PARAMETRIC INSURANCE

APPLIED TO AGRICULTURAL SECTOR

IN THE REGION OF MERCOSUR

13th meeting AIDA Climate Change Working Party
LIMA – PERU
Tuesday 4 October 2016

MERCOSUR GROUP

María Kavanagh	**Argentina**
Pery Saraiva Neto	**Brazil**
Ana Rita Petraroli	**Brazil**
Ivy Cassa	**Brazil**
Ricardo Peralta Larrain	**Chile**
Miryam Aragón Espejo	**Perú**
Roxana Corbran	**Uruguay**
Andrea Signorino Barbat	**Uruguay**

General Coordination: Maria Kavanagh

External Contributor: S4 Agtech agronomist Santiago González Venzano

Page

INDEX

Abstract 3
Acronyms 4
Introduction 5

CHAPTER I
Parametric evaluation methods 6/7
Background of Parametric Insurance in Comparative Law 7/12

CHAPTER II
Argentinian Republic
Parametric insurance 13/14
Insurance applications and parametric design 14/28
S4 Agtech 28/31
Legal Framework

CHAPTER III
Federative Republic of Brazil
Parametric insurance 32/33

CHAPTER IV
The Republic of Chile
Parametric insurance 34/36
Legal Structure 36
Proposals for Chile 36

CHAPTER V
Republic of Peru
Parametric insurance 37
Legal Framework 37/38
Based insurance design ENSO 38/40

CHAPTER VI
Oriental Republic of Uruguay
Parametric insurance 41/46
Legal Framework 46/47

Conclusion 48/50
Bibliography 51

ABSTRACT

CHAPTER I
In this chapter the issue of parametric evaluation methods, which are the first approximations to predict the relative suitability of land for different agricultural uses is developed. The various indexes numerically express the potential productivity of soils.
Moreover, in the same paragraph it referred to parametric insurance in Comparative Law.

CHAPTER II
The section discusses index insurance in Argentina, the legal framework. Indices based on satellite images. two cases of application of index insurance and finally a more contemporary to our days of the flap 4 georeferential company that uses a system developed case.

CHAPTER III
In this case, the chapter discusses Parametric insurance in the Federative Republic of Brazil. The recent floods and landslides have involved for treatment to the government, the insurance market and population.
In this context the reinsurer Swiss Re Corporate Solutions offers a parametric model based on the definition of parametric indices. Moreover, the private insurer AgroBrasil proposed a developed product available only for farmers included in the distribution of seeds.

CHAPTER IV
In this chapter, the index insurance are treated in the Republic of Chile, to deploy the product in the agricultural sector, the main challenge is to achieve cooperation between related entities, insurance companies, Meteorological Centres and NGOs. It does not exist to the effective date Paramérticos Insurance Regulations.

CHAPTER V

In this section, parametric insurance are treated in the Republic of Peru, a country where climatic factor is causing the damages in agriculture.
Faced with these contingencies, the most important insurers in the country have products for managing climate risks.
The Catastrophic Crop Insurance protects against catastrophic loss of regional impact.

CHAPTER VI
This final chapter addresses the issue of index insurance in the Oriental Republic of Uruguay. Since 2011 developed an insurance product index for livestock producers against severe droughts and other weather losses in natural pastures. Prototype contract coverage provides ample protection for livestock breeding for a period of 7 months.

ACRONYMS

AUDEA	**Uruguayan Association of Insurance Companies**
BCU	**Central Bank of Uruguay**
BSE	**State Insurance Banking**
CCRIF	**Caribbean Catastrophe Risk Insurance**
ENSO	**El Niño-Southern Oscillation (ENSO**
FAO	**United Nations Food and Farming**
FONDEN	**Natural Disaster Fund**
FRFG	**Fund for Reconstruction and Development Farm**
GTZ	**Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH Global Risk AG**
INTA	**National Agricultural Technology Institute**
IPE	**Standardized Precipitation Index**
MAGyP	**Ministry of Agriculture, Livestock and Fisheries**
MEF	**Ministry of Economy and Finance**
MPCI	**federal Multi Risk Insurance Program Crop**
NOAA	**National Oceanic and Atmospheric Administration**
NDVI	**Normalized Difference Vegetation Index**
OPYPA	**Office of Agricultural Planning and Policy**
ORA	**Office of Agricultural Risk**
PC	**Coverage Period**
SAGPYA	**Secretariat of Agriculture, Livestock, Fisheries and Food**
SBS	**Superintendency of Banking and Insurance**
SMN	**National Weather Service**
SSN	**Superintendent of Insurance of the Nation**
SST	**Sea Surface Temperature**

INTRODUCTION

Climate change is one of the major environmental challenges facing humanity today. The recognition of this issue was debated at the last climate summit, when representatives of 195 countries met in Paris and agreed on the next steps to mitigate climate change and prevent more serious consequences.

Climate records and numerous models indicate that our planet is warming. It is also anticipated that future climate is characterized by a decrease in rainfall and increased frequency of extreme weather events, more floods and more droughts.

Uncontrolled burning of fossil fuels and the injection truce greenhouse gases in the atmosphere, will transform the planet .The global temperature has risen by almost one degree Celsius; in the Arctic, more than doubled. The average temperature could increase ten degrees, enough to melt the ice of glaciers in Greenland and Antarctica, causing a rise of 120 meters from sea level.

We are entering an era marked by rapid climate changes due to the emission of greenhouse gases. Among other consequences, significant changes are expected in rainfall, increased frequency of extreme events such as droughts or floods, sea level rise, ocean acidification and prolonged changes in rainfall and temperature distributions. These extreme events would disrupt severely the ecosystems on which we depend.

The Mercosur region is characterized by its enormous ecological diversity and the area has generated a high diversity of crops that currently support the regional and global food system. There is scientific evidence indicating the impacts of climate change in the Mercosur region, especially in the climate system and the physical and biological aspects related to it, generating a set of emerging and heterogeneous issues in all spheres of social life . For these reasons, current challenges and future scenarios where climate change alters the productive and energetic conditions of industrial and agricultural activities, modified market situations, increases health risks and vulnerabilities deepens entire sectors of the population are raised.

Climate Change imposes, while dramatically more complex, emergencies for designing strategies for mitigation and adaptation to its effects on a local, regional and national levels.

Agricultural progress has effects on ecosystems, becomes rapidly and causes a profound environmental deterioration in them.

The agricultural sector in the region is undergoing a crisis with internal and external factors, the low value of grains internationally and the rising cost of production, the effects of climate change, make the return expected by producers is low.

Currently worldwide there are a considerable amount of risk transfer tools which have been implemented by states in different parts of the world.

Under the statement, the first instrument that is associated with risk transfer is the traditional insurance.

Moreover emerging risks of climate change, droughts and floods are covered by multi-risk insurance, which are very expensive in the region and the world. In this context the option of Parametric Insurance Climate Indices or as an alternative to new coverage arises.

CHAPTER I

Evaluation Parametric Methods

Given the situation, it should be mentioned in cursory way consist parametric systems. Parametric insurance contracts are based on time series of climate variables, such as precipitation and temperature. Climate variables, reported by weather stations, are considered specific time lapses (usually daily).

The insurance is structured based on the behavior of these variables, so that payments of compensation to be received by the insured to the extent that the value taken by the variable is below a threshold determined by the statistical analysis the data series which, in turn, is highly correlated with the losses in the field. These evaluation systems are the first approximations predict the relative suitability of land for different agricultural uses.

In the 70s various mathematical simulation models were tested by computing polynomial equations to interpret the main and interactions of selected soil properties on the productions of the most common crops effects. (De la Rosa et al., 1979)

In parametric methods, (Morales Poclava, C. Et.al 2015) the relationship between productivity and soil characteristics are expressed as weighted factors in a simple mathematical function. The aim of these is that the numerical factors, generally values of land characteristics, are combined to reach a final single numeric variable. (Rossiter 1994).

According Riquier and others parametric methods have the following characteristics:

Independent evaluation: each is assigned a numerical value according to their influence on the productive capacity of soils

Combination: using mathematical operations, the different numerical values obtained, generating a final score that is included in a valuation scale continues generally from 0 to 100. These indices are incorporated later in a small number of classes. Since 1930, various proposals have been developed parametric character have gradually incorporated a greater number of factors to quantify the productive capacity of soil environment. While some systems are very few known, restricted to local or regional level, others are accepted internationally as the Storie index and the Riquier system, Bramao and Cornet (Vidal and Diaz 2002)

The index Storie or land index is a multiplicative index developed in the United States of America, in order to express a weight for zoning soil on crop productivity, which is assigned to each factor soil a percentage of the ideal then multiply (FAO 2003) value.

The Riquier, Bramao and Cornet system the authors suggest that the ability of land use can be expressed more correctly in terms of productivity, defining it as the soil's ability to produce a quantity of products of a particular crop per hectare per year . Productivity is expressed as a percentage of the optimal productivity, understood as the performance of the same crop on a soil without limitation (Vidal and Diaz, 2002)

The system sets for three uses (pasture, crops and deep-rooting plants) productivity index and an index of potential. The first numerically reflects the current capacity of a soil for performance in a particular crop the current capacity of a soil for performance in a particular crop, regardless of the economic factors that may influence the development of certain production orientations.

The second index numerically expresses the potential productivity of soils once incorporated all the necessary amendments, previously determined and including the most expensive, to overcome the factors (soil, physiographic and / or environmental) affecting yields (Riquier et al ., 1971)

The aforementioned systems operate on data collected for mapping units of soil maps. Currently the various data collected in space and time, allow quantitative estimates of the relationship between soil and use, especially for the relationship between productivity and edaphic, climatic and operating factors. For this we have developed a number of simulation models, based on the concept of analytical systems. Some models integrate physical information with economic information, but most are oriented quantification of physical processes, variables relating some geo-bio-soil with productivity or environmental tolerance (FAO, 2003)

The models generally require much information on the level of management of each crop and specifications of inputs within these. The yield is estimated based on long-term averages and considering their variability. Another use of models is predicting the response of soil qualities. The main limitation of these models is that they require very detailed data and have been tested only in very specific areas. Without dismissing their importance, these are not always applicable for lack of knowledge and quantified information, its main advantage the possibility of estimating the production of any crop anywhere, previous calibration and validation (FAO, 2003)

three [1]levels are recognized at international level insurance rates, classified according to the insured and beneficiaries.

Micro. It is defined as insurance rates to micro level when the insured farmer individual. There is a contractual relationship between the insurer and the farmer, with several options distribution and trading to allow the sale, distribution, and pay compensation to the farmer. In index insurance contracts at the micro level is the best known type of contract and developed internationally.

Meso. Under this type of insurance scheme, the insured and the policyholder is an institution that concentrates or "adds" risk. The insurable interest of this institution is to protect non-payment, for example, loans to producers due to crop losses.

Macro. An insurance rates at the macro level is when the government uses the policy to provide protection to the financial risks associated with large-scale events.

One example, though not directly related to the agricultural sector, Catastrophe Risk Insurance Caribbean (Caribbean Catastrophe Risks Insurance - CCRIF) by which the market reinsurers immediate government makes payments. In this way the policy can provide a rapid response to disasters caused by tropical storms or earthquakes.

Background Parametric Insurance in Comparative Law

Background information regarding the implementation of parametric insurance must take them from the perspective of comparative law and experimental work.

In the United States of Mexico, attention to weather contingencies in the agricultural sector has historically demanded a lot of resources of both the Federation and the States. In 1995, the government of Mexico, creates the FONDEN program as a comprehensive program to deal with direct compensation for damage from natural disasters.

Moreover, in 2003 by order of the Law for Sustainable Rural Development program Attention Contingencies is created, it is an instrument of the Mexican Federal Government, with the participation of State Governments meets the conditions for weather contingencies

[1] *Estudio de factibilidad de Seguros Agrícolas por ïndices Informe de Avance: Seguro de índices a Nivel Macro. República Dominicana Abril 2013*

rural sector, drought, frost, hail, snow, torrential rain, flood, cyclone, tropical depression, tropical storm, hurricane and tornado.
It should be mentioned that the agricultural sector in Mexico occupies a fifth of the economically active population and (FAO 2014). A large number of medium and small producers, develop their production in farms ranching in natural grasslands, as a result the activity becomes vulnerable to the presence of extreme weather events, especially those associated with droughts that have negatively impacted the activity, reducing the amount of animals and producers generating the need for additional resources to address the availability of pasture to feed their cattle.
Before the offer by private companies and insurance funds AGROASEMEX address this problem, developed a parametric catastrophic insurance for federal and state governments what to transfer to the insurance market.
The Catastrophic Insurance pastures, is a hedge to protect only we end whose development and operation climatic events is based on the determination of threshold values established through Normalizad index NDM Difference Vegetation Index.
The NDM, also called green index, is the most used among the indices that are calculated from satellite observations and constitute a unit of measurement of quantity and quality of the vegetation on the surface, because its value is related to the level photosynthetic activity observed in vegetation.
For the design of insurance, NDM values are estimated and corrected the distortions of the effect of soil, air and sun - sensor geometry and the results are validated with experimental data under field conditions.
In the Republic of Peru, extreme events caused by the effects of ENSO (El Niño Southern Oscillation) cause catastrophic floods that severely affect the livelihoods of communities and are a significant constraint on the development of markets in the region.
Insurance against El Niño uses the average monthly temperature of the sea surface to the region as ENSO 1.2 reported by the weather forecasting center US, NOAA. The basis for payment of compensation is the average temperature of the sea surface in two months: November to December. Payments begin when measurement exceeds 24.5 ° C and payments reach a maximum of 100% when the temperature exceeds 27 ° C.
In this context, it should be mentioned the project of GTZ Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH and grobal Ag Risk, which is implemented in the regions most affected by extreme El Niño, on the northern coast of the country and develops and introduces innovative climate insurance. The insured with this coverage, it is protected against the likelihood of actual damages. (GIZ GmbH 2013)
Insurance is based on the temperature of the sea during the months of November and December, the insurance payment can be done in January before losses occur and thus allows target groups to be ready in time for possible damage.
The project strategy is based on four lines of action:
. Analysis and strengthening regional demand for climate signs. The project aims to ensure that the population and public and private institutions (Target groups) of the pilot region have increased awareness of the need and benefits of having indexed weather insurance to reduce climate-related risks.
. Development of innovative weather insurance are developed weather insurance tailored to the needs of the target group. regional actors are also offered to incorporate climate indexed insurance in their budget planning.

