can never be perfect and the payment under an index-based insurance contract cannot therefore properly be classified as an indemnity.

4.68. Article 2 of the Insurance Law, in the English translation, provides that "insurance . . . means a commercial insurance whereby "... the insurer bears a liability to indemnify for property damage or losses caused by occurrence of possible accidents that are agreed upon in the contract." This article, if the translation is accurate, could be interpreted as creating a legal impediment to index-based insurance. Furthermore, the Insurance Law contains a number of articles that, although not necessarily a legal obstacle to index-based insurance, if interpreted strictly could make it impracticable. These are discussed more fully in Annex 4.

4.69. It is therefore recommended that the central government should include a study of the legal and regulatory issues and challenges raised by index-based insurance in the current review of the Insurance Law.

Operational Framework

4.70. The key operational functions of the insurance company with consideration of the multiple stakeholders are summarized in Figure 4.5. It brings all of the stakeholders and their facilitation of important functions for the insurance company into one picture so that everyone can see the role of the different stakeholders in making crop insurance more accessible to small farmers

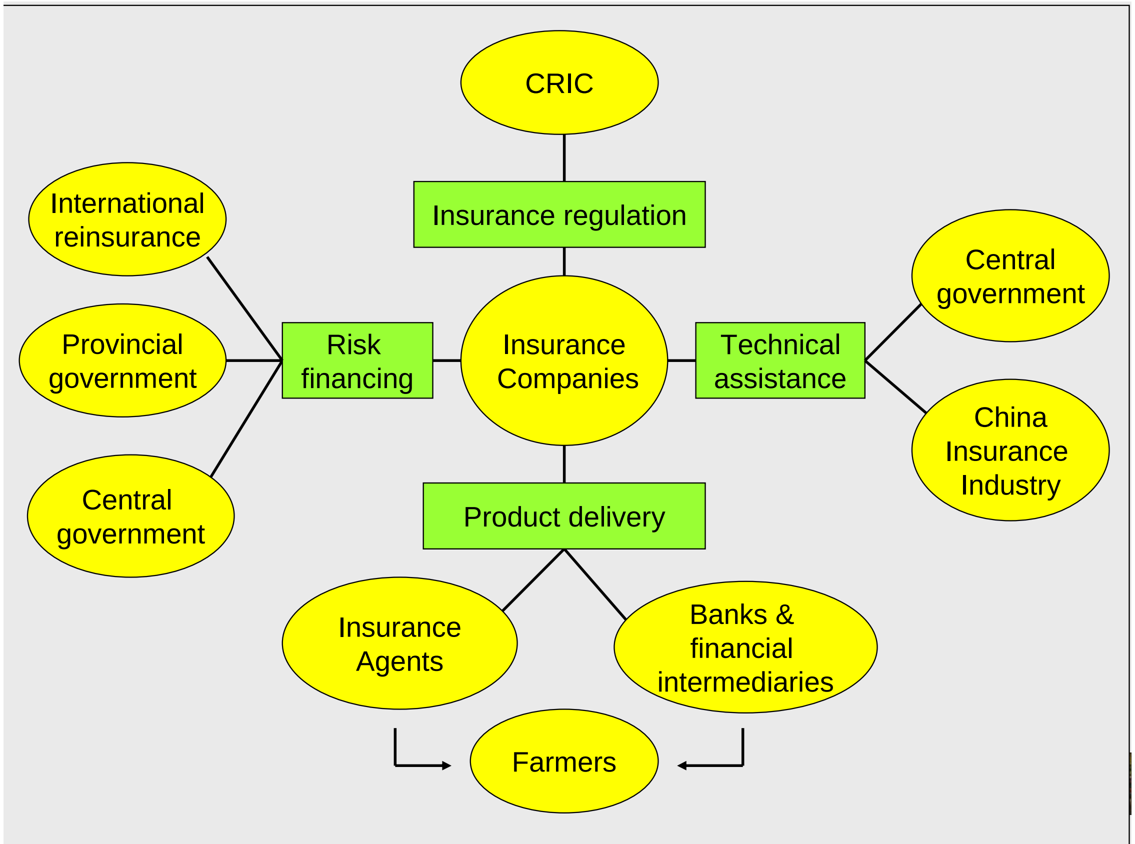
1) Product delivery and product development are key functions. Named peril and index-based insurance products should be key products if small farmers are to be served in a cost effective fashion. Further, bank and financial intermediaries should be involved in selling agriculture insurance to further reduce delivery costs.

2) Technical assistance should be national in scope in order to take advantage of the learning that takes place in many different regions of China. While Central government can be involved, it is more appropriate to try to create a service entity using, for instance, the Insurance Association of China. This entity could sell services to all firms and bring the knowledge, data, software, and other services together in a much more cost effective fashion than insurance companies performing these services on their own.

3) The insurance regulatory service deserves a special function. In this case, only one primary entity is involved in facilitating that activity – China Regulatory Insurance Commission.

