Using the Statistical Indicators for the General Insurances Activity

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Abstract. The statistics of the general insurances activity is largely used in the actuarial calculations. The actuarial analysis are achieved exclusively on the basis of primary and derived indicators, which are drawn up by various statistical methods. The statistical indicators which are used in this respect are obtained on the basis of the factors and conditions allowing the compensation cases to occur.

The actuarial analysis is performed over the time as well, by using the chronological which allow the decomposition of the phenomenon being studied by its factors of influence.

In this article, after briefly presenting a number of point of view regarding the utilization of the statistical indicators in the actuarial analysis, we have analyzed, successively, a series of issues, such as: the statistical indicators as regards the general insurances fund forming, expressed in physical and value units, or as absolute, relative and average volumes; the statistical indicators of the utilization of the general insurances funds (with the same diversified form of expression) and the statistical indicators of the outcomes of the general insurances activity.

A particular accent went to the underlying of certain methodological aspects regarding the calculation of the above mentioned indicators, emphasizing certain particular characteristics concerning their utilization in the frame of the actuarial analysis.

The article is stressing the clarification of the fact that these indicators are uzed in the actuarial analysis as a real system. The respective proportions are enumerated, by underlying the concrete possibilities of computation, which secure the possibility of performing the necessary analysis involved by a decisional process.

Key words: actuarial; general insurances; statistical indicators; insurance fund; damages.

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The statistics of the general insurances activity, largely used as far as the actuarial calculations are concerned, is represented mostly by the statistical analysis of the in a body phenomena which are specific to the general insurances.

The analysis of these phenomena is achieved exclusively on the basis of primary and derived indicators, which are drawn up by various statistical methods.

The statistical indicators of the general indicators are obtained by means of the observation of the factors and conditions of the occurrence of the insured cases during the retrospective period.

The time analysis of the statistical indicators, which is a compulsory element in order to establish the influence of the factors on the risk alteration, provides us useful information for the estimation of the statistical probability of the insurance risk, namely the pre-determination of the future damages (which is the purpose of the actuarial statistics).

1. Statistical indicators of the general insurance fund formation

a) *Absolute statistical indicators*, which are defining the general insurance fund formation, are classified as follows:

Indicators expressed as physical units:

- Number of the insured goods (for the goods insurances) (Nb);
- Number of insured persons (for the health insurances) (Np);
- Number of insurance policies (contracts) concluded (Nî);
- Number of insurance policies in force (Nv);
- Number of policies exposed to risk (N);
- Number of renewed policies (Nr);
- Number of expired policies (Ne).

Indicators expressed as value units. These indicators are classified as *indicators defining the insurance premiums and indicators defining the insured amount.*

Indicators defining the insurance premiums: The premiums are representing the main source of income for the insurer. The basic indicators are the following:

- *Total value of the gross written premiums (PS_b).* The gross written premiums mean the total premiums over one financial year corresponding to the insurance contracts being concluded within the same period, which take into account the reinsurance operations as well.
- *Total value of the net written premiums (PS_n).* This defines the written premiums which do not take into account the reinsurance operations.
- Both the gross written premiums and the net ones include the *amounts actually paid* (the actual written premiums) by the insured to the insurer during the financial year as well as *the amounts to be received* from the insured on the insurance contracts concluded during the financial year even though these amounts will be paid, partially or totally, during the following financial year.
- *Total value of the cashed or earned premiums (PÎ),* which represents the total premiums assigned to the risk exposure during a financial year. They represent that particular part of the premiums written during the respective financial year or during the previous years, which refers to risks being covered within the current period.

For instance, if a policy begins by 01.12.02 for a premium of 120 lei, the premium being cashed by the end of the year 2002 due to that policy counts for 10 lei only (assuming that the risk is uniformly distributed over the year duration). This policy would contribute with 110 lei to the total of the premiums being cashed by the end of 2003, or as an un-cashed premium (PN) by the end of the 2002 year.