. Institutionalization is intended to strengthen institutions in the field of insurance to governmental and private level. Besides national institutions support the respective adaptation of the regulatory framework for the promotion of weather insurance.
In the Federal Republic of Brazil, the region Rio Grande do Sul a public-private partnership developed an insurance program based on climate to be used as a complement to other agricultural programs indices, in this particular case, a program of distribution of seeds. Rio Grande do Sul is one of the largest producers and exporters of grain regions of Brazil. (Anderson, J. et.al 2010) weather risks are mainly related to El Niño and its inverse process, La Niña: El Niño often causes floods, while La Niña is characterized by periods without precipitation and drought.
Moreover, the state government of Rio Grande do Sul in 1980 established a program of distribution of seeds to help farmers growing corn for animal feed.
The program provides certified seed corn farmers, whose payment is not made effective until after harvest. Therefore, if the crops fail, the government loses money; if crop failure is repeated, the program might not be feasible.
The government was interested in an insurance program to transfer and spread risk. He invited several partners to develop and implement a program capable of being offered to all farmers seed program beneficiaries: about 170,000 low-income farmers. AgroBrasil, a private agency agricultural risk management, assumed leadership and proposed a product based on a performance index for areas that already had developed. The partners have worked with several private insurance companies and reinsurance in recent years to provide coverage to farmers using an adapted version of this product. From 2001 to 2008, between 15,000 and 46,000 households hired each season insurance Insurance is only available to farmers included in the seed distribution program, and its adoption is voluntary.
It is important to note that the insurance program based on a performance index by area, protects insured farmers against any risk that may reduce the average yield of a given area, compared with the historical production of the crop in the same area. The activation threshold is initially set at 10% deviation from the average regional yield for the first year of operation, but in the following years was changed to a 20% deviation.
The premium paid by farmers is subsidized by about 90%. The government pays the full premium directly to the insurance companies start of the season, and collects the insurance cost less allowance along with payment of the seeds once farmers have collected the harvest.
In the region of Central America, there are several strategies used to resolve what is the best approach to the introduction of insurance based on climate indices oriented development. Among the proven direct marketing strategies are small farmers or agricultural companies working under contract with small farmers. In Central America has chosen a third way, rather than starting by small farmers, insurers worked first with medium and large farmers and to quickly establish a commercial product that could later be expanded to cover a bag of customers more extensive, in which they enter the small producers. This project brought together several countries in the region, promoting the dissemination of ideas and the pooling of efforts employees.
These efforts were accompanied by an extensive capacity building work with a remarkable leadership of local insurance companies.
At the same time, the World Bank created a partnership with the Inter-American Development Bank and the Central American Bank for Economic Integration and began funding activities strengthening the agricultural insurance market. They included training,

policy work, efforts to improve access to quality weather data, and the introduction of index insurance pilot projects in Nicaragua and Honduras.
The initial activities of design contracts were not explicitly targeted to large farmers, but they were interested in the product and provided enough data for it to be designed according to your needs. Given the scale of farmers, the information available was markedly different from a targeted exclusively to small producers pilot. Farmers had multiple land located
at different distances from the weather station. Precipitation measured in each of their fields, keeping rainfall records and historical returns in computerized form, because they could validate options contracts based on climate indices and provide feedback directly. The data and comments provided allowed more difficult to model risks they were addressed drought, such as excessive rain. But in addition to the feedback provided by farmers directly, the size of holdings helped push the introduction of index insurance by providing a larger base and therefore more viable for the project.

International experiences

Globally, there are numerous pilot projects in several developing countries in the insurance climate indices, among which may be mentioned, for example flood insurance in the Mekong Delta in Vietnam, insurance livestock in Mongolia, insurance count farmers in Ethiopia and India.
The fund Catastrophe Risk Insurance for the Caribbean (CCRIF - Caribean Catastrophe Risk Insurance Facility) is a unique and pioneering financial instrument, the result of regional collaboration, in essence it is a reserve fund for governments. Parametric insurance is designed to give access to instant liquidity Caribbean governments to disaster caused by hurricanes or earthquakes. Caribbean governments pay an initial fee to participate in insurance. In the case of earthquakes, the insurance pays according to the Richter scale. The premium is built taking into account the risk of exposure to earthquakes and hurricanes in the country. Each government of the 16 participating Caribbean countries determines the insured amount. Payment is made if the earthquake or hurricane exceed the threshold set out in the contract. If the rate of earthquake or hurricane reaches the threshold, the payment is based on the index and, from there, the amount of premium is paid.
Insurance can be obtained at a low cost because it depends on the ability of capital markets and the participation of 16 countries. To date, the highest payments
were nearly eight million Americans by the Haiti earthquake dollars, occurred in January 2010 and 6.3 million by Hurricane Ike in the Turks and Caicos Islands in 2008. Payments to three weeks after the occurrence took place of the event. (OFF, P. 2010).
In the case of the Republic of Colombia, agricultural activity is highly dependent on exogenous factors that can affect productivity and thus, the growth of the economy, the price of the basic food basket or even food security. However, the presence of agricultural insurance tends to be concentrated in countries with high agricultural development
The meteorological phenomenon of "Girl", characterized by incessant rains, has caused catastrophic flooding for farmers in the country. This forced the Colombian Ministry of Agriculture and entities such as the Agricultural Society of Colombia (SAC, 2011) 2 to create some policies and grounded in subsidies to purchase insurance instruments. (Luna Rozo, A.F. 2013)
Climatic circumstances that have accompanied Colombia in the last four years, forced the Argentine government to implement a series of measures to mitigate the losses suffered by the agricultural and livestock sector. In Cundinamarca, for example, in the last three years

they flood in more than 32,000 hectares dedicated were presented by 90% to agricultural and livestock production, resulting in over 50,000 million pesos loss.

In this context, climate insurance has been an initial mechanism in the country to protect producers (natural or legal person), with agricultural projects against climate risks, according to the crop and the area (Banco Agrario de Colombia, 2011).

The market climate insurance is intended is to farmers, as long as the project is aimed at planting or maintenance of agricultural products; for this, the Banco Agrario de Colombia provides benefits to determine who in their profile:

Request credit for more than 100 smlmv amount ($ 51.5 million) or more than 50 hectares extension.

Values and lower wages smlmv 100 hectares or 50 hectares, provided in the same area has been granted an associative credit with the same crop insurance.

Insurance coverage protects climate risks according to the crop and the area in the following eventualities (Banco Agrario de Colombia, 2011):

- Excess rain.
- Flood.
- Strong winds.
- Avalanches.
- Deficiency rain.
- Hailstone.
- Frosts.
- Slip

A study by the Banco Agrario de Colombia (2011), this type of insurance is directed to short-cycle crops and the insurance period runs from the roots to harvest. For middle and late crops yield, the effect is annual and renewable. Consequently, the insured can select a single risk, in which case technical assistance should take the most appropriate plan for this purpose; currently, in Colombia the insurer to exercise this management company is Mapfre Seguros, entity in which, according to the parameters and variables of the case, defines insurance rate and policy. This takes effect in practice assurance crops or livestock activities from the date of the technical visit by the insurer insurance coverage applies.

Cruz and Llinas, (2010) cite that traditional insurance cover losses expected climatic events whose probability is low, but the risk is very high. By contrast, weather derivatives cover events of low risk but high probability fluctuations such as heat, cold or rain in a defined season. This means that not necessarily the insurance status should be given to large climatic effects of magnitude, but low, but most likely to occur without estimating an unpredictable risk. Some events are low risk but high probability of occurrence.

Moreover, businesses can buy insurance against climatic disasters, such as earthquake or flood, an event that is high risk but low probability of occurrence.

In Spain the insurance indemnifies farmers indices based on the behavior of an indicator (index) indirectly related to losses in the field. Performance indices are used in homogeneous risk areas comprising several farmers, or climatic parameters or indirect indicators associated with the behavior of the climate, such as the Index Normalized Difference Vegetation (NDVI or NDVI). Among the insurance index they are:

- The performance index insurance area. Estimates are based on performance in an area / homogeneous region. The compensations are activated whenever yields in the area / region fall below a preset threshold.

• The weather index insurance. They are based on time series of climate variables, such as precipitation and temperature. Climate variables, reported by weather stations, are considered specific time lapses (usually daily).
The insurance is structured based on the behavior of these variables, so that compensation payments are received by the insured to the extent that the value taken by the variable is below a threshold determined by analysis
Statistical data series and that, in turn, is highly correlated with the losses in the field.
This mode is used to provide protection, especially against systemic events such as excess or deficit of precipitation.
Another way to design a safe is by NDVI. This index is used to estimate the state of vegetation from measurements with remote sensing, which allows identifying the presence of vegetation on the surface and characterize the spatial distribution and evolution of their status over time.
vegetation in question. Based on historical data stored in series relative or
The behavior of vegetation is determined primarily by weather conditions. The interpretation of the index should consider phenological cycles compensation, if an event occurs that causes damage that are located below these thresholds.

CHAPTER II

ARGENTINIAN REPUBLIC

Parametric Insurance

Agriculture plays a key role in Argentina, occupies first place worldwide as an agricultural exporter after Brazil and the second net agricultural exporter. The agriculture sector accounts for 10.2% of GDP and employs 5% of the workforce.

The farmer prevented attempts against the risk to the economy of production. How to address the problems of exploitation are reflected in consider hiring insurance arm themselves with stock, or liquidate stock, make investments on the farm in order to suppress certain risks, particularly technical. Thus, irrigation avoids the risk of drought.

No clutch, it is necessary to refer to three figures: storage, insurance and futures markets. (Boussard, J.M. 2015) In this context we examine the Climate Insurance Index or Parametric.

These insurance contracts are characterized, to protect the insured against a possible loss of income related to a change in climate or other index, for example performance. Insurance Superintendency of the Nation SSN, regulatory agency of insurance companies and reinsurance companies, signed with the Ministry of Agriculture, Livestock and Fisheries in 2014, a cooperation instrument for further analysis on the feasibility of insurance parametric indices or, as alternative instruments for risk management.

For this purpose the parties to the agreement undertake to perform, among others determined the following:

- To develop instruments that establish improvements in the conditions of the policies, through the use of climate data.
- Generate proposals that contribute to the articulation of risk management mechanisms and further development of the insurance market in order to have broader coverage of climate risks.
- Create an area formally public-private coordination to contribute to the development of an integrated sustainable coverage system.

Develop the study of the occurrence and extent of damage, training and financial assistance to carry out development activities and research information applied to agricultural risk.

- Generate training programs for the productive sector on risk management and consistent adoption of hedges to protect agricultural production of climatic events.
- Create conditions and develop a plan aimed at implementing a parametric agricultural insurance market.
- Define a scheme of public participation - private self contemplating the contribution of alternative financial and institutional actors in the productive sectors, which are outside the traditional insurer circuit, in order to share information and define methodologies for calculating contingencies by performing actuarial estimates prepared jointly.

Through these instruments, known as parametric insurance or indexes, the compensation process is triggered when an objective index reaches certain preset levels. The coverage provided to producers is based on the assumption that the index is significantly correlated with production losses.

They are basically divided into three types:

- Performance Indices area: based on an indicator of average production within a predetermined area (eg department or party). If the yield obtained is below the set limit, the insured farmers receive compensation. Conglomerate allows Homogeneous Risk Areas facing similar conditions and risks.

- Climatic indices: measured as an index which is determined by the historical correlation between climatic events and crop yields. The index can be, for example, accumulation of precipitation, temperature, humidity, wind speed, sunny days, etc. The compensation will occur when a weather index reaches or exceeds a predetermined threshold level.
- Indices based on satellite images (NDVI: Normalized Difference Vegetation Index) are based on satellite images and are indirectly related to the loss of production. (Argentina, Ministry of Agro Industry Agricultural Risk Office)

Currently, the SSN authorizes index insurance but, unlike what happens in other countries, requires a "double trigger", ie, first, the climate variable and, second, that the client has economic crop damage insured. In the rest of the world, with the first trigger it is enough. Indeed, the regulator is considering changing that clause so that in Argentina this also be the case. The main reason why you want to start using this type of insurance is another solution that allows give assurance to certain climatic hazards such as drought.
Even if drought materialize only once every five or six years, the risk of disaster is enough to slow economic dynamism, growth and wealth creation in every year, whether good or bad. The successful implementation of this tool will depend on demand, ie to what amount they are willing to pay the producers. A series of hypothetical surveys show that producers are willing to pay enough securities to cover the cost of index insurance.

Insurance applications and Parametric Design
The Agronomists Laura B. Gastaldi, Galetto Alejandro and BA in Economics Daniel Lema designed in 2008, Parametric insurance coverage to protect companies producing milk risk of adverse events of precipitation. The research is part of the Master's thesis "Milk production in Pampeanas Extra areas. The case of Northern Province of Santa Fe. "Coverage was presented in November 2008 at the Regional Agricultural Economy Congress held in Montevideo Uruguay. In 2009, it was published in the Journal of the Association of Agricultural Economics.
Coverage was made aware of the insurer Sancor Seguros, with whom an agreement was signed to fit commercially. During the years 2009 and 2010, I was working in partnership with the insurance mentioned several meetings with dairy producers, in order to adjust the design to your needs were made during this time.
Coverage uses standardized precipitation index (IPE) as an indicator of the occurrence of extreme precipitation events. This index is routinely estimated by the National Weather Service (NWS). The IPE is calculated on a monthly basis and reflects changes in accumulated rainfall a month or longer time scale such as 2 months, 6 months etc.) for a particular historical series (1961-2000 in case of SMN). Thus, this index allows to track the occurrence of events of deficit or excess rainfall at different time scales, but not a direct indicator of intensity (mm / hour) or waterlogging (surface water).
The proposed insurance will cover extreme precipitation events of catastrophic type that are supposed to exceed the capacity of handling or management of this risk by the dairy farm producer. These events associated with IPE values of Table I

SPI CATEGORIES	SPI VALUES

Extremely damp	**2.00 to top**
Very damp	**1.50 to 1.99**
Moderately damp	**1.00 to 1.49**
Slightly damp	**0.50 to 0.99**
Normal	**0.49 to -49**
Slightly dry	**-0.50 to -0,99**
Moderately dry	**-1.00 to -1,49**
Very dry	**-1.50 to -1.99**
Extremely dry	**-2.00 to lower**
	Source: Mc Kee et al. (1993)

Excess precipitation will be monitored with an IPE of 2 months (IPE2) and 6 months (IPE 6) deficit for events. Table 2 shows the preliminary parameters of the proposed coverage presented.

Table 2 Preliminary parameters of the proposed coverage for companies milking yard

DETAIL	**PARAMETRIC**
Climate indicator	**Standardized Precipitation Index (SPI)**
Insured events	**Extreme rainfall (excess or deficit)**
Weather Station (WS)	**A dairy farm agree with the producer (distance between the insured field and WS <20 km)**
Extreme rainfall deficit	
Index trigger	**SPI 6 = - 2 (minimum compensation)**
Output index	**SPI 6= - 2,5 (maximum compensation)**

Excess rains end	
Index trigger	**SPI 2=2 (minimum compensation)**
Output index	**SPI 2=2,5 (maximum compensation)**
Insured capital	**Milk production**
Contract period	**> 2 years**

If verified extreme precipitation event SPI> SPI 2 or <-2, the dairy farm producer entitled to compensation which shall be expressed as a percentage of the insured monthly production of milk.
The compensation is calculated taking into account the SPI value in WS chosen as reference by the dairy farm producer and unit rates of payment.
These coefficients were determined from evidence of milk lost due to extreme rainfall events and were then adjusted with dairy farmers of the central dairy region of Santa Fe.
Payment ratios differ depending on the type of event, being on average higher for excess rainfall. They are also different stations to enter one time event, such as the occurrence of excessive rainfall in the autumn with a SPI 2 = 2.10 will have a greater compensation for an event of equal intensity (SPI 2 = 2.10) registered in summer. In the case of the biggest rain deficit compensation will be delivered in spring and summer.
Figure 1 schematically shows the proposed mechanism for calculating compensation.