4) Risk financing is where this chapter begins and where it ends. The chapter introduces multiple ideas about how to assure that extreme losses can be paid. These ideas involve both Central and Provencal government as well as international reinsurers.

Figure 4.5: The Operational Functions of the Insurance Company with Consideration of the Multiple Statehoods



Chapter 5: Summary Conclusions

5.1. This chapter summarizes the key outcomes and conclusions on the technical, financial and operational review of the existing agricultural insurance programs in China. It aims at providing suggestions, based on international best practice, which the central government and provincial governments as well as insurance companies could consider to make agricultural insurance more attractive to small farmers so as to increase the agricultural insurance penetration and to develop financially viable insurance programs without relying on heavy government subsidies.

Conclusions

5.2. ***The Government of China (GoC) is working on the development of agricultural insurance through a series of provincial pilot initiatives***. The GoC has reiterated its commitment to agricultural and rural developed in the 11th Five-Year-Plan. In particular, GoC recognizes the importance of revitalizing the agricultural insurance industry and has undertaken a series of pilot projects to test different models of insurance. These pilots are currently under implementation in several provinces: Heilongjiang, Xinjiang, Jiangsu, Shanghai, Jilin, Xinjiang, Zhejiang, Sichuan, and Hainan. The China Regulatory Insurance Commission (CIRC) has also approved the launch of specialized agricultural insurance companies in Shanghai, Jilin and Heilongjiang provinces. The Ministry of Finance has recently approved a budget of RMB1 billion (US$250 million) for the financing of a premium subsidy program in selected provinces: Jiangsu, Jilin, Xinjiang, Hunan, Sichuan, and Inner Mongolia. The Ministry of Agriculture is also considering the financing of its own set of pilots.

5.3. ***China is facing key challenges in the development of agricultural insurance.*** These challenges, similar to those faced by many other countries who want to promote agriculture market-based insurance, are summarized below.

5.4. ***National agricultural insurance uptake is low.*** In 2005, the agricultural insurance premium volume approximated RMB729 million (US$91.1 million), that is less than 0.5% of the estimated potential agricultural insurance premium from a nation-wide MPCI program and about 0.6% of national non-life insurance. On the supply side, agricultural insurance is only available in a few provinces. The history is dominated by prior agricultural insurance activities, which were heavily influenced by public sector interventions. On the demand side, the majority of Chinese farmers lack awareness and education related to insurance in general and crop/livestock insurance in particular.

5.5. ***Insurance is not currently geared towards small farmers***. The majority of the present insurance premium is derived from farmers insured in former military reclamation areas, and where individual grower crop MPCI programs are feasible because of the unique features of the reclamation areas, large farm structure and the organization of agriculture. These MPCI products are not well suited to wide-scale replication with small farmers outside the reclamation areas.

5.6. ***China's crop risk profile shows great differences in risk across crops and geographic areas*, *but drought remains the principal cause of crop yield losses in most provinces.*** Risk exposure for small and geographically concentrated crop insurance companies can be high, and it can still remain high for a well diversified book of crop insurance business within a single province because of the high level of covariate risk like droughts, floods and typhoons. However, pooling agricultural risks across the country can significantly reduce the peak risk exposures.

5.7. ***Insurers have limited financial capacity to deal with catastrophic losses***. Domestic insurers are exposed to catastrophe risks and have limited opportunity to diversify their portfolios. Several Chinese agricultural insurers are involved in the purchase of international reinsurance and/or co-reinsurance arrangements with local governments. However, the level of private reinsurance cover does not seem to be adequate to protect against catastrophic losses.

5.8. ***Crop insurance products currently available are mainly multiple-peril crop insurance products (MPCI).*** A key product offered at present is MPCI, which is enabled by the linkages to reclamation groups. Named peril crop insurance is also offered in China on a limited basis.

5.9. ***Livestock insurance is a minor class of the agricultural insurance business.*** Several companies underwrite individual livestock policies for cattle, pigs, sheep and goats, poultry and aquaculture, but the premium volume is less than 8% of total 2005 agricultural insurance premiums volume.

5.10. ***MPCI products are under-priced and do not allow for price differentiation***. While it was not possible to conduct a detailed review of the risk analysis and rating methodologies adopted by the insurance companies, it appears that most companies are currently offering single rates for each crop type with little or no differentiation according to regional risk exposure and results. In addition, the risk assessment conducted under this study shows that domestic insurers tend to under-estimate the underlying crop yield risks and, therefore, they may under-price their products. A fundamental best practice of agricultural insurance involves risk classification and differential premium rates based on those risk classes. Further difficulties arise from the use of individual farmer yield assessment against area based insured yields, giving rise to anti-selection.

5.11. ***Domestic insurers have limited access to technical services and international agricultural insurance expertise.*** Provincial insurers have limited access to technical insurance services in specialist areas such as product design, ratemaking, underwriting, loss adjustment, etc. Chinese insurers have had little contact with the international insurance and reinsurance community, to share experiences in program and product design, and for technology transfer.

