Actuarial principles of the cotton insurance in Uzbekistan

Topic 1: Risk evaluation

Shamsuddinov Bakhodir

The Tashkent branch of Russian economic academy, the department of higher mathematics and information technology

700063, Uzbekistansky street 49-7, Tashkent, Uzbekistan

tel.:(998-71) – 132 64 86

fax: (998 71) – 132 60 22 or 132 60 19

shams1964@rambler.ru

Abstract: The brief analysis of modern state of crop insurance in Uzbekistan is made. A dynamics of a loss cost in several regions of Uzbekistan is shown. Two methods of premium rate calculations are reviewed. The mix of these methods is offered for calculation of premium rate.

Keywords: an actual production history, a loss cost, a net-premium, a premium rate.

Agricultural manufacture plays an important role in economy of Uzbekistan, accounting for 25 percent of gross domestic product (GDP), 60 percent of foreign exchange earnings, and 45 percent of employment. By far the most important crop is cotton. The sown land under cotton is 1,388 million hectares. It is 38 % from all arable land. Uzbekistan ranks as the world's fifth largest producer of cotton, wich alone accounts for about 50 percent of export earnings.

The insurance industry in Uzbekistan is at an early stage of development. The ratio of premiums to GDP is about 0,5 percent in 2002.

As of May 2003, the insurance industry comprised 29 registered insurance companies. There is only one insurance company that provides agriculture insurance service, Uzagrosugurta State joint stock insurance company . The company provides all risks insurance related to agriculture.

The present paper is devoted to research of tariff politics of the Usagrosuguta company in the field of cotton insurance.

The crop insurance till 1997 was mandatory. The premium rates were established by way of 1-1,5 percents without dependence on geographical and climatic conditions.

The transition to voluntary crop insurance has led to differentiation and sharp increase of the premium rates in all regions of Uzbekistan. And the increase of premium rates has led to a decrease of demand to this insurance service. In 2002 15,66 percent cotton planted areas were insured.

The cotton insurance is includes such risks, as a drought, a hurricane, a cold, a hailstones, a downpour, a flood, a wreckers, a biological illnesses - the number of such risks is 18.

A policyholder establishes an actual production history (APH) yield based on the grower's actual production records for 5 years. If the grower does not have 5 years of production records, an APH yield can be based on as little as 3 years of yield data. Coverage level is 50%.

“Liability” = “Price Guarantee”* “APH yield” *“ Coverage level”

“Premium” = “Liability” * “Premium rate”

“Indemnity” = “Liability” – “Market price of actual yield”

The crop insurance is a unprofitable kind of activity. Therefore premium rates have high meanings. In Uzbekistan premiums are not subsidized, but insurance indemnities are subsidized.

In this connection, in some regions of republic, risky for agriculture, the Uzagrosugurta company is compelled to render insurance services by the insurance premium rates in adequately to losses. Figure 1 shows a comparison of average loss cost with a premium rate in 5 regions of Uzbekistan - Carakalpakistan (I), Kashkadarya (II), Namangan (III), Surkhandarya (IV) and Tashkent (V). Figure 2 shows the dynamics of loss cost in these regions and Republic of Uzbekistan (VI) for 1998-2002 years.