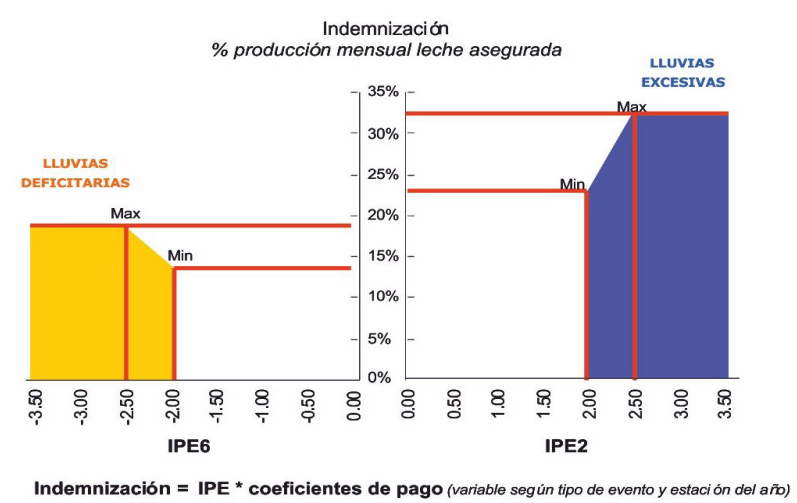


Figura 1: Mecanismo propuesto para el cálculo de la indemnización. Ejemplo con valores arbitrarios.

In this context, an example would be a producer of the town of Ceres (Santa Fe) milk production ensures your company with the occurrence of events of extreme rainfall deficit (SPI 6 <-2). In August 2009, the producer receives compensation for the IPE in June was lower than the trigger index. (Figure 2)

Instead, in December of 2011, it does not correspond any compensation because the accumulated rainfall loa last 6 months were also short of the local historical measure but not to the extent of becoming a catastrophic event type Figure 2- b.

In December of 2011 if he had corresponded compensate dairy farmers insured Pergamino area of Buenos Aires Province.

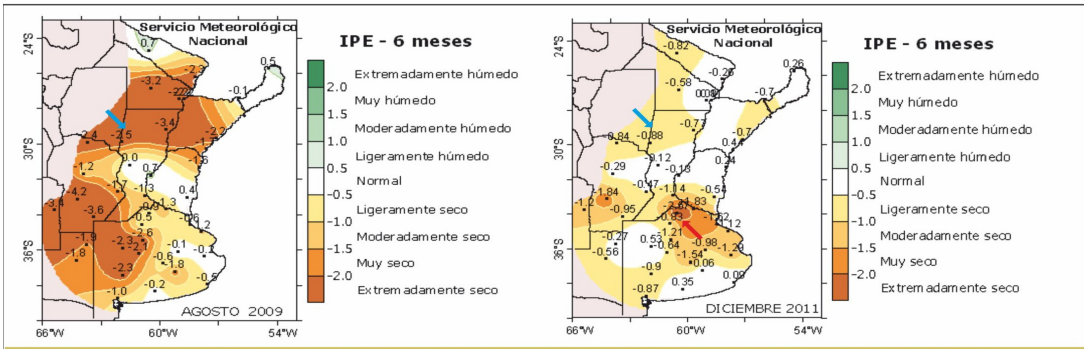


Figura 2: : Mapa de distribución espacial del Índice de Precipitación Estandarizado para la escala temporal de 6 meses (IPE6) en dos periodos: a)- Agosto de 2009 y b)- Diciembre de 2011. Las flechas azules en los mapas indican la localidad de Ceres (Norte Provincia de Santa Fe) y la flecha de color rojo señala la localidad de Pergamino (Provincia de Buenos Aires)

The implementation of these covers is conditional on the existence of an adequate network of weather stations.

In 2011, the agronomist Laura B. Gastaldi INTA Rafaela Santa Fe Province, with Scientific Researchers Daniel Osgood, Guillermo Podesta and BA in Economics Daniel Lema designed a model of Insurance water deficit in soybean based on a climate index for the area of Pergamino, Argentina. Insurance was designed as part of a training conducted by the Engineer Laura Gastaldi, at the International Research Institute for Climate and Society IRI. IRI arises from a collaborative agreement between NOAA and the University of Columbia (NY USA). The cover design was presented at the Regional Congress of Agricultural Economics developed in Valdivia - Chile and published that same year in the Journal of the Argentina Association of Agricultural Economics.

Insurance is designed to soya first occupation in the area of Pergamino, Buenos Aires Province (33 ° 54'40.78 "S 60 ° 36'22.49" W), crop occupies 57% of the agricultural area compared to 16 % with soybean or corn 15%. The choice of this site was based on the availability of information and the fact that the risk associated with changes in the amount and frequency of rainfall is perceived by the zonal farmers as a major problem for the next 10 years (Cabrini and Calcaterra, 2008). Additionally, it is an area where there is high willingness to take agricultural insurance. For example, in the 2006/2007 campaign 95% of the soybean acreage was insured against hail at an average yield of 25 quintals / ha (Cabrini and Calcaterra, 2008), the average yield of 32 quintals zonal / ha (campaigns 2007/08 to 2009/10, SAGPyA).

a) Design insurance

For the design of coverage the following parameters were considered.

• indoor climate Event rain deficit.

• Weather Station Reference: rainfall data from the meteorological station of the National Agricultural Technology Institute (INTA) of Pergamino were used. The data cover the period July 1931 - June 2010 and presented the following distribution: i) medium: 943.10 mm per year; ii) Quartile 1: 802.3 mm; iii) Quartile 3: 1134.10 mm; iv) Maximum: 2014.6 in the period July 2006-June 2007; v) minimum: 511.9 mm between 1949-1050. In Figure 1 the historical behavior of annualized rains between July and June is exposed, the average annual and decadal variation coefficient. The highest average annual rainfall of the entire series was associated with the 2000s, as well as interannual variability.

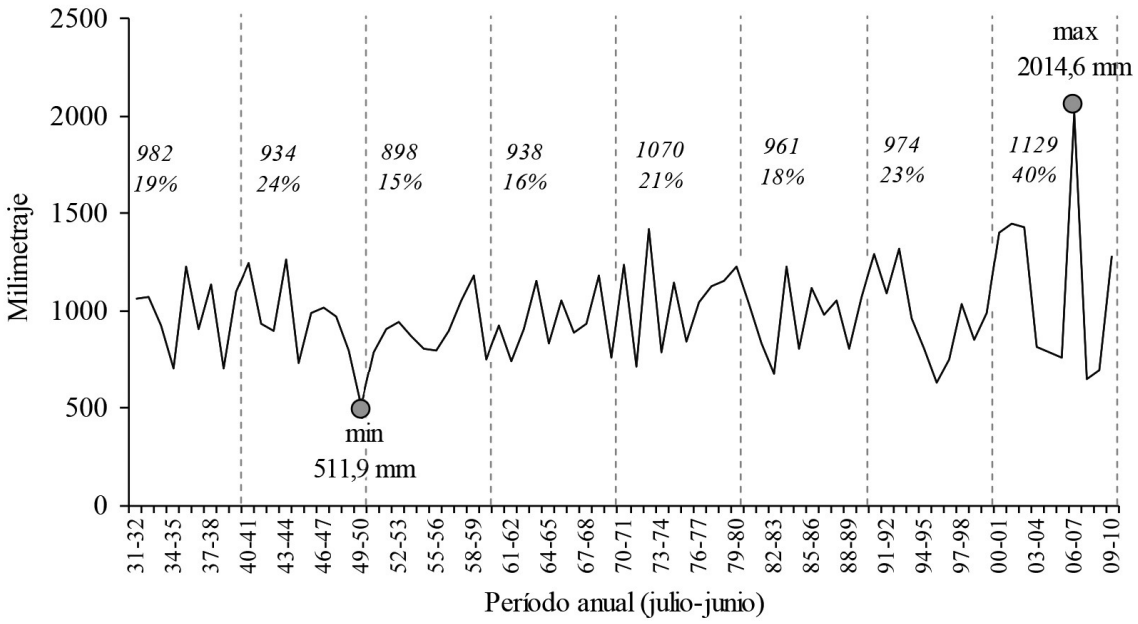


Figure 1. Historical performance of rainfall in Pergamino.
Annualised Period: July 1931 to June 2010. Average and decadal variation coefficient

• Coverage Period (pc): This is the period, measured in days, during which the occurrence of the event covered climate is liable to be indemnified; parameter which can vary between contracts and should be agreed between the producer and the insurance company. In this work a period of 62 days was considered from 21 December to 20 February inclusive. These dates were established considering the phenology associated with soy first occupation (long maturity group IV) planted during the first ten days of November.
• Climate Index: daily rainfall accumulated during the coverage period, expressed in millimeters (mmcf) were considered. To calculate the cumulative rainfall, daily rainfall values were truncated at 70 mm (maximum), assuming rainfall amounts above that level are lost through runoff.
• Index trigger (mmd): The value accumulated during the coverage period (bcf) which activates the compensation mechanism rains. This parameter also vary between coverage and must be agreed between the parties (producer and insurance company). In this proposal a trigger rate of 130 mm was considered to be associated with the historical average of 226 mm pc. Water requirements soy first in the region vary Andriani (2000) between 450 and 650 mm. Thus, this insurance proposal would ensure that between 20 to 30% of these water requirements are recorded in the period of coverage.
• Output Index (mms): This is the index value below which 100% of the sum insured is indemnified. He was selected considering the minimum value recorded in Pergamino bcf during the period from 1931 to 2010, rounded to the nearest whole number -50 mm-.
• Sum insured: Is the capital on which compensation is calculated.
From these parameters they were retrospectively determined campaigns which had indemnified insurance and frequency of occurrence of payments, where:
• Right to compensation

When mmp c <mm d
• Frequency of occurrence of compensation
No compensation / No. of years analyzed
• Likelihood of payment
No. of years analyzed / number of allowances
• Amount of compensation (i)
It was calculated using two payment schemes. The first payment was called progressive type (hereinafter PP), and this compensation varies between 0 and 100% of the sum insured.

The second payment scheme is called "occurrence-severity" (hereinafter POS) proposal introduced in Gastaldi et al, (2009). In this case, the policy is agreed on a fixed% to compensate for the occurrence of the event (bcf <mmd) and the remaining percentage up to 100% of the sum insured indemnify the severity of the event. In this work a fixed% compensation of 25% of the sum insured was considered, considering the relationship between the costs of implementation and area protection (Journal Agromercados, 2011) and the average zonal performance (8 quintals / ha and 32 qq / ha, respectively).
b) Evaluation insurance
The coverage assessment was carried out following the methodology proposed by Osgood et al. (2007). It consisted of an analysis of correlation between the time series of compensation associated with the hypothetical insurance, where time and amount of compensation is integrated with series of losses soybean yields that reflect those liable unfavorable crop years have been compensated.
Series soybean yield losses were constructed with statistical data and simulated production. Statistics yields are estimates conducted annually by the Ministry of Agriculture, Livestock and Fisheries of the Nation (SAGPyA) for soybean cultivation in general, ie without specifying whether it corresponds to the first or second occupation. The series used extends from 1980/1981 to 2009/2010, and was corrected by a tendency to remove possible production variations associated with technological factor.
Meanwhile, the simulated yield data were obtained for the period 1931-2010 with software called Weather Index Insurance Educational Tool (WIIET), the International Research Institute for Climate and Society (IRI) (Osgood et al., 2007) . This software contains a module that allows to estimate the water needs of crops (ISNH or WRSI its acronym in English), the satisfaction rate was assumed next performance (varia-ble proxy). This estimate is based on an equation that considers the daily behavior of rainfall during the crop cycle (in this soybean case sown in early November in Pergamino) values of potential evapotranspiration (reference to the area of Pergamino), and coefficients crop (Kc) and productivity response factor (Ky) (referential publication FAO).
To generate the series of soybean yield losses, it proceeded first to select a trigger yields (rd), below which the campaign was considered unfavorable. This renders trigger was determined taking into account the number of years that had indemnified insurance (probability of payment), assuming the same proportion of unfavorable campaigns. For example, if the probability associated with the insurance payment was 20%, the critical yield was calculated considering the performance of the series associated with the percentile 0.20. Then came the loss of the difference between the trigger performance and performance measured in each campaign (rc), where:
• Amount of production loss (p)

If ≥ rc rd Loss = 0
If rc <rd Loss = rd - rc
Table 1 presents the structure
Table 1 shows the structure of the series of compensation and in Table 2 corresponding to the number of lost revenue structure is presented.
Table 1. Structure of the historical series of compensation.

Campaña	Indemnización (%)
1931/32	$0\% \leq i_{t\ '31/'32} \leq 100\%$
…	$0\% \leq i_{t\ldots} \leq 100\%$
…	$0\% \leq i_{t\ldots} \leq 100\%$
…	$0\% \leq i_{t\ldots} \leq 100\%$
2009/10	$0\% \leq i_{t\ '09/'10} \leq 100\%$

Table 2. Structure of the historical series of yield losses
In addition, the correspondence between the indemnified campaigns examined regarding unfavorable productive campaigns through indicators used to assess situations dichotomous type (WWRP / WGNE Joint Working Group on Verification).

To do this, the amount of (uncompensated) and unfavorable crop years (favorable) indemnified periods were organized in a contingency table, as example presented in Table 3.

Table 3. Table of contingencies

Then indicators were calculated:
• Performance Insurance = (correct correct payment + nonpayment) / (general total)
• Probability of correct payment = (correct payment) / (correct payment + nonpayment)
• Probability of incorrect payment = (incorrect payment) / (correct + incorrect payment nonpayment
• Bias = (correct incorrect payment payment +) / (correct payment + nonpayment)
c) Cost of insurance
The total cost of insurance is called a premium and is calculated by adding to the commercial premium (required to meet the payment of the compensation provided monetary value) operating and utility costs sought by the insurers companies, plus taxes and fees levied activity. In this paper, only the commercial premium, which is interpreted as the minimum price that the insured should pay the insurance for drought insurance for soya first occupation was estimated.
The commercial premium was assessed using the average of the historical series compensation (Table 1). Also it can be calculated by multiplying the frequency of payments and the average value of compensation for the years in which compensation were recorded. The premium is estimated by assuming different scenarios, built from the behavior of rainfall in Pergamino sub-periods between 1931-2010 and from that series.
Features of insurance and historical performance potential

Table 4 shows the parameters describing the proposed rainfall deficit in soybean coverage designed in this work are summarized. Ensure capital is expressed in total bushels of soybeans, taking into account the implanted surface (secured) and a yield per hectare, which would be limited at most to the zonal average of the last five years. Then, depending on the price of soy available at the time of subscription the sum insured in monetarios5 terms would be fixed. The insurance should be done at least one month before the start of the coverage period. A subscription should present proof of registration in the National Register of producers of cereal grains and oilseeds as well as documentation regarding sales volumes in previous years to avoid the use of insurance for speculative purposes.
Table 4. Coverage of drought for soybean first occupation in the Party of Pergamino

DETAIL	PARAMETER
CROP INSURED	**SOJA 1 OCCUPATION**
INSURED CAPITAL	**RETURNS**
CONTRACT DURATION	**ANNUAL**
INSURED RISK	**RAINFALL DEFICIT**
PLANTING DATE	**NOVEMBER 1st DECADE**
PERIOD OF COVERAGE	**21 DECEMBER TO 20 FEBRUARY**
DATE OF HARVEST	**LAST DECADE OF MARCH**
CLIMATE INDEX	**ACCUMULATED RAINFALL**
WEATHER STATION	**PERGAMINO INTA**
SHUTTER INDEX	**130 MM**
INDEX OF OUTPUT	**50 MM**

In Figure 2 the campaigns in which insurance should be indemnified because mmcf <mmd = 130 mm exposed.