5.12. ***Crop insurance products like MPCI are generally subsidized***. The provincial governments provide financial support to the agricultural insurers in the form of up-front premium subsidies and/or catastrophe reinsurance protection. The Central Government has recently approved a RMB1 billion (USD125 million) premium subsidy program for selected provinces.

5.13. ***Public support is not geared to provide insurers with incentives to improve their operations and expand their services to small farmers.*** Public support to agriculture insurance is mainly through direct premium subsidies. This does not create incentives for agricultural insurers to provide better services to existing insured farmers and to offer new products tailored to small farmers.

5.14. ***Premium subsidies, as currently allocated, may not foster the development of agriculture insurance among small farms***. The budget allocated by the central government and the provincial government for agricultural insurance mainly focuses on premium subsidies. These subsidies may be mainly captured by large insured farms and do not benefit small uninsured farmers.

5.15. ***There is currently no legal and regulatory framework for agricultural insurance***. The present insurance law includes no specific provisions for agricultural insurance; hence insurers operate without a firm legal framework. The Insurance Law is currently being reviewed but agricultural insurance does not seem to be included in the revision exercise.

Key Challenges Facing Agricultural Insurance Industry in China

5.16. These challenges, which are also faced by many other countries, can be overcome over time through an appropriate agriculture risk management framework relying on a strong partnership between the central government, the provincial governments and the insurance companies. This public-private partnership is based on three pillars: agricultural insurance product development; agricultural risk financing; institutional capacity building.

Agricultural insurance product development

5.17. ***No size fits all.*** No single product solution will meet China's needs, due to the very wide range of climatic and farming conditions. A variety of appropriate crop insurance products is required in each province. As a result, a mix of existing crop insurance products and index products is recommended to allow for the expansion of crop insurance. A structure whereby products are developed within each province will increase the likelihood that tailored agricultural insurance products will be developed to match the great diversity of agriculture in China.

5.18. ***MPCI is unlikely to be a viable insurance product for small farmers in China***. International experience has highlighted several drawbacks with individual MPCI, including the absence of farmer-level yield time-series, leading to the common practice of establishing yields on district average yields, thus generating adverse selection. MPCI may be a viable option only for those areas where the operating costs can be supported by highly developed local infrastructure, such as the Heilongjiang Reclamation Group and Xinjiang Production and Construction Corps.

5.19. ***New crop insurance products should be specifically developed for small farmers***. These products should offer effective and affordable insurance to small farmers and should focus first on the financing of catastrophic losses.

- ***Named peril crop insurance.*** Named peril crop insurance employs simplified systems of loss adjustment, involving measurement of percentage damage soon after the loss has occurred. This type of product could cover sudden-onset hazards such as hail, frost and excess rainfall at a competitive price.

- ***Weather index insurance.*** Weather insurance offers some promise, but only for selected hazards like drought. Weather index insurance is only effective when basis risk (i.e., potential mismatch between actual losses and indemnities) can be minimized. It is also very difficult to design an effective weather index insurance product if losses are caused by a complex interaction between multiple weather variables. For these reasons, the primary focus should be for drought in rain-fed crops. A second focus could be for specific crop types and specific time windows during the growth cycles of vulnerable crops, including prolonged cold conditions for cotton.

- ***Area yield index insurance.*** Area yield insurance should be investigated. Area yield index insurance is a product which is most suited to those crop and hazard combinations where a peril, or series of more complex perils, simultaneously affects a crop in a particular region. These conditions are most likely to be found in wide-scale and uniform crop production systems, such as in rice production and in field scale crops such as cereals and oilseeds, or cotton. The product allows all perils to be insured. However, the availability of quality historical yield statistics is a pre-requisite to area yield index insurance.

5.20. ***Livestock insurance products and services should be studied in the light of international best practice***. Specific issues which should require particular attention include: (i) the provision of epidemic disease cover and government slaughter order, which are usually excluded by international reinsurers; (ii) herd-based covers/deductibles for larger livestock production units (cattle, pigs and poultry); (iii) rates and deductibles set at actuarially sound levels.

5.21. ***Agricultural insurance solutions should be provincially based.*** Given that risks, crops and farming practices are mainly province-specific, agriculture insurance solutions should be developed by and adapted to each province. Provincial governments and local insurers should play a central role in fostering innovative agriculture insurance programs.

5.22. ***Insurers should perform a formal portfolio risk assessment.*** Insurers should conduct a formal assessment of the catastrophic risk exposure of their portfolio of insurance business. This would allow them to identify peak exposures in their portfolio, to rebalance their portfolio and to structure cost-effective risk financing strategies (including risk retention and reinsurance purchasing), leading to an increased capacity to sustain catastrophic losses.

5.23. ***Agricultural insurance ratemaking techniques should be revisited in the light of international best practice.*** Insurers could consider using actuarially sound rating techniques consistent with international best practice and with Chinese conditions. The methodology should be designed to achieve actuarially-sound premium rates that are stable yet reflective of regional differences and responsive to changes in risk over time.

