MARKET NICHE IN AGRICULTURAL INSURANCES

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As the negative effects of climatic warming are more and more obvious, the demand for insurance solutions to cover the costs resulting from weather whims shall increase in direct ration with risk exposure. Although the situation might be interpreted as a business opportunity, in order to be able to offer the proper cover it is necessary to comply with fundamental demands regarding the weather risk insurance. Thus, when conceiving viable insurance solutions of the consequences intervened in case of a catastrophic event generated by harsh weather conditions we must take into consideration factors such as measurement possibility of the respective risk, in order to decide if this can or can not be accepted. Thus, in this item we tried to illustrate some elemental aspects connected to agricultural insurances perspectives.

Keywords: agricultural insurance, weather insurance, weather derivative.

1. The existing background of agricultural insurances

The experience of economically developed countries revealed the fact that without a stable development of *agricultural insurances,* there is no chance for high performance agriculture. The investment necessary for working the field by means of an intensive technology is too important to disconsider the climatic risks whose manifestation may ruine the entrepreneurs. The agricultural field of activity confronts with climatic risks which acquired lately a frequence and an intensity of manifestation unknown for us. In our country, calamities produced in agriculture, such as the drought, the hail, very low temperatures (under the limit of biological stand for crops and large farms), rainstorms causing indirect effects: overflowing, flooding, landslides etc., are very known due to their wide broadcasting.

A world classification of the flooding risk was undertaken, taking into account the quantification of 26 variables, within it Romania occupied the 49th position[101]. According to the statistics, during the years 1960-2003, 1.923.000 hectares of agricultural surface were damaged by flood.

Concern for risks that stifle investment and contribute to vulnerability of the rural poor is a driving force behind various types of agricultural insurance. Insuring small-scale farmers against crop losses to adverse weather or other hazards has attracted public sector involvement in the provision of agricultural insurance in many countries among which Romania. With few exceptions, such interventions have encountered severe problems owing to high administrative costs, moral hazard, adverse selection etc. Government interventions should be aimed at improving the accessibility and quality of private sector insurance. This will require the establishment of a framework for responding to severe systemic events affecting agricultural production, and establishing an appropriate regulatory environment to foster private sector innovation and investment in services for less catastrophic events.

2. Limits of the classical agricultural insurance

"The collaboration between public authorities and the insurance industry is necessary for the implementation and the operation of a protection strategy for insuring against disasters", represents one of the conclusions formulated by ICAR Forum 2006[102]. The implementation of strategies of managing natural disasters leads to the diminution of the total cost allocated to damages. But, most of the time, it is impossible to implement similar strategies in different countries.[103] In this situation, the political will is determined within each country, different targets being followed.

In Romania, especially during the development process existing at present in agriculture, the public-private relationship is still absolutely necessary due to the failure proved by small farmers in dealing with multiple

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[101] Source: Water Careful Management Laboratory, Hydrology and Water Careful Management National Institute – www.hidro.ro

[102] The International Catastrophic Risks Forum, 3rd edition, held at Bucharest on 2nd -3rd of October 2006.

[103] As Alberto MONTI, Principal Administrator (Insurance), Financial Affairs Division, EOCD (European Organisation for Cooperation and Development) mentioned in his presentation held within ICAR Forum 2006.

issues (the partitioning of fields, the lack of equipments and of a suitable infrastructure, new European rules, climatic changes generating effects which become more and more disastrous etc.). A long term and serious involvement of the government may cause negative consequences.

The governmental involvement on any market presents the possibility to exclude the particular sector. For this reason, the agricultural insurance market does not constitute an exception. The governmental aid in managing the risk in agriculture is materialized in the support allocated to the insurance premiums for certain categories of policies and risks and in the financial and material aid previous to the manifestation of risks considered disasters.

The damages alloted by the government are received only by those who have already concluded an insurance, even the utmost simple one, such as the insurance against the hail – it is the cheapest one. Then, the authorities are forced to declare by Government Decree, (according to the existing pseudopolitical interest) as a "calamity-stricken area" any surface affected by nature caprices, because of the large sums of money paid in this purpose. Such a conduct leads to an uneven environment, where the private insurers' interest decreases gradually, in a proportional manner to the lack of interest proved by possible customers of private insurances.