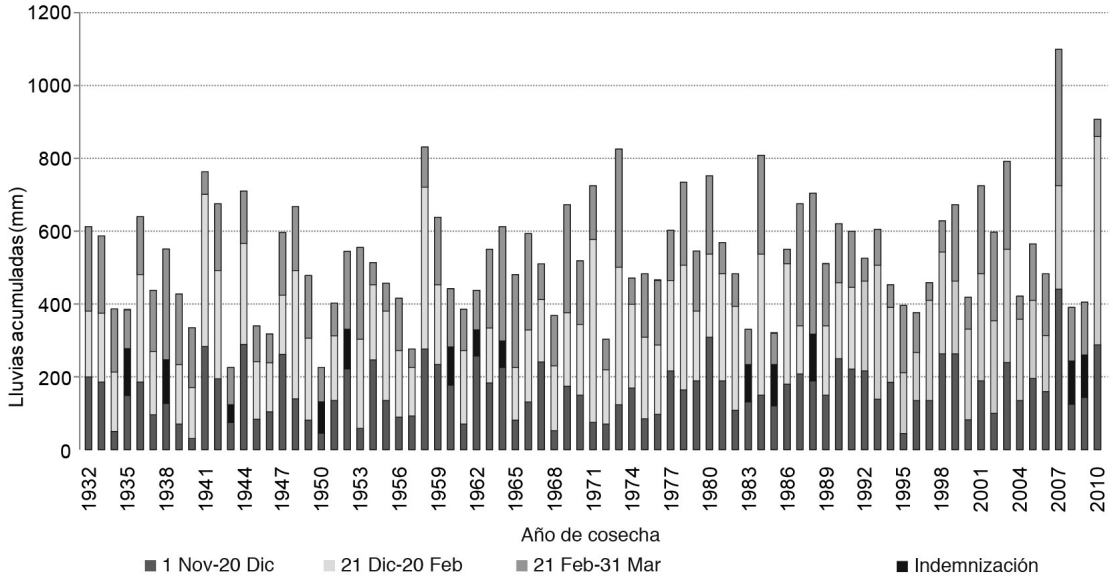
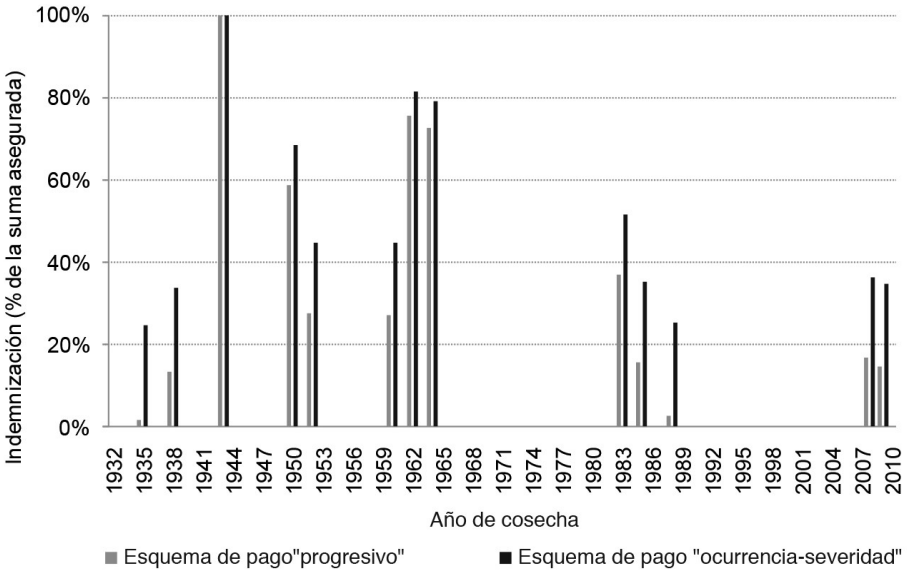


Figure 2. Historical performance of the rains during the first cycle soybean occupation (1/11 to 31/03) in Pergamino. Compensable events rainfall deficit.

In the 79 analyzed crop years (1931/32 to 2009/10) were recorded in Pergamino 13 events liable deficit rains have been compensated, giving on average (1) payment every six (6) years, ie a probability payment of 0.16. The most pronounced rainfall deficit occurred in the 1942/1943 campaign, with accumulated rainfall.
in the period decreased coverage proposed index output (bcf mm 48.3 mm vs 50 mm). It was also very dry the crop year 1961/1962 where only rained 69.4 mm. From the 70s, the occurrence of events rainfall deficit was reduced and during those years and until the early 80s had not paid compensation insurance. Then they began to register other episodes of rainfall deficit, highlighting the 2007/2008 and 2008/2009 (MMcf 116.5 mm and 118.1 mm, respectively). Only on that occasion they were recorded two consecutive years of pagos.Tomando 2008/09 as an example, the PP compensation should have been 14.9% of the sum insured. So if a farmer from that region had secured 100 ha of soybean average yield of 32 quintals soybean / ha, had received compensation equivalent to 476.8 quintals soybean production or 14.9 ha.
Compensation (2008/09) = [(130 mm - 118.1 mm) / (130 mm - 50 mm)] * 100
Compensation (2008/09) = 14.9% of the sum insured.
If the farmer had chosen a POS scheme, compensation would have been of 36.16% of the sum insured.
Compensation per occurrence (2008/09) = 118.1 mm <130 mm = 25% of the sum insured
Compensation for severity (2008/09) = (130 mm-118.1 mm) x (75% / (130 mm-50 mm)
Compensation for severity (2008/09) = 11.16% of the sum insured
Compensation "occurrence-severity" (2008/09) = 25% + 14.06%
Compensation "occurrence-severity" (2008/09) = 36.16% of the sum insured.
2009/10 - In Figure 3 the values of PP and POS compensation of 13 liable crop years have been compensated in Pergamino, between 1931-1932 are presented.

Compensation "occurrence-severity" (2008/09) = 25% + 14.06%
Compensation "occurrence-severity" (2008/09) = 36.16% of the sum insured.
2009/10 - In Figure 3 the values of PP and POS compensation of 13 liable crop years have been compensated in Pergamino, between 1931-1932 are presented.



The PP 1934/35 and 1987/88 campaigns compensation had been almost negligible monetary terms for the agricultural producer, with values of 1.8% and 2.6% of the insured, respectively sum. This situation could result in claims, and even derail marketing insurance on these campaigns, since there would be no incentive to continue hiring insurance compensation which is associated in some campaigns, very low. Under this assumption, the POS compensation mechanism would be more convenient. But on the other hand, the cost of insurance is associated with the compensation expected to be paid; then cover with PP would be more affordable boosting its marketing.
Another factor that could encourage or discourage the intention to purchase insurance is the frequency of payment of compensation. In this sense, very frequent payments, for example less than three years, derived in an expensive coverage and therefore financially inaccessible to smaller producers. At the other extreme, infrequent payments, for example once every ten years, they would not be attractive to the farmer because not perceive the usefulness of transferring risk to third parties rain deficit. In the latter case, it could increase the trigger index (mmd) to increase the frequency of payment, but without neglecting the purpose of insurance is to alleviate a "real" situation of rainfall deficit affecting cultivation, avoiding contracts designed only commercial purposes.
Overall, the questions that arise during the design of an index-based coverage -referidos more appropriate trigger, probability and frequency of payment, etc. usually have an answer in the farmers themselves. Patt et al thereon. (2008) indicate that the participation of

farmers is key to the success of index-based coverage, and a clear communication about its scope, advantages and disadvantages. In addition, it is essential to know the potential demand and willingness to pay for such products, which could be estimated by contingent valuation, as done in Galetto et al. (2011).

Insurance assessment

In Figure 4 Zonal soybean yields for the period 1980/1981 to 2009/2010 (30 campaigns) estimated from data presented SAGPyA. The trend component was removed from the series and yields expressed in relative terms. The trigger performance below which the campaign was considered unfavorable corresponded to the index 0.88, identified from the same five campaigns criticism of the 30 analyzed. The unfavorable ratio between overall productive campaign and campaigns analyzed (5/30) is equivalent to the probability of payment of the proposed coverage (0.16). For each of these unfavorable campaigns corresponding loss was estimated to be zero in the remaining campaigns. Thus, the series of yield losses 5 was conformed loss values and 25 zero values.

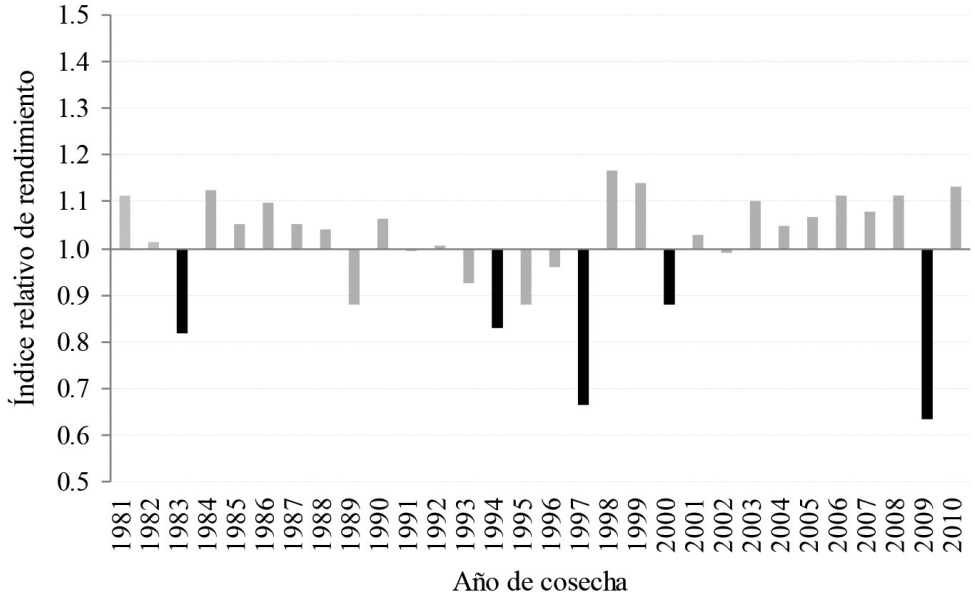


Figure 4. Relative yield of soybeans estimated from data published by SAGPyA. liable campaigns be indemnified (identified in red)

This series of loss of income, generated with estimates of yields SAGPyA, correlated 30% with the number of compensation PP and 33% with the number of POS compensation, both presented in Figure 3. These values correlation should be interpreted taking into account that:

i) Official estimates of yields SAGPyA, used to generate the number of production losses include both soybean first and second occupation; while the insurance was designed to cover deficit rains soybean first only. Therefore, they can register associated to soybean yield losses only second that the hypothetical insurance ind emnizará not and vice versa.

ii) The insurance only covers accumulated in the reproductive period and does not consider pre-planting and during crop emergence could also affect yields rainy conditions.
Specifically, the insurance had indemnified in 1982/1983 and 2008/2009 campaigns, where effective production losses were recorded as emerges from a comparison of Figures 3 and 4. However, it also had indemnified in other campaigns as 1984/1985, 1987/1988 and 2007/2008 where, according to statistics SAGPyA, yields were relatively normal. These "false" shots or "improper payments" could be associated to the fact that soy has a great plasticity and can recompose rainy periods of deficit even occurred during flowering. Thus, the insurance pays shoot and although the harvest is then acceptable.
On the contrary, the insurance had not fired in 1993/1994 and 1996/1997 campaigns, where according to estimates with data from SAGPyA yield losses (Figure 4) were recorded. This mismatch may be that soybean was adversely affected by factors other than the rains flowering, and therefore did not fire insurance. Precisely in these crop years stem canker outbreaks of soybean were recorded, which causes losses and are indicated in Wrather et al. (1997a) and Wrather et al. (1999b), some of which were associated with the uniformity of germplasm and lack of crop rotation, ie related to the technical management of soybean causes.
In Figure 5 zonal yields estimated from 1931/1932 to 2009/2010 ISNH from indicating in red the most critical campaigns throughout the period analyzed (0.71 trigger performance) are presented. In this case, the number of production losses made with the ISNH correlated 46% with the number of compensation PP and 38% with the number of POS compensation. While again there were campaigns where insurance had not fired in the two worst seasons (1942/1943 and 1949/1950) had had coverage optimum performance; also in 1982/1983.

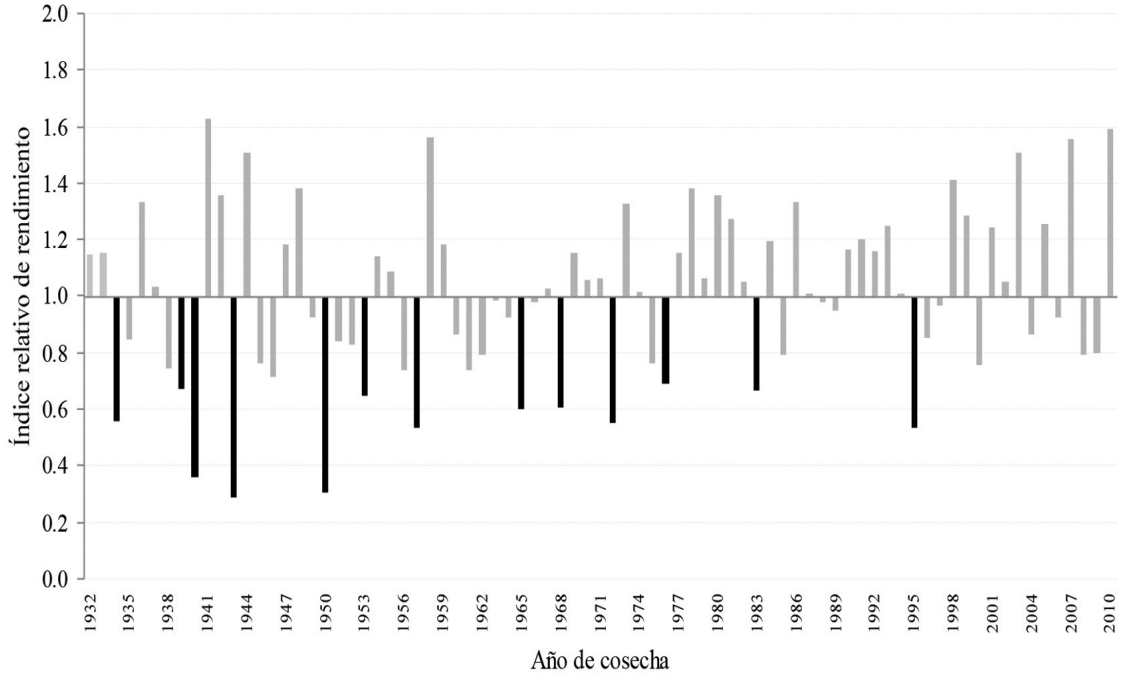


Figure 5. Relative yield of soybeans estimated from the rate of water needs satisfaction (ISNH). liable campaigns be indemnified (identified in black).

Table 5 shows the performance indicators associated with dichotomous situations arise.

The correspondence between trigger type (right or wrong) and productive campaign (liable to be indemnified or not) can be considered appropriate, given that 80% of those age insurance behaved according to the productive campaign. It was also acceptable to the relationship between the amount of compensation paid in the 79 years analyzed and total amenable to being indemnified campaigns. However, this value of bias does not consider whether there is also correspondence between the year in which the payment and the year was unfavorable agricultural season is recorded. When considering the latter, only 40% of unfavorable campaigns were compensated. Again, this may be due to production losses to factors beyond the rainfall conditions in bloom, covered by the proposed insurance risk were due.