Agricultural risk financing

5.24. ***Fostering commercial agricultural reinsurance capacity.*** The provincial and central governments should further promote access to agriculture insurance to local reinsurer (e.g., China Re) and international reinsurers in order to increase commercial agricultural reinsurance capacity.

5.25. ***The government should contribute in the financing of losses that cannot be transferred to the private market at acceptable costs***. The government should focus on catastrophic losses, acting as reinsurers of last resort, when the financial resources of the domestic insurance industry are scarce and the access to international reinsurance markets is limited. This risk transfer arrangement should allow insurance companies to build up reserves and to retain larger layers of risk over time. The resulting risk exposure of the government should be adequately financed through an appropriate country risk financing strategy including, e.g., reserve funds and contingent debt facilities provided by international institutions like the World Bank.

5.26. ***The role of the central government and provincial governments in the financing of catastrophic risks in agriculture should be clarified.*** If central government wishes to offer a subsidy to local insurance companies, the central government could offer free stop loss reinsurance at an agreed proportional level above certain extreme levels (based on the relative risk of the province) to the provincial government or the provincial insurance companies. The central government could also sell stop loss reinsurance for the remaining proportion. The provincial government could buy this stop loss reinsurance for their local insurers. This would be the provincial government subsidy contribution to agricultural insurance. The most direct reinsurance stop loss would be based on the book of business for the local insurance companies or an indemnity-based policy. This could be supplemented with an index-based (macro index insurance) form of reinsurance. Finally, if central government does not want to offer a subsidy, they can still perform a useful risk pooling function by selling the entire level of stop loss reinsurance to either the provincial government or the local insurance companies at a fair premium.

Institutional capacity building

5.27. ***A Technical Support Unit should be established as a central agricultural insurance service provider***. This unit should have support from the Central Government and linkages to the Provincial Governments, insurers and reinsurers. This center of expertise would provide market services for a fee to support rapid development and scaling-up of agricultural insurance in each province and nationally. It would provide technical support and training in the specific areas of product identification, product design, risk assessment and product pricing.

5.28. ***A centralized agricultural database for China should be created***. This database would include agricultural crop, livestock, forestry and aquaculture product and yield statistics. Production damage loss data and animal mortality statistics and meteorological data, with the purpose of making this data available to agricultural insurance companies.

Government support and public subsidies

5.29. ***On-going pilot initiatives on agriculture insurance should be better coordinated***. The Central Government, through the Ministry of Finance, and the provincial governments, through their Finance bureaus, are piloting a series of agriculture insurance initiatives. These pilots should be better coordinated and be implemented as part of a national policy framework for the development of agriculture insurance.

5.30. ***A public subsidy program should be developed to create incentives for agricultural insurers to expand their services to small farmers.*** Public support should focus on the development of risk market infrastructure and public goods that will give agricultural insurers incentives to offer affordable and effective insurance to farmers, and particularly small farmers. This may include the support of a Technical Support Unit, the development of a centralized agricultural database, the development of new delivery channels to reach small farmers, the development of promotional and educational programs, etc. Financial incentives, such as direct premium subsidies, could be targeted to small farmers as part of a social program, but they should not support unsustainable farming activities.

5.31. ***Targeted premium subsidies could support marginal farmers as a social tool.*** Premium subsidies could be targeted to marginal farmers under a social program. However, they should be combined with the promotion of risk mitigation activities (e.g., drought resistance seed, etc.).

5.32. ***Government reinsurance should complement private reinsurance.*** Public subsidies for reinsurance should be made available for risk layers that cannot be transferred to the reinsurance market at acceptable costs or for which reinsurance capacity is unavailable. This is usually the cease for top (catastrophic) layers where the government could act as a reinsurer of last resort.

5.33. ***The Government should facilitate the pooling of agricultural risks***. Provincial agricultural co-insurance pools, like those established in Hainan and Zhejiang, should be supported by the provincial governments in order to help local companies reduce their risk exposure. A national agricultural insurance pool, promoted by the Central Government, could help insurers and provincial governments to further reduce their risks. However, these insurance pools should be designed to ensure that cross-subsidization is kept to a minimum and remain negligible compared to the benefits provided by the pooled portfolios.

5.34. ***National and provincial governments should study carefully the financial implications of any public support*** as the provincial agricultural insurance programs expand in order to avoid huge fiscal costs of highly subsidized mature agricultural insurance programs such as the USA, Canada or Spain. It is estimated that if China were to adopt a US-like MPCI program, the total cost of crop insurance subsidies would exceed US$9 billion per year.

5.35. ***An appropriate legal and regulatory framework should be developed to support agricultural insurance***. Although there are some differences between agricultural insurance and other forms of general insurance, the principles governing the regulation and supervision of general insurance, and insurance contracts, are largely applicable to agricultural insurance. Given the considerable overlap, it is recommended that the Insurance Law is applicable to agricultural insurance, but enabling different provisions to be made for agricultural insurance, where appropriate, through regulations made under the Insurance Law or, if considered necessary, through the proposed agricultural insurance law. The legal and regulatory framework should also allow index-based products, like weather index products, to be classified as insurance products when there is a reasonable correlation between the index and the insured's loss and the principle of insurable interest is met.