This is why the concept of cashed premium will be further used in accordance with the above definition.

The concept of net premium is used also for the administration expenses net premiums; therefore it is necessary to have a contextual approach on the matter.

Indicators characterizing the insured amount

The insured *amount is that part of the insurance value for which the insurer undertakes the liability in case of the occurrence of the phenomenon (event) for which the insurance has been concluded.*

The insured amount represents, in all the situations, the maximum limit of the insurer liability and constitutes one of the elements at the basis of the insurance premium calculation.

The main statistical indicators regarding the insured amount are the following:

- Total value of the insured amount for the concluded contracts (SA);
- Total value of the insured amount for the renewed contracts (SA_r);
- Total value of the insured amount for the expired contracts (SA_e);
- Total value of the insured amount for the contracts being ceded within reinsurance (SA_{CR});
- Total value of the insured amount for the contracts received within reinsurance (SA_{PR}).

b) *Relative statistical indicators* which are characterizing the general insurances fund formation, having a particular importance as the risk estimation and the analysis of the general insurances activity, are the following:

■ *Rate of the cashed premiums ($R_{pî}$)* calculated as ratio between the cashed and written premiums. The formula of calculation is the following:

$$R_{pî} = \frac{PÎ}{PS}.$$

This ratio indicates the tendency shown by the insurance activity, assuming that the insurance classes which are used are basically annual, and indicates the general increase/decrease of the used insurances volume.

■ *Coverage degree in insurances (G_c):*

$$G_c = \frac{N}{M} \times 100 , G_c < 100\ \%$$

where:

M – number of insurable goods (persons).

This indicator shows, as percentage, how much of the number of goods (persons) is insured. To the extent this indicator is recording values closer to 100, it means that the insurances are more developed.

■ *Coverage degree by insurance* (G_{aa}):

$$G_{aa} = \frac{SA}{V_b} \times 100 , \ G_{aa} \leq 100\ \%$$

where:

V_b – real value of the goods by the time the insurance is concluded.

The coverage degree is calculated for the goods insurances only and bears the necessary significance if it is computed separately for each goods included by the insurance.

■ *Renewing degree of the contracts* (G_{rc}):

$$G_{rc} = \frac{N_r}{N_î} \times 100 \ ; \ G_{rc} \leq 100\%$$

The average indicators of the insurance fund formation are the following:

■ Average written premium on a contract (policy) ($\overline{PS}$):

$$\overline{PS} = \frac{PS}{N} .$$

The result is expressed in *lei/contract.* This indicator may be calculated both in the case of goods and persons insurances and as well in the case of the civil liability insurances.

■ *Average insured amount* ($\overline{S}$) is calculated as the ratio between the total insured amounts and the total number of the insurance contracts concluded. The calculation formula is the following:

$$\overline{S} = \frac{SA}{N_î} .$$

The result is expressed in *lei/contract.* This indicator may be calculated also as a ratio between the insured amount and the number of policies exposed to risk during a financial year.

It is calculated for both the whole stock of the existing insurances at a certain moment (policies in force) and separately for the insurances being contracted during a certain period of time.

2. Statistical indicators of the general insurances fund utilization

The statistical indicators which are defining the insurance fund utilization are classified as: indicators characterizing the damages and the insurance expenses and indicators characterizing the insurance reserves (technical reserves).

a) *Absolute statistical indicators*, applying to *the damages and insurance expenses*, are the following:
Indicators expressed as physical units:
■ Number of goods destroyed or damaged (in terms of goods insurance) (n_v);
■ Number of compensated policies (n_d);
■ Number of damages (n) or number of insured cases.
Indicators expressed as value units:
■ *Value of the paid compensations (DP).* The compensations being paid within a financial year represent the totality of payments which the insurer is making on the account of the damages recorded by the insured. DP includes *the payments made for the damages which are liquidated* during the year as well as the *partial payments* made on the account of un-liquidated damages;
■ *Value of the occurred damages (DA)* during a financial year represents the total of the damages arising due to events occurring during the financial year, irrespectively the moment the payment of the compensation is made (damages liquidation), and the fact that these events are reported or not by the end of the financial year.
■ *Total value of the recorded insurance expenses (CA),* including wages, payments of commissions, rents for offices, expenses for IT equipments, expenses for consumable materials, advertising expenses. These expenses are know as administration or management expenses.

b) *Absolute statistical indicators,* characterizing the *technical reserves.* The technical reserves, called also non-life insurance reserves, or *provisions (commissions)*, represent the obligations arising as a result of running an insurance activity.