PRODUCTION LOSSES

	SIMULATED RETURNS	STATISTICAL RETURNS
PERFORMANCE OF INSURANCE	**79,75 %**	**80%**
BIAS	**86,67%**	**100%**
LIKELIHOOD OF PAYMENT CORRECT	**40,00%**	**40,00%**
LIKELIHOOD OF PAYMENT INCORRECT	**10,94%**	**12,00%**

Insurance cost

the minimum price proposed would be marketed if insurance is presented to end,. This is a minimum value because only the pure premium regardless of administrative expenses and the cost of capital faced by insurance companies to offer coverage in the real market was measured. This premium was estimated assuming different scenarios of future behavior rains, and the two proposals for calculating the compensation (PP and POS). T he results are summarized in Table 6. First the section of the historical series of rainfall used to build the stage, the number of analyzed campaigns and behavior of rainfall during the proposed in this insurance coverage period indicated. Then, the parameters associated with the coverage amount of compensation referred to, the average rainfall indemnified periods, frequency of payment; and finally the risk premium associated with each scheme calculation of compensation (PP and POS).

Under the assumption that future rains will behave as recorded in the first scenario, proposed insurance should be marketed at a minimum price of 5.9% of the sum insured for the PP scheme and 8.5% for POS. This is the most pessimistic scenario, given the severity of events rainfall deficit during the period of insurance coverage. If instead, behavior rainfall is forecast and the fourth stage, the coverage would be more economical for the least occurrence of events of drought and of lesser magnitude.

Table 6. Insurance drought in soybean flowering period of first occupation in Pergamino. Pure premium associated with different assumptions of future rainfall scenarios.

	Escenarios supuestos de comportamiento de las lluvias				
Escenario	1	2	3	4	5
Campaña inicial	1931/1932	1960/1961	1980/1981	1990/1991	2000/2001
Campaña final	2009/2010	2009/2010	2009/2010	2009/2010	2009/2010
N° campañas analizadas	79	50	30	20	10
Promedio lluvias 21 dic-20 feb *(mmpc)*	217	227	236	245	255
Coeficiente de variación lluvias	45%	44%	43%	42%	52%
N° indemnizaciones	13	7	5	2	2
Promedio lluvias períodos indemnizados (mm)	101	103	116	117	117
Probabilidad de pagos	16%	14%	17%	10%	20%
Frecuencia de pagos (en años)	6,08	7,14	6,00	10,00	5,00
Esquema de pago "progresiva"					
Indemnización máxima (% capital asegurado)	100%	76%	37%	17%	17%
Campaña	1942/1943	1961/1962	1982/1983	2007/2008	2007/2008
Promedio indemnización (% capital asegurado)	35,8%	33,7%	17,4%	15,9%	15,9%
Prima pura (% capital asegurado)	5,9%	4,7%	2,9%	1,6%	3,2%
Esquema de pago "ocurrencia-severidad"					
Indemnización máxima (% capital asegurado)	100%	82%	53%	38%	38%
Campaña	1942/1943	1961/1962	1982/1983	2007/2008	2007/2008
Promedio indemnización (% capital asegurado)	51,8%	50,3%	38,1%	36,9%	36,9%
Prima pura (% capital asegurado)	8,5%	7,0%	6,3%	3,7%	7,4%

for a correct quote to ensure the commercial viability of this type of coverage. In this sense Greene et al., (2008) indicate that it is transcendental, review, adapt and improve contracts annually Overall, the sensitivity experienced by the pure premium to the different scenarios, indicates the need for climate information further, from forecasts and / or multivariate scenarios for index insurance can incorporate new knowledge of local and regional climate and keep pace of climate change.

Our purpose was to assess the viability of the project, consulted the agronomist Laura B. Gastaldi, informed us that the proposed insurance model was not possible to implement in the current Insurance Law.

S4 AGTECH

.A Enterprise level, Lapel 4 is an agronomic study of precision agriculture based in Pergamino and Daireaux.

The modus operandi of flap 4

Flap 4, has a geo-referenced system, generating environment maps on satellite information with orders for machinery used.

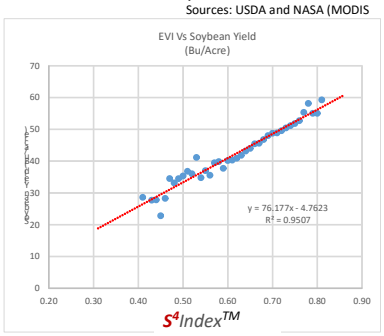
Web platform Lapel 4 producers manage information for decision-making. This information has agreed language environments and corresponds with drawings on an interface of geo-referenced maps. The information generated is synthesized in real-time reporting, allowing to generate a control board to assess the progress of the agricultural operation.

In September, 2015 in Agro Insurance, presented the flap 4 Parametric Coverage for Field Crops

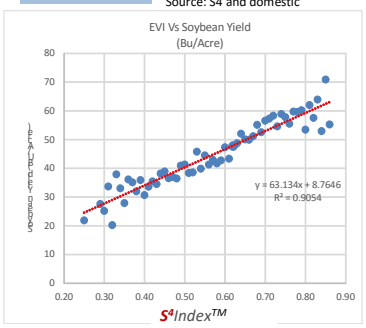
S4Index™ Reliability: Global model

Through our algorithms, we found excellent correlations (>90%) between the S4Index™ and crop yields for different regions

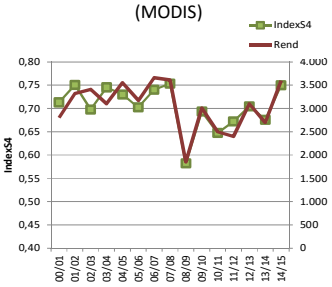
Relationship between EVI Index and Soybean yields in Illinois counties for the last 15 years.
Sources: USDA and NASA (MODIS



Relationship between the Index and the yield obtained from combines monitors (Pampas region)
Source: S4 and domestic



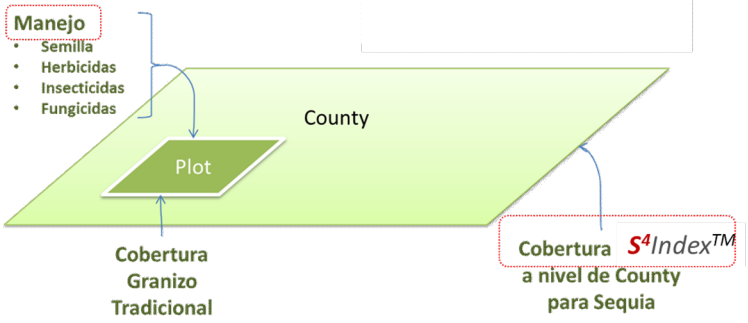
Relación entre el Índice y el rendimiento para los condados del Pdo de Villegas durante los últimos 15 años
Fuente: MAGyP y NASA (MODIS)



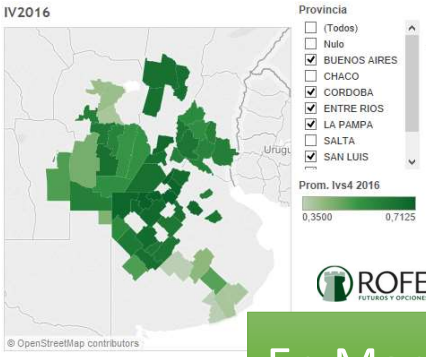
9/18/2015 Draft - Confidential 3

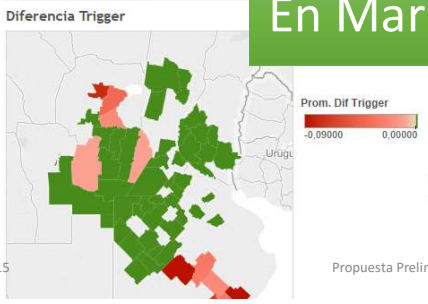
S4Index™ Porque un Índice a nivel de Partido?

	NO Sistémica	Sistémica
Controlada	Manejo	Gestión de Precios
No Controlada	Granizo	Sequia



- *Se elimina el Riesgo Moral y Selección Adversa*
- *Aparece el Riesgo Base*





Provincia
(Todos)
Nulo
BUENOS AIRES
CHACO
CORDOBA
ENTRE RIOS
LA PAMPA
SALTA
SAN LUIS

Prom. Ivs4 2016
0,3500 0,7125

ROFEX
FUTUROS Y OPCIONES

En Marzo

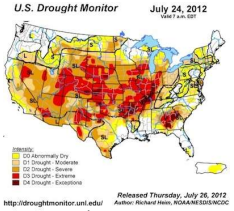
Prom. Dif Trigger
-0,09000 0,00000

Liquidación del Agregador a los Productores

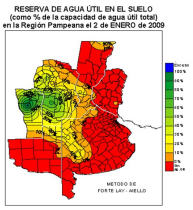
Provincia	Partido/Departamento	Trigger	S⁴Index™	rigg..	Liq % M...
BUENOS AIRES	9_DE_JULIO	0,57	0,63	0,00	0%
	AMEGHINO	0,55	0,69	0,00	0%
	AZUL	0,45	0,42	-0,03	15%
	BALCARCE	0,47	0,38	-0,09	45%
	BOLIVAR	0,51	0,64	0,00	0%
	BRAGADO	0,53	0,66	0,00	0%
	CHIVILCOY	0,55	0,69	0,00	0%
	COLON	0,60	0,71	0,00	0%
	DAIREAUX	0,53	0,66	0,00	0%
	GENERAL_PINTO	0,57	0,71	0,00	0%
	GENERAL_VILLEGAS	0,56	0,70	0,00	0%
	GUAMIN	0,40	0,50	0,00	0%
	HIPOLITO_YRIGOYEN	0,51	0,64	0,00	0%
	JUNIN	0,57	0,71	0,00	0%
	LEONARDO_N._ALEM	0,57	0,71	0,00	0%
	LINCOLN	0,55	0,69	0,00	0%
	LOBERIA	0,41	0,38	-0,03	15%
	LOBOS	0,51	0,64	0,00	0%
	NECOCHEA	0,42	0,35	-0,07	35%
	OLAVARRIA	0,44	0,35	-0,09	45%
	PEHUAJO	0,54	0,68	0,00	0%
	PERGAMINO	0,54	0,68	0,00	0%
	RIVADAVIA	0,45	0,56	0,00	0%
	ROJAS	0,58	0,70	0,00	0%
	SAN_ANDRES_DE_GILES	0,48	0,60	0,00	0%
	TANDIL	0,51	0,49	-0,02	10%
	TRENQUE_LAUQUEN	0,50	0,63	0,00	0%
CHACO	12_DE_OCTUBRE	0,40	0,50	0,00	0%
CORDOBA	GENERAL_ROCA	0,45	0,60	0,00	0%
	GENERAL_SAN_MARTIN	0,47	0,59	0,00	0%
	JUAREZ_CELMAN	0,48	0,66	0,00	0%
	MARCOS_JUAREZ	0,55	0,54	-0,01	5%
	PRESIDENTE_ROQUE_S_E...	0,54	0,55	0,00	0%
	RIO_CUARTO	0,46	0,45	-0,01	5%

S⁴Index™ Drought Parametric Protection

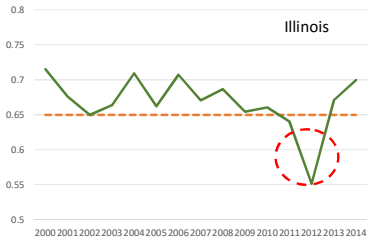
"What if?" Analysis for Illinois (US) and Villegas, Bs.As province (Arg)

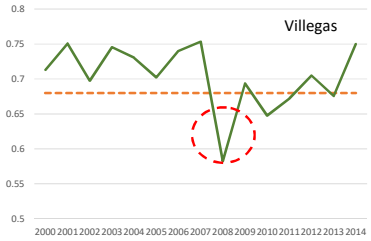


2012 Drought in US, worst in 50 years
https://www.ncdc.noaa.gov/sotc/drought/201206

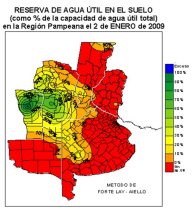


2008 Drought in Arg, worst in 50 years

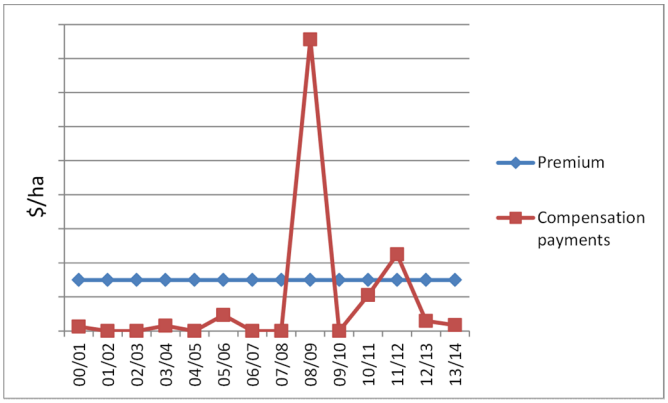




Un Ejemplo:



Resultado de la Cartera para el Oeste en los últimos 15 años



Legal framework

The first restriction was found wanting implement index insurance was a legal impediment type. According to the Insurance Law No. 17,418 of the Nation, agricultural insurance are framed within the property insurance; and as such, there must be a real and verifiable financial loss for the obligation is incurred by the insurer for damages to the insured. Insurance rates just have such a design that does not guarantee that property damage for payments are triggered. However, the key is to choose an index mark a high correlation between climate phenomenon and crop productivity, as it is an almost irrefutable proxy that if the phenomenon occurs, there will be losses associated with the crop with a chance high. Given the efforts by ORA-MAGyP to the National Insurance Superintendency, was achieved was reached to consider approving the proposal without the need to change the law. It would require only a technical note, with the backing of the World Bank, where the correlation and the use of the index is justified.

CHAPTER III

FEDERAL REPUBLIC OF BRAZIL

Parametric Insurance

Recent natural disasters in Brazil floods, landslides torrential rainfall and its consequences for treatment involving the government, the insurance market and population.

In this context, Swiss Re Corporate Solutions offers the first product of parametric type in the country. It targets sectors of the economy that have revenues and operating costs directly affected by unexpected variations in climate, such as companies generating energy with major renewable sources in agribusiness that are affected by the regime rain, wind, sun and temperature.

This is a pioneering product in the Brazilian market and represents our vision to develop innovative solutions for the business needs of our customers. It's a new way to help businesses minimize losses in its financial results to the unpredictable weather events such as excess or lack of rain, for example safe climate indices not only contribute to greater predictability of commercial enterprises, but also they help improve your credit market assessment, as rating agencies better evaluate companies that are more resistant to inclement weather.

Parametric insurance is based on the definition of indexes for the occurrence of natural events. By the time it reaches or exceeds the parametric index, the policy can be activated. In case of rain, for example, one indicator is a precipitation above a certain rate agreed between insurer and insured. Therefore, it is different from the traditional model, which is based on the occurrence of an event. In practice, it resembles a financial transaction option, but more simple and flexible.

The value of the insured in the parametric insurance is pre-defined in accordance with the client. Payment of compensation is faster, usually occurs within two to six weeks. The coverage period may also be different, as defined by the customer.

The solution developed by Swiss Re Corporate Solutions sets the option for the customer buys the product according to the variable that best fits your activity. Precipitation (mm rain), river flow, temperature extremes, wind, solar radiation and Niño indices are some of the options. You can also perform combinations of these risks.