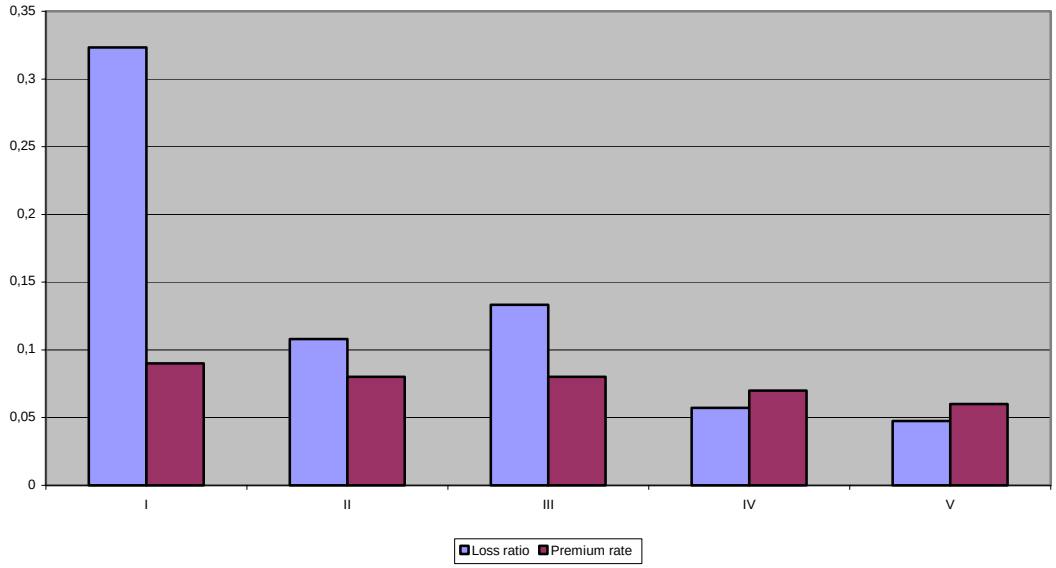

Figure 1.

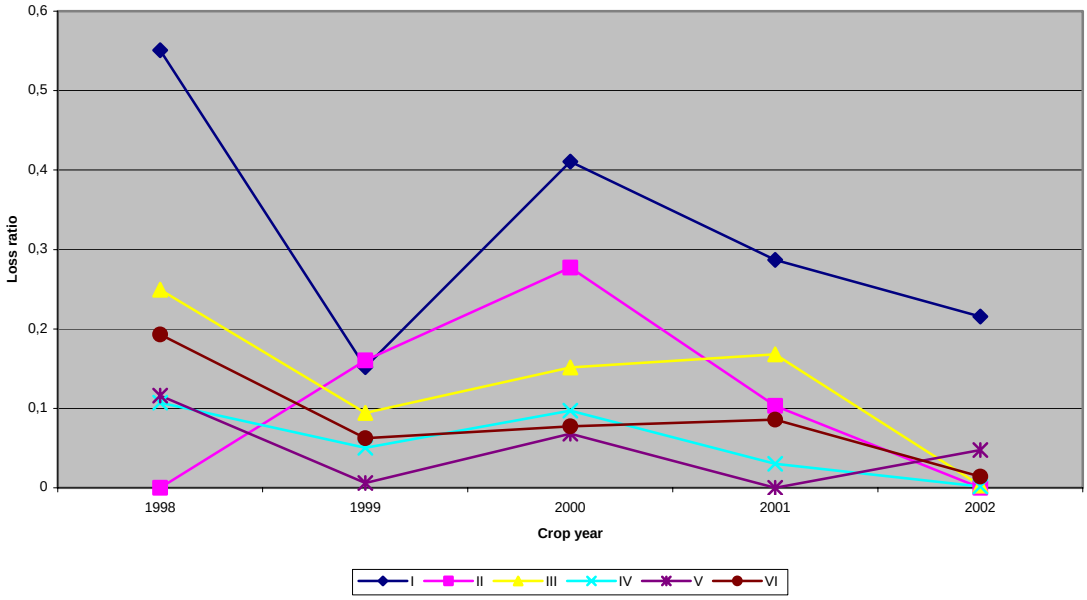

Figure 2.

It is well known that the premium rate is calculated on statistics of a loss cost for a certain period (usually, for 5-10 years).

There exist 2 methods of calculation of the premium rate, applied by the Uzagrosugurta company. Method 1 is based on an average loss cost. Method 2 is based on an estimation of future value of a loss cost.

The brief description of these methods.