The following absolute statistical indicators covering the reserves from of the general insurances can be identified:
■ *Total value of the un-cashed premium reserve (RPN),* value equivalent to the un-cashed premium (PN) if RPN is calculated as from the gross written premium;
■ *Total value of the reserve for the reported but yet not liquidated damages (RDRN),* representing the un-liquidated obligations for damages which occurred and have been reported;
■ *Total value of the reserve for the damages which occurred without being reported (RDANr),* representing the obligations undertaken by the insurer for the occurred damages which were not yet notified by the insured to the insurer.
Other absolute indicators of the insurance fund utilization are the following:

- *The premiums ceded for reinsurance (P_{re}), representing the premiums due to the ceded risks in reinsurance or the part of the re-insurer (the insurance company which undertakes the risk in reinsurance) out of the gross written premiums of the party which is ceding (the insurance company which transfers the risk in the reinsurance);

- *Insured amount for the compensated policies (contracts) (SA_d).*

c) *The relative indicators* of the general insurances fund utilization, which are established by statistical methods, are the following:

■ *The damage frequency (q),* representing the total number of damages per unit exposed to risk:

$$q = \frac{n}{N}.$$

This indicator can have a sub-unity value ($q < 1$) or an over-unity value ($q > 1$) and serves as estimator of the probable number of the insured events related to the unity of risk exposure.

■ *Compensation index (I):*

$$I = \frac{DA}{SA} ; I \le 1$$

The compensation index represents the part of the insured amount out of the insured amount exposed to risk, which is compensated.

■ *Risk weight (G_r)* represents the ratio between the average insured amount of the compensated contracts ($\overline{S}_d$) and the average insured amount of the concluded contracts ($\overline{S}$):

$$G_r = \frac{\overline{S}_d}{\overline{S}}.$$

This indicator can have sub-unity, equal to one and over-unity values. It is an indicator of efficiency, which shows for which contracts, on an average basis, the compensations have been made with an insured amount which is higher or lower than the average insured amount exposed to risk.

■ *Coverage degree of the damage (G_{ad})* shows, as percentage, which is the ratio between the compensation and the occurred damage. The calculation formula is the following:

$$G_{ad} = \frac{DP}{P} \times 100,$$

where:

P is value of the damaged recorded by the insured goods.

The coverage degree of the damage may be analysed separately, depending of goods included by the insurance. This indicator shows the degree of the coverage for the damage through the compensation being received. In order to avoid that the paid compensations (DP) equals the damage value, which would favour the occurrence of the risk, the insurer uses as gears "the system of the limited coverage" as well as the *franchise,* consisting of the exoneration of the insurer from covering the damage to the extent of a certain amount or quota.

■ *Damage rate (RD),* which is calculated as a ratio between the occurring damages (DA) and the cashed premiums (PÎ):

$$RD = \frac{DA}{P\hat{I}} \times 100.$$

The damage rate is expressed in percentages and may be lower, equal or higher than hundred percent. To the extent the level of the RD is lower, the financial situation of the insurance company is more favourable. Usually RD is calculated as against the reinsurance net value but the gross value is used as well in order to establish the performance of the writing activity of the insurer. A high value may indicate either an inadequate tariffs for the premiums or an insufficient control on the damages. Since the occurring damages comprise an estimation of the un-liquidated damages, RD depends on the solidity of the constituted reserves.