Private insurance companies may be no longer interested in making an offer of agricultural insurance if the rules of the game are not known from the beginning. It is necessary to be informed upon the previous establishment of the intervention level (of the sum) to which the government interferes in order to offer assistance. If the governmental acts and decisions are clear and transparent, the insurance providers will prove much trust working on the agricultural market.

One may conclude that the governmental involvement in managing the risk within the agricultural sector explains the possibility of dealing with an increased risk affecting the producers' activity.[104] Generally, farmers should not count on the aid offered when dealing with a disaster, as long as they are not applying all the measures meant to control the risk. An important way in the evolution of the agricultural insurance system, as it is shown by the experience of economic developed countries, is to combine the classical type of insurance with the deriving products.

The traditional agricultural insurance which may be multi-risk (it considers a variety of risks) or uni-risk (it refers to the manifestation of one single risk), presents a series of limitations, that is why it is more and more avoided by the possible customers. The main limits of the classical agricultural insurance may be:

- informational asymmetry;
- denatured stimulation;
- unfavorable (adverse) selection;
- administrative costs;
- moral hazard.

3. New types of agricultural insurance

During the last few years, at the international level, a variety of new financial mechanisms present the capacity of solving many issues related to the traditional projection of agricultural insurances. New instruments operate based on the configuration of the insurance indemnity payment, thus it will be paid when it reaches a certain level determined by statistic calculations and designed as the "index".

The international practice registers two types of agricultural insurances based on the index: weather insurance depending on the index and surface insurance depending on the index. The use of the two types of policies for the insurance against natural disasters intensified the access to insurance services for the poor persons living to the country. The "release mechanism" (the index) may be verified in an independent manner, thus the vulnerability to political interaction and the manipulation of the loss registered by farms reduce. Reduced administrative and transactional costs together with other profits force the private sector of agricultural insurances to offer to possible customers' unsignificant subsidies or no subsidies.

I. Weather insurance based index – the insurance indemnity will be paid by the insurer under the circumstances of reaching a release mechanism previously established, called the "index".

[104] Mahul, Olivier - "Optimal Insurance against Climatic Experience." *American Journal of Agricultural Economics* 83(3), 2001, pp. 593–604.

The index may consist of a variety of weather indicators, such as: rainstorms volume, temperature, humidity, wind intensity or the number of sunny days, each indicator is confirmed by a independent third person and mutually related to individual damages registered as a result of the event manifestation.

II. Surface insurance depending on the index – the payment of the indemnity is completed when the cropped surface is reduced (the output too) under a certain percentage determined according to climatic characteristics of the area, as a result of the manifestation of a disaster (drought, flood etc.).

The insurance is sold using standard devices (for example, currency units or "units") corresponding to a policy or to a certificate for each bought unit. The insurance premium is the same for each buyer, providing an equal indemnity if the insured event takes place. Buyers are free to purchase as many insurance units as they want.

III. A weather derivative represent a contract between two parties which stipulates the value of the payment taking into account meteorological conditions manifested during the period of the contract.

Weather derivative is a financial instrument used by companies to reduce the risk associated to unfavorable or unpredictable weather events evolutions[105]. The derivative seller accepts the risk by cashing a bonus (derivative price). If the event doesn't take place, the seller makes a profit, but if the event takes place, the buying company cashes a preliminarily agreed amount. In USA, Europe and Australia, temperature, snowfall quantity, freeze expansion and rainfall quantity are key conditions for which corporations buy weather derivatives. The cost of a weather derivative depends on the probability of weather negative impact upon the business and duration of the contract concluded between the bank and corporative entity.

A weather derivative is defined by many elements, as it follows:

Reference weather station. All contracts of weather derivative type are based upon weather observations accomplished at one or more specified weather stations, accomplished by an entity certified by national weather authority of the state on which territory there are the respective stations. Most part of the dealings are based upon only one station, but some contracts are based upon a combination of reports from many stations, and others upon differences between the values noticed at two stations.