For ora part of this case study the region Rio Grande do Sul in Brazil shows how a public-private partnership can develop an insurance program based on climate to be used as a complement to other agricultural programs indices, in this case a program seed distribution. Rio Grande do Sul is one of the largest producers and exporters of grain regions of Brazil. Weather risks are mainly related to El Niño and its inverse process, La Niña: El Niño often causes floods, while La Niña is characterized by periods without precipitation and drought. The state government of Rio Grande do Sul in 1980 it established a program of distribution of seeds to help farmers growing corn for animal feed. The program provides certified seed corn farmers, whose payment is not made effective until after harvest. Therefore, if the crops fail, the government loses money; if crop failure is repeated, the program might not be feasible. The government was therefore interested in an insurance program to transfer and spread risk. He invited several partners to develop and implement a program capable of being offered to all farmers seed program beneficiaries: about 170,000 low-income farmers. AgroBrasil, a private agency agricultural risk management, assumed leadership and proposed a bas product was developed. The partners have worked with several private insurance companies and reinsurance in recent years to provide coverage to farmers using

an adapted version of this product. From 2001 to 2008, between 15,000 and 46,000 households hired insurance each season (see table). He had developed. The partners have worked with several private insurance companies and reinsurance in recent years to provide coverage to farmers using an adapted version of this product. From 2001 to 2008, between 15,000 and 46,000 households hired insurance each season. Insurance is only available to farmers included in the seed distribution program, and its adoption is voluntary. The insurance program based on a performance index by area protects insured farmers against any risk that may reduce the average yield of a given area, compared with the historical production of the crop in the same area. The activation threshold is initially set at 10% deviation from the average regional yield for the first year of operation, but in the following years was changed to a 20% deviation. The premium paid by farmers is subsidized by about 90%. The government pays the full premium directly to the insurance companies start of the season, and collects the insurance cost less allowance along with payment of the seeds once farmers have collected the harvest.

Insurance has been able to reach the low-income small farmers participating in government seed program. However, there are some barriers that need to be addressed if we are to expand the program and make it sustainable in the long term. The main limitation is that the program currently uses the seed program as a single channel of distribution; that is, it depends on the seed program and government support. AgroBrasil is interested in expanding the program to other regions, and proposed projects include it in other states. The participation of more private companies in the initiative will also serve to expand distribution channels.

CHAPTER IV

THE REPUBLIC OF CHILE

Parametric Insurance

In Chile, the Pacific Ocean has a moderating effect of the impact of climate change, global cause that level rising temperatures, but new studies show that the country still recorded significant changes in climate.

A research commissioned by the Ministry of Environment Centre for Agriculture and Environment of the University of Chile, analyzed the climate scenarios 2030 and 2050. They will be necessary mitigation measures, as not only the climate in the country will be warmer but prone to storms and more cloudy days. Possible effects include transfer of traditional crops in the central south zone and decreased coverage of native forests.

Parametric insurance is an insurance contract that pays compensation based on the intensity of an event (eg, intensity earthquake or wind speed). Unlike traditional insurance that require the determination of an individual loss, insurance Parametric calculate payments using a predetermined formula with variables that are exogenous to the insured and the insurer, but have a strong correlation with the damage on the insurable interest the client's. Typically, these insurance covers a portion of the estimated by the government, with a deductible and compensation limit defined losses. Therefore, the parametric insurance is a type of insurance that does not compensate the specific loss from the event, but predetermine a payment amount in case of occurrence of a generic event trigger, which is usually a natural disaster that causes loss single or series of property damage.

In this case, the Insurable Interest corresponds to material goods insured, infrastructure in general; crops, animals and everything involved in the different production processes. And the risks covered are the property damage caused by an event whose trigger is the default index or parameter.

Cost Coverage

The key to this insurance is the development of a rigorous model capable of assigning a predefined risk level to each client according to the general characteristics of their insurable interest. Then, the premiums should be calculated on the basis of these estimated risks. Specifically, the cost of each policy comprises:

The losses estimated according to historical records available.

Technical reserves required by the regulator and the acquired reinsurance. This will mainly depend on the structure of the investment portfolio of the insurer.

Operational costs.

Once developed the measurement model and calculated parameter for a particular event, the resulting index is compared with the maximum points threshold and the actual event. If the calculated value is less than the threshold, no payment, and if exceeded, payment is made but should not be higher than determined by the policy of private and public entities involved in this insurance. The compensation is calculated as follows:

$$\text{PAYMENT: } \frac{(\text{Index-index threshold event}) * \text{Limit Policy}}{(\text{Maximun Index} - \text{Index of the event})}$$

Where: -Index threshold: Represents the minimum intensity agreed to start compensation. Maximum –Index to consider: Represents the maximum intensity reached by the event. – Limit Annual Policy: Maximum payment defined by public and private entities involved. No. 1 contains graphic function face an insurance payment. For example, compared to a flood whose index is 200, according to records of water drop ONEMI, the compensation is

to apply the payment formula is $ 5 million. A positive linear function of the intensity and the payment is appreciated, but bounded both by the intensity threshold (index 100) as the maximum payment limit defined as political ($ 20 million).

Payment: $\frac{\text{5 mil} = (200\text{-}100) * \text{20 mil}}{(600\text{- }200)}$

Therefore, the insurance company could limit the risk assumed by the minimum and maximum limits set by the contract, and the restriction on the total amount of annual compensation.

Parametric Insurance Benefits

. Reductions in administrative costs by subscription, settlement and litigation. The compensation amounts are standardized 2 according to the measurement of an observable event. Thus, payment is immediate since it is not necessary to note the losses, also reducing the costs of litigation between the parties.

The cost of capital is lower and that compensation limited to the occurrence of an objective parameter, which diversifies the risk, and therefore reserves required to support liabilities decrease.

The insured is not able to alter the conditions after the incident to overvalue compensation because the indices used in the calculation of payments are objective and independent of the actions of the parties involved. 3.4. No adverse selection (information asymmetries), because even if the insured has more information than the company about potential damages or losses to which it is exposed, models of risk allocation are designed in relation to the frequency and severity of hedged risk.

Transparency, are based on calculated from records from independent agencies indexes, and also establish the payment through transparent formulas or calculations included in the policy.

Constitute a new type of financial instrument where the underlying asset is a physical index (wind speed, amount of fallen illimetres, among others.). They are interesting for the financial market since they have no correlation with the portfolio of assets of an investor and therefore allow greater diversification. This could facilitate access to capital markets through its securitization and as reinsurance.

Challenges of Parametric Insurance

The basis risk arises when compensation is not exactly equal to the actual loss. By definition, the index used in index insurance is a “proxy” or estimate of actual damages, therefore, compensation may be slightly higher or lower than the payments. Thus, the rigorous design of the terms and conditions for this type of policy is critical to minimize this risk.

Product technical limitations that its use is limited to hazards that can be illimet with a high level of confidence. Measurement models for hurricanes and earthquakes have been developed and tested for over a decade and are constantly improving. However, for other hazards such as volcanic eruptions or tsunamis, models are under study.

Limitations market because even though the models of catastrophic risks are developed by independent agencies, investors charge a margin premium reflecting uncertainty in accepting new risks, and this could raise its value even on losses that provides cover .

Education is essential since the index insurance are a combination of insurance and financial concepts, therefore, only proper understanding of these instruments by generators of private and public policies ensure their proper use

Legal structure

Insurers offering such products must be separate legal entities, registered in the Superintendency of Securities and Insurance and a representative of major shareholders directory. They must have their own risk management strategy (in line with the future implementation of Risk Based Supervision) including buying reinsurance.

Proposals for Chile

In order to implement this product, for example in the domestic agricultural sector, the main challenge is to achieve cooperation between related entities: Insurance companies, responsible meteorological centers to perform and certify the measurements, and government organizations today subsidize important part national agricultural insurance. Specifically, a parametric agricultural insurance linked to a rainfall index indemnify the farmer as long as the rains fallen exceed an amount of illimetres in a given period of time. Such compensation would be for the previously agreed amount, which may be the total estimated (depending on the index of the real event), a percentage of it and / or a payment limit loss. Proper use of this type of insurance in the agricultural sector, boost greater efficiency in the management of insurance, allowing improve your current coverage, 3% of the national insurable surface. In addition, insurers would be able to deliver higher quality and variety in the benefits of this product. Moreover, for small domestic farmers allow lower premiums expand access to this product shelter, and thus reduce their current vulnerability to inclement weather.

Consulted the Superintendency of Securities and Insurance of Chile, he reported that to date has not issued regulations on index insurance. However there is an insurance program with a state subsidy, administered by the Agricultural Insurance Committee.

CHAPTER V

REPUBLIC OF PERU

Parametric Insurance

The climate factor is causing the most problems in world agriculture. It originates in some regions up to 78% of annual losses in the sector.

There are currently more than 600,000 cultivated hectares in the levees and there are still 900 thousand available for expanding the agricultural frontier in those regions.

The main challenges facing the rural sector in Peru, are the problems of marketing, technological capital, problems and climate challenges with a wide climatic variability by region, El Niño and La Niña.

In this context, the country's largest insurance products accounts for climate risk management.

The Business Interruption Insurance, this insurance pays the sum insured as a result of the occurrence of El Niño (FEN) end. It is an indexed based on the Sea Surface Temperature (SST) in the Niño 1.2 region (north coast of Peru and Ecuador coast) insurance measured by the Climate Prediction Center US - NOAA.

El Niño affects Peru since ancient times, but climate change is causing an increased frequency and severity of this global phenomenon.

If the TSM average of November and December is> 24oC then be indemnified. Therefore, this insurance will pay the sum insured before the occurrence of floods or extreme rainfall disasters that could occur in the summer.

Catastrophic Agricultural Insurance is an insurance indexed to crop yield in a given area. **Protects against catastrophic loss of regional impact.**

Covered risks: drought, excessive moisture, frost, low temperatures, flood, flood, hail, fire, high winds, high temperatures, lack of floor to harvest, pests, diseases and predators.

Mitigates losses in a given area to climatological and biological adverse events. They are mainly insured potato and corn crops in the 8 poorest regions of Peru.

The target beneficiaries are micro and small subsistence farmers or subsistence (rural communities). a sum of up to S / is ensured. 750 (US $ 270) per hectare is not designed to cover production costs. You pay the insured amount when production of the area is less than 40% of the historical average (last 5 years).

Legal Framework

In Peru, in the last twenty years we have developed a set of initiatives, both public and private, which aimed to create an agricultural insurance market. During the 1990s there were three initiatives led by the private sector, which failed in its attempt to develop an agricultural insurance. Then in the next decade, was the Peruvian government which assumed the role of promoter agricultural insurance market (GIZ, 2013).

The institutions of the Government of Peru supported the market innovative insurance against weather events by adapting the regulatory and institutional framework for the promotion of such insurance. It is clear that the key players in the public domain, responsible for public policy management and risk management are:

The Ministry of Agriculture

The Superintendency of Banking and Insurance

The entities in charge of the emergency system or attention to weather disasters such as the National Institute of Civil Defense

The National System for Disaster Risk Management

From 2010 to 2013, there were several important regulatory changes within the public sector and the private sector (GIZ, 2013). Management Risk Management whose functions are, among others, designing and proposing policies, guidelines and strategies for financial risk management (market, liquidity, credit and / or counterparty, investments, country) was created in March 2011 , operational and fiscal contingent of legal and contractual nature or arising from disasters associated with natural phenomena. In May 2011, the Law 29,664, Law Risk Management (DRM), created the National System of Risk Management Disaster (SINAGERD), which established as a primary role of the national government and regional governments the responsibility for taking charge prevention, preparedness and emergency response against catastrophic weather events such as extreme Niño Phenomenon. This law also states that regional governments have the main responsibility for prevention and emergency response, and stresses the need for financial mechanisms to help them transfer or retain the risks of extreme events. In November 2012 the Law 29,946, Insurance Contract Act, which repeals pertinent in the Commercial Code, which dates from 1902, and modifies the current Banking and Insurance Law was enacted. The new legal framework helps improve contractual relations in the insurance market as it gives policyholders greater equity and transparency in insurance contracts. In the Superintendency of Banking and Insurance (SBS) it was concluded that a specific regulatory framework is required to consider index insurance. Currently, government institutions formed by the Ministry of Agriculture and Irrigation (MINAGRI), the Ministry of Economy and Finance (MEF), SBS and regional governments promote, in partnership with the private sector, development and dissemination of schemes weather risk insurance.

Insurance technical design based on ENSO

This parametric insurance offers the opportunity to mitigate and develop adaptation strategies to problems that brings the phenomenon of El Niño end as loss of crops, destruction of roads, among others, because you pay before the incident occurs. Offer was designed as a safe at the macro level. It can be purchased from various sectors, public and private sectors: financial institutions, local and regional governments, producer associations, enterprises production chains, boards and commissions of irrigators users. The German Development Cooperation (GTZ) and GlobalAgRisk continues to develop capabilities in the different actors, through training, to have a good knowledge of how this type of insurance can facilitate and improve prevention strategies and adaptation of the financial sector and government institutions.

Sum insured: the insured determines the sum to ensure, calculated from a risk analysis that estimates the biggest losses that might occur due to extremely heavy flooding. Payment system: Insurance is structured as one contingency, pay based on the occurrence of an adverse event defined in this case, the phenomenon Extreme Child, unlike insurance compensation where payment of compensation is based on the level of insured losses. The basis for payment of compensation is the average temperature of the sea surface in two months: November and December. The data of the temperature of the sea surface are obtained from the report prepared by the Atmosphere of the United States of America National Oceanic and Administration - NOAA. 23 Payments begin when the average exceeds 24.5ºC and payments reach a maximum of 100% when the temperature reaches 27 ° C. The payment function is linear between these two temperatures. The insurance payment is calculated by multiplying the sum insured by the El Niño index. Calculation of compensation: Amount Insured

• (TSM - 24.5) / (27 - 24.5) Where: TSM = average sea temperature during November and December Initial timer (24.5 ° C) Trigger limit (27 ° C)
• Example 1: Insured Amount: $ 1,000,000 Bonus: 10% ($ 100,000) TSM (FEN 82-83) = 25.36 °
• Compensation = (25.36 - 24.5) / (27-24.5) = 0,344 Payment = 34.4% * 1,000,000 = $ 344,000
• Example 2:
• Insured Amount: $ 1,000,000 Bonus: 10% ($ 100,000) TSM (FEN 97-98) = 26.28 °
• Compensation = (26.28 - 24.5) / (27-24.5) = 0,712 Payment = 71.2% * 1,000,000 = $ 712,000
• Payment frequency: Compensation is paid before the occurrence of the phenomenon El Niño end. This is so because the current EENIP developed for the region of Piura 24 makes payments based on the average of monthly measurements of the temperature of the sea surface in the months of November and December, taken from the CHILD 1.2 area. ; payment is usually performed in January; while severe rainfall in Piura, usually occur from January to April.