The damage rate may be calculated also as a ratio between *the paid damages* and *the written premiums,* but this ratio may mislead and should be used with a maximum of care.

■ *Rate of the administration expenses (RC)* is calculated as a ratio between the administration expenses (CA) and the cashed premiums:

$$RC = \frac{CA}{P\hat{I}}.$$

Usually this indicator is calculated against the net reinsurance value. In this case, the reinsurance commission is deducted from the expenses, while the reinsurance premiums are deducted from PS.

■ *Rate of reinsurances (R_{re}):*

$$R_{re} = \left(1 - \frac{PS_n}{PS_b}\right) \times 100.$$

This ratio shows, as percentages, the quota of the premiums being ceded in reinsurance, namely the level of dependence of the insurer as regards the re-insurer.

Rate of the net damages (R_{dn}):

$$R_{dn} = \left(\frac{DA_n}{DA_b}\right) \times 100,$$

where:

DA_n – occurring net damages of reinsurance (without damages being liquidated by the re-insurer);

DA_b – occurring gross damages (including damages being liquidated by the re-insurer).

This ratio shows, as percentages, the quota of the damages compensated by the insurer.

c) Out of the *average indicators* of the fund utilization, the most frequently used in the general insurances practice are the following:

■ *Average occurring damage* ($\overline{DA}$):

$$\overline{DA} = \frac{DA}{n}.$$

The calculation is also called *the strictness of damages*. The strictness of damages estimates the average value of an individual damage and is expressed as *lei/damage*.

The strictness of damages is an important element for the calculation of the premium tariff of an insurance contract. In case there is no information available concerning the occurred damage, the paid compensation (DP) may be used for the calculation modifying thus the value *n* depending on the number of the paid compensations.

■ *Average duration for the damages liquidation* ($\overline{D}_l$):

$$\overline{D}_l = \frac{t_1 + t_2 + ... + t_n}{n},$$

where:

t – number of days considered from the moment the damages are reported till the moment they are sorted out (liquidated);

n – number of the damages being sorted out.

Diminishing the damages liquidation duration is a goal which should permanently focus the attention of the insurance company, as a continuous process.

d) *The equilibrium relationship* between the absolute indicators of the insurance fund forming and utilization, which may occur within a financial year, *t* are the following:

■ *Between the cashed premiums (PÎ) and the written premiums (PS)*. For a financial year *t*, the cashed premiums are computed according to the following formula:

$$\hat{PI}(t) = PS(t) + PN(t-1) - PN(t) = PS(t) - \Delta PN,$$

where:

PN (t-1), (t) – un-cashed premiums by the beginning and by the end of the year *t*;

$\Delta PN = PN(t) - PN(t-1)$ – absolute alteration of the un-cashed premiums, calculated as a difference between the un-cashed premiums by the end of the financial period and the un-cashed premiums by the beginning of the same period.

In case that the reserve is calculated as from the gross value of the written premiums, we can substitute PN by RPN in the above formula.

■ *Between the written premiums and the cashed premiums:*

$$PS(t) = \hat{PI}(t) + \Delta PN;$$

■ *Between the net written premiums (PS_n) and the gross written premiums (PS_b):*

$$PS_n(t) = PS_b(t) - P_{re}(t);$$

■ *Between the paid compensations (DP) and occurred damages:*

$$DP(t) = DA(t) + DN(t-1) - DN(t) = DA(t) - \Delta DN,$$

where:

DN(t-1),(t) – non-liquidated damages by the beginning and the end of the year *t*.

In case that a damage occurs during the financial year *t* and is liquidated within the same year, it is inserted in the term DP(t) only. If the payment is made after the end of the year, the estimated volume of the damage is inserted in DN(t). In case the expenses involved by the settlement of the damages are taken into account as well then the estimated volume of the damages is inserted in RDN(t). If a damage which occurred prior to the year *t* has not been yet liquidated, the estimated volume of the damage is inserted in DN(t-1).