Glossary

Accumulation	The concentration of similar risks in a particular area such that an insured event may result in several losses occurring at the same time.
Actuarial	Branch of statistics, dealing with the probabilities of an event occurring. Actuarial calculations, if they are to be at all accurate, require basic data over a sufficient time period to permit likelihood of future events to be predicted with a degree of certainty.
Ad hoc Response	Disaster relief arranged in the aftermath of a disaster. Ad hoc responses are generally less efficient than planned responses or a well-designed risk management framework.
Adverse Selection	Adverse selection occurs when potential insurance purchasers know more about their risks than the insurer, leading to participation by high risk individuals and non-participation by low risk individuals. Insurers react either by charging higher premiums or not insuring at all, as in the case of floods.
Agricultural Insurance	Insurance applied to agricultural enterprises. Types of business include crop insurance, livestock insurance, aquaculture insurance and forestry, but normally exclude building and equipment insurance although these may be insured by the same insurer under a different policy.
Area-based Index Insurance	The essential principle of area-based index insurance is that contracts are written against specific perils or events (e.g. area yield loss, drought, or flood) defined and recorded at a regional level (e.g. at a county or district level in the case of yields, or at the local weather station in the case of insured weather events). Indemnities are paid based on losses at the regional level rather than farm level.
Asset Risk	Risk of damage or theft of production equipments and assets.
Asymmetric Information	An information imbalance due to one party in a transaction possessing more or better information than the other party (parties), such as knowledge of hidden costs or risky behavior. Buyers of insurance products typically have better information about their level of risk exposure, which they may hide from insurers in order to gain lower premium rates.
Basis Risk	The risk that the with index insurance, the index measurements will not match individual losses. Some households that experience loss will not be covered and the risk that households that experience no loss will receive indemnity payments. As the geographical area that is covered by the index increases, basis risk will increase as well.
Capacity	The maximum amount of insurance or reinsurance that the insurer, reinsurer or insurance market will accept.
Catastrophe	A severe, usually sudden, disaster which results in heavy losses.
Ceding company	A direct insurer who places all or part of an original risk on a reinsurer
Claim	An insurer's application for indemnity payment after a covered loss has occurred.
Cognitive Failure	In the case of decision-making in risk management, cognitive failure occurs when decision-makers fail to account for the possibility of

	infrequent catastrophic risks.
Co-insurance	1. The situation where the insured is liable for part of each and every loss, which is often expressed as a percentage of the sum insured. 2. When several insurers each cover part of a risk.
Collective policy	A policy issued on behalf of a number of insurers or a policy covering a number of items, each being insured separately.
Commission	A proportion of the premium paid by the insurer to the agent for his services in procuring and serving the policy-holder.
Correlated Risk	Risks that are likely to affect many individuals or households at the same time. A clear example is a fall in commodity price. Coffee growers in the same community are likely to be simultaneously affected by a decrease in price. Futures and options markets can be used to transfer these risks to parties outside the local community. Another example is a widespread drought, which can damage agricultural production over an entire region.
Country Risk Profile	The level of risk exposure of a country determined by the occurrence of events such as price shock and adverse weather events that impact major private and public assets and economic activities within a country at the micro, meso and macro levels.
Crop Insurance	Provides financial compensation for production or revenue losses resulting from specified or multiple perils, e.g., hail, windstorm, fire, flood. While most crop insurance pays for the loss of physical production or yield, coverage is often available for loss of the productive asset such as tree crops.
Deductible (Excess)	An amount representing the first part of a claim which an insured has to bear as stated in the policy. The deductible is usually expressed as a percentage of the sum insured, but may equally be a monetary amount.
Default	Failure to fulfill the obligations of a contract
Direct Premium Subsidy	A subsidy which is calculated as a percentage of the insurance premium paid. Such a subsidy is problematic because it disproportionately benefits high risk farmers who pay higher premiums. Attracting higher risk farmers can significantly increase the costs of insurance.
Disaster Index Insurance	An insurance contract in which payments are triggered by extreme weather events. Disaster index insurance is a form of weather insurance which covers catastrophic weather events or the extreme tail of the probability distribution of weather events for a region or country. *See **Index Insurance** also.*
Drought	One of the most commonly requested perils by farmers, but it is also one of the most difficult perils to insure because of problems of its definition, isolation and measurement of effects on crop production. In contrast to most weather perils, drought is a progressive phenomenon, in terms of an accumulating soil moisture deficit for plant growth, and its impact on crop production and yields is often extremely difficult to predict, then measure and isolate from other non insured causes.
Due Diligence	The responsibility of an external reviewer to perform an investigation of risk associated with a potential client considered prudent and