For a possible El Niño in 2016, it should have hired the policy at any time until 31 January 2015. The customer must indicate an insurable interest that could lead to economic to the insured upon the occurrence of El Niño losses. This makes it possible for those persons or entities that have an insurable interest during a flood, can use the real-time payment to invest in prevention measures loss before they occur floods related to El Niño (GIZ, 2011). The amount of time in advance with which you can make insurance payments in case of flooding depends on the index used to measure the occurrence of El Niño. The anomaly in the temperature of the sea surface that defines the occurrence of El Niño begins in the Eastern Pacific and migrates to the Peruvian coast. This means that the rate established in the area further west, the CHILD zone 3, which corresponds to the average November temperature offers the possibility of receiving payment in early December. In addition, both indices (zone CHILD 3 in November and area CHILD 1 + 2 in November and December) are closely correlated with extreme along the coast of Peru rainfall, so the Child 3 zone is used for new applications EENIP (in two regions south of Piura: La Libertad and Lambayeque), which offers an additional month in advance before the onset of heavy rains (GIZ, 2011). Coverage area: The insurance is implemented in the region of Piura, which is the region most affected by the extreme phenomenon on the north coast of the country (see Figure 5). However, it is considering extending coverage to the regions of Lambayeque and La Libertad.

Results The insurance is being offered by the Financial Institution Trust (formerly Caja Nuestra Gente). Still lack clarity on how regional governments and public institutions can hire this index insurance. The spread is still minimal, so that farmers' associations do not have adequate knowledge of the benefits that provide them (CEPES, 2012). In 2011 the first policy of this insurance was sold to Financial Trust to protect 585 agricultural loans worth US $ 4.6 million. In 2012 the 3560 policy to protect agricultural loans worth US $ 27.3 million was renewed. Thus, it has protected 5% of the portfolio of agriculture in the north. The implementation of this type insurance even shows obstacles to overcome (GIZ, 2013): The insurance market and the financial market register a limited number de agents and little diversification of instruments. Although the Peruvian market has shown an interesting growth in recent years, the number of companies willing to innovate with these instruments is limited.

The risk of El Niño is concentrated territorially in 3 northern departments of the country. This restricts the alternatives when thinking of financial instruments to manage it. It is necessary to assess how can form baskets of instruments to diversify risk, so it is an attractive product demand. There is insufficient technical capabilities for the design and implementation of more complex products. a training effort is necessary not only for companies that offer (eg insurance companies) but even to regulators. Participation in dissemination seminars and courses on these instruments are valid mechanisms to achieve this condition.

Little prioritization of the issue in the public agenda of the organismos responsible. Particularly for the public sector, design and implementation of risk transfer mechanisms are not being prioritized, so that the allocation of time, human and financial resources to develop these instruments is limited. The role of cooperating agencies and multilateral organizations is essential to place the topic on the agenda of short- and long-term sustainability of public institutions. Little assurance culture, although there may be some knowledge on the risk. The little perception of the benefits of acquiring a (an intangible) financial service of this kind means that there is reluctance on the part of consumers to purchase these services. The low insurance culture includes not only private actors, such as associations of producers or transporters, but also the public sector, as owner of public infrastructure in the sectors potentially affected by natural phenomena and in particular El Niño. High informality of potentially insurable goods and services: titles, inputs, compliance of construction and operation, among others, generates assets, goods and / or services many agents are not subject assurance. Ignorance of the advantages and disadvantages of new financial instruments by institutional investors, such as pension funds and mutual funds.

CHAPTER VI

REPUBLIC OF URUGUAY

Parametric Insurance

The Oriental Republic of Uruguay has a developed agricultural insurance market. The country has over 75 years experience hail insurance for crops. Currently, five insurance companies (4 private plus public, Banco de Seguros del Estado) are actively involved in covering damage caused by the risks of hail, fire and fire, affecting oilseed crops cereals (soybean and sunflower), which include rice, wheat, corn, fruit and vine. However, the multi-risk insurance (MPCI), which covers losses in crop yields that are caused by various risks including some more systemic as drought, floods and frost character, have not spread in the country for its high cost. This type of insurance is offered in a very limited way for some producers have sufficient historical information on its soybean, corn, sunflower, wheat or barley. With respect to livestock insurance, there are only coverage for accident and mortality in pedigree breeding stock, basically.

Uruguay also has a developed forestry insurance market covering commercial plantations of eucalyptus and pine, located mainly in the eastern and northern parts of the country. Agricultural insurance is voluntary in Uruguay and, with the exception of fruit and vegetable crops, it does not have a state subsidy. Since 2002 the MGAP administers the Fund for Reconstruction and Development Farm (FRFG) that aims to rehabilitate systems fruit and vegetable production and farms of pigs and chickens, as well as the promotion of insurance contracts agricultural subsidies through differential premiums, higher subsidy the smaller the size of the producer. The agricultural insurance market is controlled and regulated by the Superintendency of Financial Services (SFS).

To date, no country exists in the commercial insurance covering livestock producers against quantitative and qualitative losses in natural pastures. Any insurance currently provides coverage for losses in natural pastures of grazing. In 2007 the GoU created the Agricultural Emergency Fund to address climate or health emergencies of origin, and in 2008 provided compensation payments to those agricultural and livestock producers who suffered losses due to drought. The FAE was created by decree in late 22, 2007 in response to losses caused by drought. This fund provides financial assistance ex post, also in productive infrastructure and inputs so as to allow them to agricultural and livestock producers recover from losses caused by climatic disasters. Currently, this fund has very limited resources and could not respond to further losses as the 2008-2009 dry when direct losses to crops and livestock were estimated at US $ 869 million (Rural Association of Uruguay 2009). It is for this reason that the Office of Agricultural Planning and Policy (OPYPA-MGAP) seeks to design a product transfer risk ex-ante to protect livestock producers against increased drought and to have access to insurance markets and local and international reinsurance.

In 2011, the Government of Uruguay (GoU) through the Ministry of Livestock, Agriculture and Fisheries (MGAP), asked the World Bank to conduct a feasibility study for developing an insurance product index to protect livestock producers against severe droughts and other weather losses in natural pastures. Specific components of this study included: (i) identify and hire an international specialist in remote sensing NDVI to develop a database NDVI for pasture in Uruguay; (Ii) assist the Office of Agricultural Planning and Policy (OPYPA-MGAP) in the design, pricing and planning of the implementation of insurance NDVI index for livestock producers in Uruguay; (Iii) develop a policy framework based on public-private partnerships (PPP) for the implementation of NVDI Index insurance in Uruguay; (Iv) provide capacity building to MGAP and the insurance industry on issues

related to insurance NVDI Index; and finally (v) provide the insurance regulator in strengthening capacities in designing Index NVDI insurance. The feasibility study referred to herein was implemented by the World Bank under a technical assistance program to - reembolsable No MGAP.

In 2011 OPYPA-MGAP formally requested the World Bank to provide technical assistance in this design a NVDI insurance program for livestock producers Index of Uruguay.

The NDVI index, which is based on satellite images sensors, can be used as an indicator of the growth conditions of vegetation over large areas of the planet. The images of NDVI can be used for multiple purposes, such as: (1) distinguish between different types of land use, for example, distinguish the type of vegetation in areas with low density of vegetative material areas with bare soil, water or ice; (2) measure the growth conditions of vegetation and distinguish between a healthy type of vegetation a type of dry or dead vegetation. Vegetative materials differ from other floor coverings because it absorbs much of the visible light and reflecting light waves in the near infrared. Several satellites, including NOAA (and Landsat), measuring the intensity with which the two light waves are reflected from the surface of the earth. The NDVI is an expression that measures the difference in reflectance of two ranges lightwave: radiation Red (R) and Infra-Red (NIR) through the following equation "(NIRR) / (NIR + R) ". By normalizing NDVI differences, it takes values ranging from -1 to 1. The values of 0.5 or more indicates dense vegetation; while values between 0.0 and 0.1 indicate bare ground and below 0.00 indicate values surfaces covered with water or ice.

The NDVI is also a good indicator of the growth conditions of different types of plant materials (eg annual crops, pastures and forests). The current status of plant materials can be estimated indirectly. In turn, the actual values of the index can be compared with the index estimates made during other seasons. These comparisons are possible by calculating the amount of red light or infra-red (NIR) that 42 is reflected by the vegetation on the soil surface to the satellite sensors. For example, plants with optimal levels photosynthetic absorb a large amount of visible red light (R) and reflect a lot of light NIR - this is a unique feature of healthy plants. By contrast, plants under stress conditions (eg due to severe drought) and are in stage of senescence reflect much less the NIR light. In the case of natural pastures in Uruguay, the typical monthly values NDVI for pastures healthy growth are around 0.60 to 0.65, while the lowest values of dry winter are around 0.50 to 0.55, and in years with droughts down to 0.17.

The NDVI index measures not only the vegetative state of land cover in a reliable manner; but also, it is correlated with climatic variables such as precipitation and potential evapotranspiration. A study conducted in temperate regions of Argentina showed that climatic variables may account for 89% of the variability in annual values of the index NDVI: the values of this index increased linearly with the average annual precipitation and decreased with evapotranspiration potential, 80% of the variation in the NDVI values are explained by precipitation and 9% by evapotranspiration (Guerschman et al 2003). These correlations between NDVI, photosynthesis and plant vigor, and the amount of rain, show that NDVI is potentially a good indicator to measure the impact of drought on the quality and productivity of pastures.

The NDVI provides an opportunity to ensure the production of pastures against climate risks. Today, there are various insurance schemes that offer this type of coverage to livestock producers. The availability of an extensive database, accurate and high spatial resolution NDVI, and the ability to use these values as indicators of crop productivity make

it a historical source of adequate data for program implementation insurance. Analysis of monthly data index over a period of between 20 and 30 years allows the design of insurance contracts; which they could be calibrated according to the frequency of occurrence of extreme weather years (eg severe droughts), and the frequency and magnitude of payments. However, the application of NDVI within the insurance industry is recent. Since 2000, only four agricultural insurance markets, including Spain, the US, Canada and Mexico, have developed commercial insurance programs for pasture from NDVI. The use of the NDVI in the insurance industry because it provides a rough measure of the level of water stress in vegetation. Payments in all these programs is determined based on the negative deviation from the mean of the actual values of NDVI in the insured during the period of coverage area, according to the scales of pre-agreed payment for a specific geographic area.

The implementation of insurance contracts NDVI has numerous technical and operational advantages when compared to traditional patterns of agricultural insurance insurance policies traditional damage or yield loss have not been successfully adapted for the protection of natural pastures nowhere of the world. There are several potential advantages of using NDVI to provide coverage pastures. For example: (i) Reduction of adverse selection and moral hazard: the compensation is based on variable NDVI index, 43 can be manipulated by ganaderos19 producers to increase the potential or magnitude of the loss to likely be compensated by a insurance company; (Ii) the NDVI insurance can be designed to protect the different insurable interest, including: producing individual farmers (insurance at the micro level), "aggregators regional risk" such as input suppliers and rural banks (insurance meso level) governments or regional authorities (insurance macro level); (Iii) the possibility of offering insurance benefits NDVI to smaller farmers: since insurance NDVI index is based on a variable agreed as acts as objective indicator of the losses suffered by the insured without the need for previous inspections on individual farms and to evaluate the losses of livestock producers, reducing transaction costs and implementation of a safe for small units of agricultural exploitation; (Iv) the transparent structure of insurance products NDVI can facilitate understanding of the contract.

Despite the many advantages of insurance contracts NDVI Index; there are several technological limitations: The most important are: (i) the NDVI sensors are very sensitive to the presence of clouds, waves that scatter red light. To disperse these waves NDVI values or results in empty values also volcanic ash negatively affect NDVI values are reduced, and although NASA has developed correction procedures, not all corrected images appear to be of high quality; (Ii) the spatial resolution sensor is an important, especially in the design of safe pasturas20 limiting factor. The first sensors NDVI Landsat of the 1980s and 1990s produced images NDVI for Uruguay with a typical resolution of grids or pixels of 5km x 5km, and although this area was reduced by MODIS in 2000 to 250mm x 250mm, when bases are required data at least 20 years to design and charging insurance contracts, are not homogeneous series of data. The resolution of 5 km xs km (2500 hectares) could be used to build an insurance scheme at the aggregate level, but not at the level of individual producers (micro level), although this might change in the future with access increasingly economic satellite images with resolutions up to 30m x 30m or even less; (Iii) the varied land use is another limiting factor in developing indices NDVI. The land use within a pixel is rarely dedicated to the same use 100%, and so the NDVI value measured by the remote sensor is the sum of the reflection of all existing land cover types. In addition, the land use changes over time, often motivated by market conditions (for example, a rise in the price of a crop) situation that could motivate farmers to decide plow their natural pastures and sow

crops and annual cereals. Then, the design of a NDVI requires careful analysis of historical land use and preparation of maps of land use to distinguish between units of grazing and other land uses (see Chapter 4 for more detail on the development of the database NDVI to grazing areas in Uruguay).
The World Bank made a bid in the first half of 2011 in order to identify an international company specializing in remote sensing to develop a database of NDVI for Uruguay, and to classify and map land use (forage resources) in the country. He chose the Laboratory of Regional and Remote Sensing Analysis of the Faculty of Agronomy of the University of Buenos Aires (LART-FAUBA), which is a recognized institution in the analysis and interpretation of remote sensing data related to natural resources, agricultural use the land and the environment. LART-FAUBA has previous experience in designing databases for insurance programs NDVI pasture. In 2008 the Office of Agricultural Risk (ORA), Ministry of Agriculture, Livestock and Fisheries (MAGyP) of Argentina, hired LART-FAUBA to develop a base of NDVI data for provinces and selected regions of Argentina with the purpose of monitoring the state vegetation. This work was later used as the basis of the feasibility study ORA-MAGyP-World Bank on insurance applications NDVI pasture in Argentina (2011 to 2012).

Between July 2011 and June 2012 LART-FAUBA developed a database of 30 years of NDVI data from (1981 to 2011) with a monthly temporal resolution. It has also created digital maps pastures 5km x 5km scale for the 19 departments of Uruguay. The generation of this database has been obtained by combining the NOAA images from 1981 to 1999 with a resolution of 5km x 5km (2,500 Ha) and images of the MODIS platform ranging from 2000 to 2011 and have a resolution of 250m x 250mm (6.25 Ha). Figure 4.1 shows a schematic representation of the processes used in the development of NDVI data base. The final database contains 30 years of monthly average NDVI values for a total of 6,232 pixels 5km x 5km.
LART-FAUBA mapped and classified the type of coverage and land use for each of the pixels, specifically in order to identify and distinguish the areas of natural pastures of other forms of land use and type of coverage. During the mapping three activities were carried out, including: (1) use of Landsat images low? resolution to generate a land use classification for the 19 departments; (2) samples in the field to validate the land use classification given; and (3) use of images NDVI MODIS (250mm x 250mm) with the aim of establishing phenological signature of NDVI values for each of the months of the year for both resources forage The main objective of insurance coverage NDVI Index macro level to provide contingency payments to the Government of Uruguay (GoU), based on the evolution of the NDVI. The payment would receive the Government to provide timely assistance to livestock producers in the case of the occurrence of natural disasters; and thus prevent further losses for not acting on time. In other words, it is proposed that the coverage of NDVI Index pastures is an insurance product at the macro level. Also, it is proposed that the product is purchased by the government as a financial instrument to protect its budget in years of losses in the livestock sector induced disasters (mainly droughts); and to ensure a priori timely payments to livestock producers in areas where the quality of pasture has declined seriously. Under the proposed insurance program, all of the approximately 38,000 cattle producers located in the areas of pasture qualified and eligible categories of animals would be automatically registered with the (s) insurer (s). Similarly, registered producers

would benefit if the insurance policy triggers a payment in areas where they are located and for non-fodder.