■ *Between the occurred damages and the paid damages:*

$$DA(t) = DP(t) + \Delta DN;$$

■ *Between the net compensations paid by reinsurances (DP_n) and the gross paid compensations (DP_b):*

$$DP_n(t) = DP_b(t) - S_{re}(t),$$

where:

$S_{re}(t)$ – amounts paid by reinsurances within the period (t);

$DP_b(t)$ – gross compensations paid within the period t (they are known also as *paid damages*).

3. The statistical indicators of the outcome of the general insurances activity

a) *Absolute indicators* which underline the *outcome of the general insurances activity* are the following:

■ *The writing outcome (RS),* which indicates by how much higher the premiums cashed within a financial year *t* are in comparison with the compensations and the expenses recorded within the same financial year (CA):

$$RS(t) = \hat{PI}(t) - DA(t) - CA(t);$$

■ *The insurance outcome (RA),* which measures the financial performance of the general insurances activity being run over the period to close:

$$RA(t) = \hat{PI}(t) - DA(t) - CA(t) + I(t) = RS + I(t),$$

where:

I(t) – income obtained out of investment of the technical reserves.

The equation concerning the insurance outcome may be written as several equivalent forms:

$$RA(t) = RS + I(t) + S_{re}(t) - P_{re}(t).$$

b) *Relative indicators,* which underline the *outcome of the general insurances activity* are the following:

■ *Combined rate (R_{cb}):*

$$R_{cb} = RD + RC = \frac{DA}{P\hat{I}} + \frac{CA}{P\hat{I}}$$

The combined rate is a measure of the insurer profitability. A high rate (>1) means that the insurer set up premium tariffs at a level which is not enough to cover the writing activity (compensations + expenses).

■ *Rate of the writing outcome (R_{rs}):*

$$R_{rs} = \frac{RS}{PS};$$

■ *Rate of the insurance outcome (R_{ra}):*

$$R_{ra} = \frac{RA}{PS};$$

■ *Rate of the profit (R_{p}):*

$$R_{p} = \frac{P_r}{PS},$$

where:

P_r – total profit of the insurance activity.

The statistical indicators of the general insurances activity fulfil to a number of requirements of great importance for the knowledge and the analysis of the level, the structure and the evolution of the insurances activity, as well as for the substantiation of the steps of pricing and writing policies and the evaluation of the outcomes being achieved both at a macroeconomic level and at the level of structural elements of the general insurances market.

For a proper establishment of these indicators, playing a particularly important part in the process of building up an adequate picture on the situation of the general insurances activity and on the evaluation of the economic performances, it is compulsory that an adequate accounting system be available.

References

Anghelache, C-tin (2004). *Statistica teoretică și economică*, Editura Economică, București

Anghelache, C-tin, Capanu, I. (2004). *Statistică macroeconomică*, Editura Economică, București

Anghelache, C-tin, Badea, S.G., Capanu, I., Wagner, P. (2005). *Bazele statisticii teoretice și economice*, Editura Economică, București

Cistelecan, L., „Tarifarea pe piața internațională a asigurărilor auto", *Finanțe. Bănci. Asigurări*, nr. 7-8, București, 2000

Constantinescu, D.A. (1999). *Tratat de asigurări*, Editura Semne, București

Pecican, E. (1994). *Econometrie*, Editura ALL, București

Năstase, C-tin, „Companiile de asigurări au sfidat recesiunea", *Capital,* nr. 45, București, 1999

Purcaru, I. (1994). *Matematică și asigurări*, Editura Economică, București

Theiler, G., Tövissi, L., „Aplicarea conceptului de risc la asigurările societăților de asigurare", *Revista română de statistică*, nr. 6, 1999

Verejan, O., Pârțachi, I. (2004). *Statistica actuarială în asigurări*, Editura Economică, București

Voineagu, V., Isaic-Maniu, Al., Grădinaru, A., Mitruț, C. (1994). *Statistica teoretică și economică*, Editura Tehnică, Chișinău