	necessary for an adequate assessment of that client's level of risk. The process associated with "due diligence" in insurance includes underwriting, contract design, rate making, adverse selection and moral hazard controls.
Endogenous Market Factor	A factor occurring within the market which impacts market transactions such as fluctuations in local supply or demand or political instability within a country.
Ex ante Risk Mechanism	Action taken prior to a potential risk event. Making preparations before a disaster helps avoid inefficient, quick response coping decisions. If *ex ante* strategies are not in place, short-term coping strategies will be utilized that have no significant benefit in the long run.
Ex post Risk Mechanism	Risk management strategies that are developed in reaction to an event, without prior planning. While *ex post* strategies have a role to play in a risk management program, risk management mechanisms can be more effective when introduced *ex ante*.
Exposure	The amount (sum insured), exposed to the insured peril(s) at any one time. In crop insurance, exposure may increase then decrease during the coverage period, following the growth stages of the crop from planting to completion of harvest.
Exogenous Market Factor	A factor occurring outside the market which impacts transactions within the market, such as a shift in the global demand for a commodity.
Financial Intermediary	An institution such as an insurance company, bank or microfinance institution that serves as a middle man or acts as a go-between for sellers and buyers of financial services such as credit or insurance.
Financial Risk	Risk that income will not reach expected levels or the invested value in a crop will be lost due to adverse changes in weather and price. Many agricultural production cycles stretch over long periods of time, and farmers must anticipate expenses that can only be recouped once the product is marketed, leading to cash flow problems that can be made even more severe by a lack of access to credit or the high cost of borrowing in rural areas.
Franchise	An amount of loss which has to be reached before the insurer will pay a claim and once this threshold is met, the insurer has to pay the claim in full. For example, a farmer insures his crop for $1000 with a franchise of $100. If the claim is for $99, then this is borne by the farmer. If the claim is for $101, however, then the whole amount of the $101 is paid by the insurer..
Gross Net Premium Income	Gross written premium of a primary insurer minus cancellations, refunds and reinsurance premium paid to other reinsurers.
Guaranteed yield	The expected physical yield of a crop stated in the insurance policy, against which actual yields will be compared when adjusting any losses.
Hazard	A physical or moral feature that increases the potential for a loss arising from an insured peril or that may influence the degree of damage.
High-Probability Low-Consequence Events	High-probability, low-consequence risks are frequent risks that cause mild to moderate damage. Insurance products for high-frequency,

	low-consequence losses are seldom offered because the transaction costs associated with frequent loss adjustment makes the insurance cost prohibitive for most potential purchasers. These high transaction costs are in part due to information asymmetries that cause the problems of moral hazard and adverse selection. *See also* ***Moral Hazard*** *and* ***Adverse Selection***.
In-between Risk	Agricultural production risks such as natural disasters that lack sufficient spatial correlation to be effectively hedged using exchange-traded futures or options instruments. At the same time, they are generally not perfectly spatially independent, and therefore traditional insurance markets cannot cover these risks. Skees and Barnett (1999) refer to these risks as "in-between" risks. Because of their unique characteristics, in-between risks require more innovative instruments.
Indemnity	The amount payable by the insurer to the insured, either in the form of cash, repair, replacement, or reinstatement in the event of an insured loss. This amount is measured by the extent of the insured's pecuniary loss. It is set at a figure equal to but not more than the actual value of the subject matter insured just before the loss, subject to the adequacy of the sum insured. This means for many crops that an escalating indemnity level is established, as the growing season progresses.
Independent Risk	Risks such as automobile accidents, fire, or illness that generally occur independently across households. Such statistical independence allows effective risk pooling across entities in the same insurance pool, making insurance possible. For independent risks, the law of large numbers suggests that, on average, the insurance indemnity paid to claimants in a particular year can be offset by the premiums received from clients who did not experience indemnifiable losses. *See also* ***Risk-pooling***.
Index Insurance	Index insurance makes indemnity payments based not on an assessment of the policyholder's individual loss, but rather on measures of an index that is assumed to proxy actual losses. Two types of agricultural index insurance products are those based on area yields, where the area is some unit of geographical aggregation larger than the farm, and those based on measurable weather events. *See also* ***Weather Index Insurance.***
Informational Constraint	Limited access to or availability of reliable data can be a significant constraint to the development and performance of risk transfer markets.
Institutional Risk	Institutional or regulatory risk is generated by unexpected changes in regulations, especially in import and export regimes, and influences producers' activities and their farm profits.
Insurability	The conditions that determine the viability of insurance as a method of managing a particular risk.
Insurable interest	An insurance policy is only valid if the insured is related to the subject matter insured in such a way that he will benefit from its survival, suffer from loss or damage caused to it or may incur liability in respect of it.
Insurance	A financial mechanism which aims at reducing the uncertainty of loss by pooling a large number of uncertainties so that the burden of loss

is distributed. Generally each policyholder pays a contribution to a fund in the form of a premium, commensurate with the risk he introduces. The insurer uses these funds to pay the losses (indemnities) suffered by any of the insured.