In the initial phase of NDVI insurance program in Uruguay it is recommended that "Section Police" is adopted as Asegurada Unit. This means that in practice, the area of homogeneous risk (HRZ) or conglomerate more representative pixels is chosen in each Police Section, and values NDVI monthly for each pixel in this area HRZs representative are averaged in order to obtain a NDVI only value Police Section and both the premiums and insurance payments are calculated for each representative HRZ Police Section.
The period of policy coverage grassland NDVI is designed to coincide with periods of normal growth and maximum productivity of vegetative biomass in Uruguay. Of extreme drought occur availability is severely reduced pastures for livestock feed, especially breeding. In Uruguay, Bermudez and Ayala (2005) reported the highest growth rates recorded natural pastures in spring (September to November) with the increase in temperature and rainfall, and in the summer (December to February). The cover is designed to ensure pastures during these peak periods of growth; and excludes the months of autumn and winter (April to August) is when the vigor and growth of pastures is usually low.
From discussions with representatives of livestock producers in Uruguay, it was finally selected cover a period of seven months, starting in September until March the following year. During the execution of the study, the coverage period was refined from discussions with technical and livestock producers in Uruguay. Initially, the livestock industry identified a coverage period of four months in spring (September to December); but later it was found that the production of pastures in summer (January to March) is equally important. A summer drought occur could have adverse implications for producers as these would not receive stock forage and pasture to feed their animals in winter.
In Uruguay, the coverage period spring (September to late November) coincides with a critical stage of livestock production, when a high demand for pastures is presented by production systems cattle breeding in the country . Production systems cattle in Uruguay are synchronized so that the period of highest nutritional requirements of herds equals the period of highest forage production. During the spring, the nutritional requirements of cows are at the highest point because they are in the process of calving and breeding. Therefore, the possibility that an event affecting forage production during spring, not only reduces pregnancy rates and breeding; but also unsettles the reproductive and productive future system. As for the autumn months (January to March), the nutritional demands of breeding cows is also high because they are nursing their calves.
Under the proposed insurance coverage NDVI at the macro level, the GoU (the Insured) you can choose between purchase coverage for a period of seven months (September to March inclusive), or restrict coverage only for a period of four months (September to late December). The pricing tool that has been designed by the World Bank team together with OPYPA in MS Excel is scheduled for insurers to calculate sums insured, pure rates and premiums techniques for spring only or for spring and summer (see Pricing section for details). Total Sum Insured for the program NDVI Macro level to cover only breeding cows is estimated to be US $ 315 million. Total Sum Insured is calculated from the number of breeding cows insurable each insured unit valued according to the value of the monthly sum insured for the coverage period of 7 months.
The definition of Insured Event is critical to the design of the insurance policy NDVI in Uruguay, and to ensure that payments represent as nearly as possible in relation to losses

suffered in the field in terms of quantity and quality the insured event pasture for insurance NDIV index can be adjusted by two parameters: the event duration and intensity of the event. For operation NDVI insurance in Uruguay it is recommended that a franchise is adopted for the purpose of removing very small payments

Prototype contract coverage provides ample protection for livestock breeding for a period of 7 months. The sum insured is carefully related to daily and monthly nutritional requirements of cows during the coverage period. The sum insured has been assessed using as a supplementary food ration mixed sunflower meal and wheat bran.
It has developed a pricing tool in MS Excel. The tool is programmed to allow the user a high degree of flexibility with regard to the definition of the thresholds and Exit Triggers Triggers that activate insurance payments in each of the 195 Insured Units (Sections Police). This tool is designed to calculate rates of pure loss, technical indicative rates and commercial rates. Also, the user can modify the sums insured and the three levels of franchise.
It has designed a User Manual that describes the pricing methodology applied to insurance product NDVI (see Annex 3). This manual can be used as basis for the preparation of the Technical Note, document Underwriters may be required to send to the Superintendency of Insurance and other key stakeholders. This exercise clearly shows charging very high exposure pasture drought; this is reflected in the relatively high technical rates presented here. The main way to reduce (increase) the pure fees and technical fees is, for example, by changing the frequency of payments of 1 in 7 years, 1 in 12 or 1 in 15 years.
Insurers and the Government (the Insured) will need to work with the livestock industry to decide what is the optimal frequency of monthly payments more suitable for this product. If the payment frequency is set for a catastrophic product (eg 1 in 15 years or older), the product could be very attractive in terms of cost, but coverage may incur basis risk related to the design of the contract (the policy may not activate payments although livestock producers in Uruguay have incurred losses in their pastures due to drought). He performed separately Monte Carlo simulation analysis to analyze the PML expected in NDVI program in 18 departments of Uruguay values. This analysis shows that 91 grouping there is considerable risk in the total value of the PML across the country benefit.
PML analysis is designed to assist local insurers in evaluating their appropriate levels of retention, reinsurance, risk stratification in this insurance program. Estimates of the PML values are very high, a situation that reflects the high level of exposure of pastures in Uruguay drought. The results of analysis of pricing and facilitate the work PML insurance companies to design a strategy for retention and reinsurance insurance program NDVI.

Legal framework
The civil legal system Uruguay has its roots in the Spanish legal system (or legal system of Continental Europe). Although Uruguay has adopted the civil legal system, judgments of the judicial system are used as a guide only and are not mandatory (not a legal precedent). This is one of the hallmarks of a legal system of Common Law The main insurance law, which regulates the insurance business in the country dates back to 1861 with the enactment of the Commercial Code which authorizes three types of insurance including:. Fire, agriculture (hail) and life insurance.
In 1911 the State Insurance Bank (BSE) that once monopolized the insurance activity in the country was created. It was not until 1993 with the enactment of the Insurance Law No.

16,426 that allowed the opening of the market to new competitors (AXCO 2012). The insurance market is regulated by the Superintendency of Financial Services (SFS) of the Central Bank of Uruguay (BCU). The SFS is responsible for establishing the regulatory and legal framework governing the insurance activity, monitor compliance with them by insurers and insurance agents; and disseminating market information. There is also an association of companies called Uruguayan Association of Insurance Companies (AUDEA), which represents the interests of private insurance companies including the 12 property companies operating in the country.

There are several features of insurance NDVI that make it different compared to traditional insurance. Because of this, the implementation of such product may require changes or amendments to the insurance legislation in several countries. To begin, the object of securing a piece of land with a defined area of an insured crop (which could be a pasture), is replaced by an index applies under a traditional insurance policy, for example. The index in this case refers to NDVI which is measured by remote sensing and is designed to provide the most accurate measurements possible on losses in quality and pasture production in years with severe climates, especially during drought events. Second, a central feature in traditional insurance policies is that the well secured (securable object) must be subjected to physical damage or loss, and loss must be measurable and quantifiable. By contrast, under insurance coverage index is not a measure of actual physical loss or damage suffered by the Insured is done; but a payment according to a procedure is performed pre-agreed once the threshold index values have enabled a payment. Such payment may be limited by a maximum value payment lump sum or installments. A further difference between the traditional system and the index is that the latter could generate payments to the insured even if the Insured has not incurred any damage or loss of property insured. Since the basic principle of a contract of insurance is to compensate the insured for a loss only, regulators have occasionally challenged the legal status of indexed schemes and have even prevented their establishment because they do not consider a type of insurance (GlobalAgRisk 2011).

CONCLUSION

Parametric or weather index insurance are contracts that stipulate compensation from the occurrence of specified weather events.
The contracts are based on parameters that seek to explain the potential losses of companies, governments, financial institutions and farmers.
This type of insurance does not require damage assessment, verification or losses. At the same time this kind of insurance show great potential as an effective risk management tool, but also face challenges in developing countries.
The main associated benefit is the reduction or near elimination of moral hazard and adverse selection in the insurance market. Adverse selection in the insurance market refers to the situation where insurers find it impossible or very costly to distinguish between applicants high risk and low risk.
So insurance contracts traded at an average premium for all individuals.
These contracts not requiring damage assessment have high penetration and eliminate costs related to information on applicants, monitoring and some administrative costs. This is reflected in lower contract prices.
Premiums are calculated according to three criteria: risk transparency, administrative costs and transaction costs. Under this system costs associated indexes for each component are lower.
In the case of Argentina, weather contingencies of the last 30 years largely affected agriculture and livestock. Traditional insurance schemes have not been able to provide practical solutions for securing large areas d.
Moreover, insurance rates wanting to be implemented in the Argentine insurance market, had a legal impediment, according to the Insurance Law 17,418 agricultural insurance are framed within the property insurance and as such must be a real financial loss and verifiable so that the obligation is incurred by the insurer for damages to the insured.
Index insurance have such a design that does not guarantee that property damage for payments are triggered.
Efforts by ORA-MAGyP to the Superintendent of Insurance of the Nation, they provided was reached to consider approval of the proposal without the need to change the law. It would require only a technical note, with the backing of the World Bank, where the correlation and the use of the index is justified.
Efforts by ORA-MAGyP to the National Insurance Superintendency, was achieved was reached to consider approving the proposal without the need to change the law. It would require only a technical note, with the backing of the World Bank, where the correlation and the use of the index is justified.
In the case of the Federative Republic of Brazil occurred recent natural disasters, floods, landslides, torrential rainfall and its consequences for treatment involving the government, the insurance market and population.
In this context, Swiss Re Corporate Solutions offers the first product of parametric type in the country. It targets sectors of the economy that have revenues and operating costs directly affected by unexpected variations in climate, such as companies generating energy with major renewable sources in agribusiness that are affected by the regime rain, wind, sun and temperature.

This is a pioneering product in the Brazilian market and represents our vision to develop innovative solutions for the business needs of our customers. It's a new way to help businesses minimize losses in its financial results to the unpredictable weather.
The solution developed by Swiss Re Corporate Solutions sets the option for the customer buys the product according to the variable that best fits your activity. Precipitation (mm rain), river flow, temperature extremes, wind, solar radiation and Niño indices are some of the options. You can also perform combinations of these risks.
In the Republic of Chile, the Pacific Ocean has a moderating effect of the impact of climate change, global cause that level rising temperatures, but new studies show that the country still recorded significant changes in climate.
A research commissioned by the Ministry of Environment Centre for Agriculture and Environment of the University of Chile, analyzed the climate scenarios 2030 and 2050. They will be necessary mitigation measures, as not only the climate in the country will be warmer but prone to storms and more cloudy days. Possible effects include transfer of traditional crops in the central south zone and decreased coverage of native forests.
Insurers offering such products must be separate legal entities, registered in the Superintendency of Securities and Insurance and a representative of major shareholders directory. They must have their own risk management strategy (in line with the future implementation of Risk Based Supervision) including buying reinsurance.
In order to implement this product, for example in the domestic agricultural sector, the main challenge is to achieve cooperation between related entities: Insurance companies, responsible meteorological centers to perform and certify the measurements, and government organizations today subsidize important part national agricultural insurance. Specifically, a parametric agricultural insurance linked to a rainfall index indemnify the farmer as long as the rains fallen exceed an amount of millimeters in a given period of time. Such compensation would be for the previously agreed amount, which may be the total estimated (depending on the index of the real event), a percentage of it and / or a payment limit loss. Proper use of this type of insurance in the agricultural sector, boost greater efficiency in the management of insurance, allowing improve your current coverage, 3% of the national insurable surface. In addition, insurers would be able to deliver higher quality and variety in the benefits of this product. Moreover, for small domestic farmers allow lower premiums expand access to this product shelter, and thus reduce their current vulnerability to inclement weather.
In the case of the Republic of Peru, The weather factor is causing the most problems in world agriculture. It originates in some regions up to 78% of annual losses in the sector.
There are currently more than 600,000 cultivated hectares in the levees and there are still 900 thousand available for expanding the agricultural frontier in those regions.
The main challenges facing the rural sector in Peru, are the problems of marketing, technology, capital, problems and climate challenges with a wide climatic variability by region, El Niño and La Niña.
In this context, the country's largest insurance products accounts for climate risk management.
The Catastrophic Crop Insurance is a Insurance indexed to crop yield in a given area protects against catastrophic loss of regional impact.
In Peru, in the last twenty years we have developed a set of initiatives, both public and private, which aimed to create an agricultural insurance market. During the 1990s there were three initiatives led by the private sector, which failed in its attempt to develop an

agricultural insurance. Then in the next decade, was the Peruvian government which assumed the role of promoter agricultural insurance market.
The institutions of the Government of Peru supported the market innovative insurance against weather events by adapting the regulatory and institutional framework for the promotion of such insurance.
As regards the Eastern Republic of Uruguay, it has a developed agricultural insurance market. The country has over 75 years experience hail insurance for crops. Currently, five insurance companies (4 private plus public, Banco de Seguros del Estado) are actively involved in covering damage caused by the risks of hail, fire and fire, affecting oilseed crops cereals (soybean and sunflower), which include rice, wheat, corn, fruit and vine. However, the multi-risk insurance (MPCI), which covers losses in crop yields that are caused by various risks including some more systemic as drought, floods and frost character, have not spread in the country for its high cost. This type of insurance is offered in a very limited way for some producers have sufficient historical information on its soybean, corn, sunflower, wheat or barley. With respect to livestock insurance, there are only coverage for accident and mortality in pedigree breeding stock, basically.
Under the proposed insurance coverage NDVI at the macro level, the GoU (the Insured) you can choose between purchase coverage for a period of seven months (September to March inclusive), or restrict coverage only for a period of four months (September to late December). The pricing tool that has been designed by the World Bank team together with OPYPA in MS Excel is scheduled for insurers to calculate sums insured, pure rates and premiums techniques for spring only or for spring and summer (see Pricing section for details). Total Sum Insured for the program NDVI Macro level to cover only breeding cows is estimated to be US $ 315 million. Total Sum Insured is calculated from the number of breeding cows insurable each insured unit valued according to the value of the monthly sum insured for the coverage period of 7 months.
In this context, the parametric insurance scheme constitute an innovative operation that contributes to a more efficient management to manage risk exposure and reduce the costs of the activity.
The insurance index represents an important element in the production chain of Latin American countries, reduce the vulnerability of the economy, create conditions of greater solvency in the production unit, avoiding loss of capital as a result of happenstance and reduces the need for public resources for finance losses from catastrophic losses.
As instruments of risk management, parametric insurance allows adopt financial strategies for the management and transfer of catastrophic risk, face more efficiently the economic and social consequences generated by adverse climatic events and reduce pressure on the finances generating aid emergency before the occurrence of such events.

Bibliography

Desarrollo y opinión de los Seguros Paramétricos en Latinoamérica
Alarcón Rodríguez J.C., Conde Balbo A.P., Moreno Díaz G.
Universidad de la Sabane
Bogotá D.C. 2009

Estudio de factibilidad de Seguros Agrícolas por índices.
Informe de Avance. Seguro de Indices a nivel macro.
República Dominicana Abril 2013

Los Seguros Agropecuarios en las Américas un instrumento para la gestión del riesgo.
Hatch D.C., Vila F., Stephenson K.
San José de Costa Rica 2012

Revista Mundo Asegurador. Año XXXVIII N° 422 D.C. 2015

Revista Investigación y Ciencia. .Edición Española de Scientific American
Temas 83 El Cambio Climático en la Biosfera .Ecosistemas amenazados y posibles soluciones. 1° Trimestre 2016

Superintendencia de Valores y Seguros- Chile

www.elobservador.com.uy
www.riscosegurobrasil.com
www.unesco.org Seguros Climáticos: La experiencia de Perú y Argentina –Unesco
www.iica.int Seguros Agropecuarios