Index of a weather derivative defines the weather parameter which establishes when and how the payments agreed by contract shall be accomplished. The indexes most frequently used are Heating Degree Days (HDD) and Cooling Degree Days (CDD) – which measure the cumulated variation of daily average temperature comparing to the level of 18^{o}C (65 Fahrenheit degrees) along a season. We must mention that other basic temperature levels may be adopted, for instance in Great Britain these are of $15{,}5^{o}$ C.

The arithmetic expression used in order to determine the HDD and CDD is the following[106]:

$$HDD = \sum_{i=1}^{N} \max\left(0, 18^{o} C - T_i\right)$$

$$CDD = \sum_{i=1}^{N} \max\left(0, T_i - 18^{o} C\right)$$

were,

N represents the number of days for which a contract is developing;

T_i - arithmetic average of maximum (T_{max}) and minimum (T_{min}) thermic temperatures of day *i.*

For instance, the daily accumulated CDD number is equal to the difference between the average temperature of the day and the value of 18^{o}C (65 Fahrenheit degrees), if the temperature is over 18^{o}C and to zero if the temperature doesn't exceed 18 Celsius degrees. If the average temperature of the day is under 18^{o}C (T_{base}), then the difference between 18^{o}C and average temperature of the day leads to HDD number, CDD and HDD values are never negative, being at least equal to zero.

As a consequence, if T_i shall be of 10 °C when the HDD value for that day is of 8 (18 °C - 10 °C = 8 HDD), instead, if T_i shall be of 20 °C, then the HDD value is 0. In the same way there can also be determined the CDD value. If T_i shall be of 20 °C, then the CDD value is 2 (20 °C - 18 °C = 2 CDD), and if T_i shall be of 10 °C then the CDD value is 0.

[105] http://en.wikipedia.org/wiki/Weather_derivatives

[106] Lixin Zeng, *Weather Derivatives and Weather Insurance: Concept, Application, and Analysis*, Bulletin of the American Meteorological Society, Vol. 81, No. 9, September 2000, pp. 2075 -2082.

During a month there can be accumulated both CDD (during the days with average temperature over 18 degrees – days with high temperature) and HDD also (during the days with average temperatures under 18 degrees – days with low temperatures). The weather (options) derivatives are defined on HDD or CDD accumulation over a specific period.

A wide range of indexes is used for the dealings restructuring which offer the most adequate hedging mechanisms for the users from different economic fields. Many dealings are based on the so-called event indexes, which count the number of days when the temperature exceeds or drops under a defined limit, during the contract. Similar indexes are used for other variables; for instance the rainfall accumulation or the number of days when the rainfall accumulation as snowfall exceeds a defined level.

Term. All contracts have a defined day of beginning and termination, which define the period for which the specific index is calculated. The most frequent market terms are 1^{st} of November - 31^{st} of March for the winter contracts and 1^{st} of May - 30^{th} of September for the summer contracts. However, there has been noticed an increasing level of contracts for a month or a week, along with the market development. Certain contracts also specify various calculation proceedings of the index in the agreed term - such as weekends exclusion or the double share for the specified days – in order to meet some individualized exposures.

Structure. Weather derivatives are based on standard structures of the derivative financial instruments, such as put, call, swap, collar, straddle, strangle. The key attributes of these structures are:

- Strike – meaning the specific index value when the contract begins the payment;
- Tick – meaning the paid amount per growing unit of the index over strike;
- Theoretical limit or value – meaning the maximum payment stipulated by contract.

Premium. The buyer of a weather option pays a premium to the seller that is typically between 10% and 20% of the theoretical amount of the contract. Still, the bonus may significantly vary depending on the risk profile of the contract. In order to exemplify, we may take into account a common shape of weather derivative, meaning the put option which offers protection to the effects of a warm winter.

There are two commonly used forms of weather derivatives: call and put.

A. "Call" contracts imply the existence of a buyer and of a seller who agree over the period of the contract and over a weather index (W) considered the main element of the contract. For example, the W may be the total amount of rain-fall during the entire period of the contract.