Insurance Agent	The person who solicits, negotiates or implements insurance contracts on behalf of the insurer.
Insurance Broker	The person who represents the insured in finding an insurer or insurers for a risk and negotiating the terms of the insurance contract. A broker may also act as an agent (i.e. for the insurer) for the purposes of delivering a policy to the insured and collecting premium from the insured.
Insurance Policy	A formal document including all clauses, riders, endorsements which expresses the terms, exceptions, and conditions of the contract of insurance between the insurer and the insured. It is not the contract itself but evidence of the contract.
Insured Peril	The cause of loss stated in the policy which on its occurrence entitles the insured to make a claim.
Layer	The term used to define a range of potential loss that is covered by insurance. For example, an insurance contract may only pay indemnities for losses within a specified range of magnitude. *See also **Risk-layering***.
Livestock Risk	The risk of death, injury, or disease to livestock.
Loss Adjustment	Determination of the extent of damage resulting from occurrence of an insured peril and settlement of the claim. Loss adjustment is carried out by the appointed loss adjuster who works on behalf of the insurer.
Loss Ratio	The proportion of claims paid (or payable) to premium earned. A loss ratio is usually calculated for each class of business in which an insurer participates. Analysis of loss ratios can be useful in assessing risks and designing appropriate insurance structures.
Low-Probability High-Consequence Events	Low-probability, high-consequence risks are events that occur infrequently yet cause substantial damage. Decision-makers, including agricultural producers, tend to underestimate their exposure to low-probability, high-consequence losses because people forget the severity of the loss experienced during infrequent extreme weather events. Thus, an insurance product that protects against these losses is frequently discounted or ignored altogether by producers trying to determine the value of an insurance contract.
Macro Level	The economic level at which countries and large donor agencies working with these countries experience risk of weather-induced humanitarian crisis or economic instability caused by price volatility.
Market Failure	The inability of a market to provide certain goods at the optimal level because market prices are not equal to the social opportunity costs of resources. The high cost of financing catastrophic disaster risk prohibits most private insurance companies form covering this risk, resulting in market failure.
Market Risk	Input and output price volatility are important sources of “market risk” in agriculture. Prices of agricultural commodities are extremely volatile as a result of both endogenous and exogenous market shocks,

	and some commodities experience shocks more frequently than others.
Meso Level	The economic level at which banks, micro-finance institutions, producers, traders, processors and input providers experience risk due to the vagaries of weather and price.
Micro Level	The economic level at which individual farm households experience risks due to shocks such as adverse weather events, price fluctuations or disease.
Micro-climate	The climates of localized areas which may differ considerably from the climate of the general region. These climate variations are caused by geographical differences in elevation and exposure.
Moral Hazard	In insurance, moral hazard refers to the problems generated when the insured's behavior can influence the extent of damage which qualifies for insurance payouts. Examples of moral hazard are carelessness, fraudulent claims, and irresponsibility.
Non-Proportional Treaty Reinsurance	An agreement whereby the reinsurer agrees to pay all losses which exceed a specified limit arising from an insured portfolio of business. The limit is set by the reinsurer and may be monetary (e.g. excess of loss) or a percentage (e.g. stop loss). The rates charged by the reinsurer are calculated independently of the original rates for the insurance charged to the insured.
Personal Risk	The risk to an individual of personal injury or harm.
Premium	The monetary sum payable by the insured to the insurers for the period (or term) of insurance granted by the policy. Premium = premium rate x amount of insurance Also, the cost of an option contract—paid by the buyer to the seller.
Premium Rate	The price per unit of insurance. Normally expressed as a percent of the sum insured.
Probable Maximum Loss	The largest loss believed to be possible for a certain type of business in a defined return period, e.g., 1 in 100 years, or 1 in 250 years.
Proportional Treaty Reinsurance	An agreement whereby the insurer agrees to cede and the reinsurer agrees to accept a proportional share of all reinsurances offered within the limits of the treaty, as specified on the slip. Limits can be monetary, geographical, by branch, class of business etc. The reinsurer has no choice of which risks to accept or decline; he is obliged to accept all good and bad risks which fall within the scope of the treaty.
Quota Share Treaty Reinsurance	An agreement whereby the ceding company is bound to cede and the reinsurer is bound to accept a fixed proportion of every risk accepted by the ceding company. The reinsurer shares proportionally in all losses and receives the same proportion of all premiums as the insurer less commission. A quota share often specifies a monetary limit over which the reinsurer will not accept to be committed on any one risk, for example, 70% each and every risk not to exceed $700,000 any one risk.
Rapid Onset Shock	A sudden large shock, such as a flood, hurricane, frost, freeze, excess heat, high wind speed, storm, or commodity price shock; Rapid onset events are relatively easier to identify that slow onset shocks, and their impact can be easier to determine.