For convenience we enter the following designations:

S_1, S_2, …, S_n - the total liabilities of company on some kind of crop insurance for n years, accordingly;

Q_1, Q_2, …, Q_n - the total indemnities for n years, accordingly.

The sizes of the loss cost for n year - Y_1, Y_2, …, Y_n, an annual average loss cost for n years $\overline{Y}$ and a root-mean-square deviation σ are calculated on the basis of this statistics:

$$Y_i = \frac{Q_i}{S_i} \quad , \overline{Y} = \frac{1}{n}\sum_{i=1}^{n} Y_i \, , \quad \sigma = \sqrt{\frac{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}{n}} \, , \qquad i=1,2,\ldots,n \ (1)$$

The net-premium rate consists of two parts - basic and risk components.

The basic component of the net-premium rate is equal to

$$T_o = \overline{Y} \qquad (2)$$

The risk component of the net-premium rate is equal to

$$T_r = \beta(\gamma,n)\cdot\sigma$$

where $\beta(\gamma,n)$ – the quantile of the Student's distribution with parameters (guarantee of safety) and n (number of degrees of freedom).

Thus net premium is equal to

$$T_n = \overline{Y} + \beta(\gamma,n)\cdot\sigma$$

The second method is applied if there exists linear trend in dynamics of loss cost

We find an estimation of the future loss cost on the basis of statistics $Y_1, Y_2, \ldots, Y_n$ and using the formula of linear approximation.

The model of linear approximation has the following formula:

$$Y_i^b = a_0 + a_1 i, \qquad i=1,2,\ldots,n. \qquad (3)$$

where Y_i^b - leveled parameter of loss cost, a_0, a_1 - parameters of linear trend.

The parameters of linear trend are defined on a method of the least squares, that is reduced to the decision of system of two linear equations:

$$\begin{cases} a_0 n + a_1 \sum_1^n i = \sum_1^n Y_i \\ a_0 \sum_1^n i^2 + a_1 \sum_1^n i^2 = \sum Y_i i \end{cases} \qquad (4)$$

The basic component of the net-premium is defined as:

$$\tilde{T}_o = Y_{n+1} = a_0 + a_1(n+1) \qquad (5)$$

The net-premium is equal to

$$\tilde{T}_n = Y_{n+1} + \beta(\gamma,n)\cdot\tilde{\sigma} \qquad (7)$$

where

$$\tilde{\sigma} = \sqrt{\frac{\sum_{i=1}^n (Y_i - Y_i^b)^2}{n-1}}$$

In figure 3 is shown the basic component of the net-premium, that is calculated on these methods.

Region	T_o(method 1)	T_o(method 2)
I	0,30	0,08
II	0,12	0,11
III	0,13	0,01
IV	0,07	0,03
V	0,05	0,01

Figure 3.

Great difference in these calculations leads to doubt of expediency of applying such methods in this particular case.

The drawback of method 1 is, that the character of change of dynamics of the loss cost is not taken into account. From the figure 2 it is obvious, that in all regions the loss cost has decreased strongly in 2002.

A dependence on the real statistical data of loss cost on time is far from being linear. It also explains of inapplicability of method 2 in this case.

Calculating the premium rate it is necessary to take into consideration the crop insurance peculiarities.

The crop productivity depends first of all on climatic conditions. The contract of insurance, as a rule, is signed before the cotton sowing term is ended. In Uzbekistan the sowing works of cotton usually begin in April. By this time it will be possible to predict climatic conditions during for production period of a cotton (May - November). It is possible to expect estimations of loss cost on the basis of this forecasts.

We offer a mix of two above-stated methods as a method of account of the basic part of the net-tariff:

$$T_0 = \alpha \overline{Y} + (1-\alpha) Y_{n+1}, \qquad 0 \le \alpha \le 1$$

Parameter α gets out depending on

1. forecasts for climatic conditions during the production period;
2. the actual production history.

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