From the beginning, the seller receives a premium from the buyer. At the end of the contract, if the W is more important than the planned step sensitivity (S), the seller is obliged to pay to the buyer a sum $P = k(W - S)$, where k is the predetermined constant factor which sets the value of the payment according the weather index unit. The step sensitivity (S) and the k factor are known as the "stike" (the approved price previously determined or the exercise price) and the "tick" (the minimum fluctuation of price) of the contract. The payment planification of the sum (P) may be dual or linear (the fixed sum, established in the contract - P_0 – will be paid if the W is more important than the S, if this condition is not fulfilled then the payment does no longer take place) .

B. "Put" derivatives are similar to "call" products except the fact when the seller pays to the buyers the sum P if the W is lower than the S. This sum is determined considering the following formula $P = k(S - W)$. "Call" or "put" products represent the equivalent of an insurance policy: the buyer pays a premium and receives the indemnity pledge in exchange, if a previous defined condition is accomplished.

A generic weather derivative contract can be formulated by specifying the following seven parameters:

- contract type (call or put);
- contract period (e.g., from 1 Nov 2006 to 31 May 2007);
- an official weather station from which the meteorological record is obtained;
- definition of weather index (*W*) underlying the contract;
- strike (*S*);
- tick (*k*) or constant payment (*PO*) for a linear or binary payment scheme;
- premium.

The parameters mentioned above determine the payment sum (P) for a linear payment planification:

$P_{put} = k\max(S - W)$ where $(S - W)$ is at least 0

P_{call}= kmax(W – S) where (W – S) is at least 0

The function max(*x, y*) returns the greater of values *x (S)* or *y (W).*

For a binary payment scheme:

$P_{put} = P_0$ if W – S < 0; $P_{put} = 0$ if W – S ≥ 0

$P_{call} = P_0$ if W – S > 0; $P_{call} = 0$ if W – S ≤ 0

The payment diagrams for a linear "call" and "put" contracts are presented as it follows:

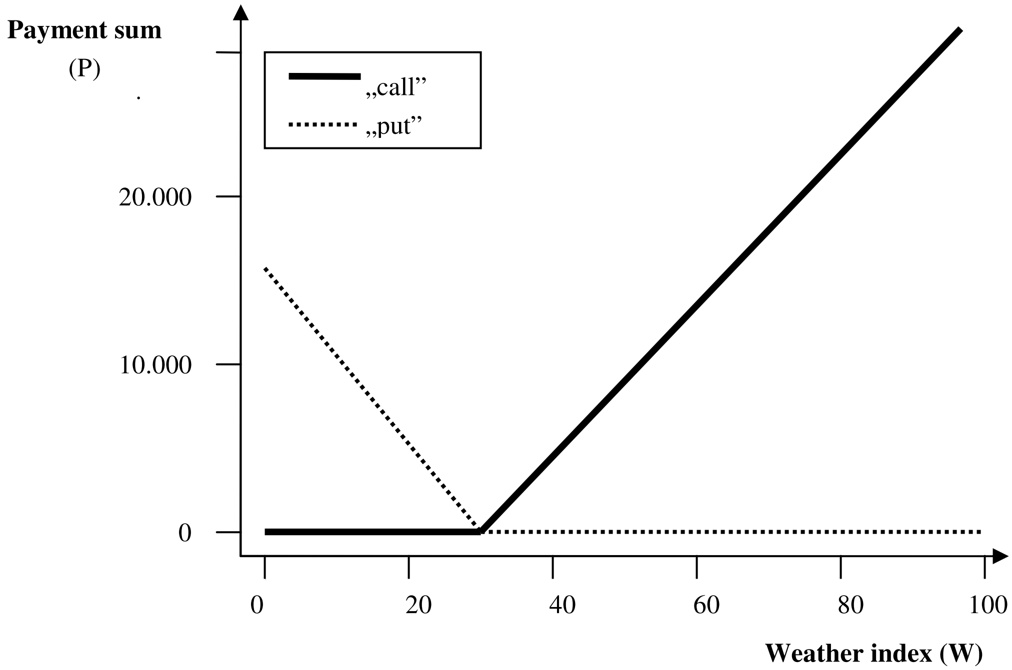

Figure no.1 – The payment diagrams for a linear "call" and "put" contracts

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