Rate On Line	A rate of premium for a reinsurance which if applied to the reinsurer's liability will result in an annual premium sufficient to meet expected losses over a number of years.
Regulatory Risk	Institutional or regulatory risk is generated by unexpected changes in regulations, especially in import and export regimes, and influences producers' activities and their farm profits.
Reinsurance	When the total exposure of a risk or group of risks presents the potential for losses beyond the limit which is prudent for an insurance company to carry, the insurance company may purchase reinsurance i.e. insurance of the insurance. Reinsurance has many advantages including (i) leveling the results of the insurance company over a period of time; (ii) limiting the exposure of individual risks and restricting losses paid out by the insurance company; (iii)may increase an insurance company's solvency margin (percent of capital and reserves to net premium income), hence the company's financial strength. (iv) The reinsurer participates in the profits of the insurance company, but also contributes to the losses, the net result being a more stable loss ratio over the period of insurance.
Risk Aggregation	The process of creating a risk-sharing arrangement which gathers together or pools risks, thereby reducing transaction costs and giving small households or other participants a stronger bargaining position.
Risk Assessment	The qualitative and quantitative evaluation of risk. The process includes describing potential adverse effects, evaluating the magnitude of each risk, estimating potential exposure to the risk, estimating the range of likely effects given the likely exposures, and describing uncertainties.
Risk Management	Care to maintain income and avoid/reduce loss or damage to a property resulting from undesirable events. Risk management involves identifying, analyzing, and quantifying risks and taking appropriate measures to prevent or minimize losses. Risk management may involve physical mechanisms, such as spraying a crop against aphids, using hail netting or planting windbreaks. It can also involve financial mechanisms, e.g. hedging, insurance and self-insurance (carrying sufficient financial reserves so that a loss can be sustained without endangering the immediate viability of the enterprise in the event of a loss).
Risk Mitigation	Actions taken to reduce the probability or impact of a risk event, or to reduce exposure them.
Risk Retention	Risk retention is the process whereby a party retains the financial responsibility for loss in the event of a shock.
Risk Transfer	Risk transfer is the process of shifting the burden of financial loss or responsibility for risk-financing to another party through insurance, reinsurance, legislation, or other means.
Risk-coping	Strategies employed to cope with a shock after its occurrence. Some examples of risk-coping strategies include the sale of assets, seeking additional sources of employment, and social assistance.
Risk-financing	The process of managing risk and the consequences of residual risk through products such as insurance contracts, CAT bonds, reinsurance or options.
Risk-layering	The process of separating risk into tiers that allow for more efficient

	financing and management of risks. High probability, low-consequence events may be retained by households to a certain extent. The market insurance layer is characterized by the ability of the market to manage risks through insurance or other contracts. Low-probability, high-consequence events characterize the market failure layer and at this layer of risk, government intervention may be necessary offset the high losses.
Risk-pooling	The aggregation of individual risks for the purpose of managing the consequences of independent risks. Risk pooling is based on the law of large numbers. In insurance terms, the law of large numbers demonstrates that pooling large numbers of roughly homogenous, independent exposure units can yield a mean average consistent with actual outcomes. Thus, pooling risks allow an accurate prediction of future losses and helps determine premium rates.
Shock	An unexpected traumatic event such as death in the family or loss of land and livestock which can be caused by catastrophic weather events or other unexpected phenomenon. Price shocks occur when the price of commodity changes dramatically due to changes in local or global supply and demand, affecting the livelihood of households dependent on this commodity either for income or caloric intake. Economic shocks can occur at the micro, meso and macro levels and can have long-term consequences for the economic well-being of actors at each level.
Slow Onset Shock	A shock that unfolds slowly, such as drought; they start unnoticed, and their impact is difficult to assess or may not be recognized until high losses are realized.
Social Safety Net	Various services usually provided by the government which are designed to prevent individuals or households from falling below a certain level of poverty. Such services include free or subsidized health care, child care, housing, welfare, etc.
Stop Loss	This term, usually applied to reinsurance business, refers to a policy that covers claims once they have exceeded a certain amount. A policy with a stop loss provision is a non-proportional type of reinsurance, where the reinsurer agrees to pay the reinsured losses which exceed a specified limit arising from any risk or any one event. For example, a reinsurer may agree to pay claims of US$200 000 in excess of US$100 000. If the claims are more than US$300 000, the reinsured (i.e., the insurer) will have to bear the remainder of the claims or make additional financing arrangements to cover the remaining risk exposure.
Subsidy	A direct or indirect benefit granted by a government for the production or distribution (including export) of a good or to supplement other services. Generally, subsidies are thought to be production and trade distorting and cause rent-seeking behavior, resulting in an inefficient use of resources.
Transaction Costs	Transaction costs are the financial costs or effort required to engage in business transactions which includes the cost or time spent obtaining information. Transaction costs associated with insurance include those associated with underwriting, contract design, rate making, adverse selection and moral hazard.

Underwrite	To select or rate risks for insurance purposes.
Weather Index Insurance	Contingent claims contracts for which payouts are determined by an objective weather parameter, such as rainfall levels, temperature, or soil moisture, which is highly correlated with farm-level yields or revenue outcomes. *See also* ***Index Insurance***.
Yield Risk	Unique to agricultural producers; like most other entrepreneurs, agricultural producers cannot predict the amount of output that the production process will yield due to external factors such as weather, pests, and diseases.