Methodological Aspects Regarding the Process of Estimating the Reserve for the Un-cleared Damages

Constantin Anghelache
Ph.D. Professor
Gabriela Anghelache
Ph.D. Professor
Academy of Economic Studies, Bucharest

Abstract. *This article emphasizes a series of aspects concerning the estimation of the reserve for the un-cleared damages. Such an activity is of an actuarial nature as it implies a present evaluation of future uncertain phenomena. Here we have the methods being used for the damages estimation, stressing out the individual estimation, the statistical methods which are used, the method of the average cost per damage, the method of the damage rate or the reserve estimation for the damages which are occurring without being yet reported.*

The analyzed theoretical aspects are accompanied by empirical examples meant to give the researcher (reader) the opportunity of a clearer understanding the mechanism in discussion. The examples are of a scholastic nature to the extent they are aiming a more explicit approach of the used mechanism only, without representing elements of a case analysis.

Key words: estimation; damage; damage rate; average cost; run-off triangle.

An insurer is bound in any moment to un-cleared liabilities in connection with damages, which occurred without being yet sorted out. The estimation of the reserves meant to cover the un-cleared damages is therefore an activity of an utmost importance for each and every insurer. Meantime, it is an actuarial activity as it implies a present evaluation of future uncertain phenomena.

There are two separate methods, which can be used for this kind of estimations:

- *The individual estimation* of the liabilities for each un-cleared damage;
- *Statistical methods*, in order to estimate the total *value* of the payments to be made for the whole portfolio of un-cleared damages.

The individual estimation is based on the individual calculation, case after case, of all the files of un-cleared damages. Each file is successively analyzed by a person from the damages department. A person of adequate expertise will take into account all the necessary elements and will credit a specific value to any damage. The amounts required by the payment of the direct expenses, connected to the respective damage, are to be added to this specific value. Eventually, there is only an adjustment to be made, respectively the future inflation of the damages, which has to be considered, depending on the forecasted moment of the damages settlement.

However, the method of the individual estimation has certain disadvantages, i.e.:

- It does not allow the estimation of the reserve for damages which although occurred are not yet reported (not notified) (RDAN) or for damages which may be re-opened;
- The estimation is based on the skill and judgment of some persons. Different person may reach different results;

- It is a method which is hard to verify;
- In the case of certain classes of insurances it may happen that there are thousands of damages, which implies a big amount of person-hour for the individual estimation of each damage.

But the method of the individual estimation offers also a number of advantages, i.e.:

- It is the sole approach allowing all the information regarding the un-cleared damages to be taken into consideration;
- There are many qualitative factors influencing the size of this damage. An experienced person would be capable to use all these factors when estimating the size of a damage;
- The method may be used even in the situation when the statistical methods cannot be utilized.

In the case of applying the *statistical methods,* it is necessary that more detailed information are available in order to divide the data by homogenous groups. What is fundamental when utilizing the statistical methods is the experience of enough information meant to allow the division of the damages in any possible subgroups.

There are different statistical methods which can be used for the estimation of the reserve for the un-cleared damages, each of them leading to different outcomes in most of the cases. The statistical methods are implying the fact that in the past there has been a stable evolution of the procedure of clearing the damages and that this stability is going to last for the future as well.

Most of the statistical methods may be divided in the following main groups:

- The chain-ladder method;
- The average cost per damage method;
- The damage rate method;
- Combinations or variations of these methods.

Basically, the variations are linked to the following:

- Adjustments depending on the previous inflation;
- Selection of the occurred damages or of the compensated damages;
- Selection of the damages cohort;
- Selection of different factors of development;
- Selection of the exposure or of the damage rate being used.

Before discussing the main statistical methods, it is necessary to underline a number of definitions:

A damages cohort is a group of damages which have a common origin period.

Usually, the origin period is a calendar year but it can be shorter, a month or a trimester for instance.

Generally speaking, there are three ways of grouping the damages:

▪ Depending on the *year when the event (the damage) arouse,* leading to the damage occurrence. By using this method, all damages due to certain events which arouse within one year time (or the corresponding period, if this one differs) are grouped, irrespectively the fact that they have been reported or compensated by the time of the analysis and irrespectively the year the insurance started to count. The advantage of this kind of grouping consist of the fact that the damages are due to the same period of exposure to risk, even if they are due to polices subscribed under different conditions. The damages occurred but not reported, the amounts to be received from re-insurances and the re-opened damages are included in the damages cohort due to the year they have occurred. The estimation and the projection of the future development of the damages in this form will allow the automatic inclusion of the damages occurred but not reported, of the amounts to be received from re-insurances and the re-opened damages belonging to the respective cohort.

▪ Depending on *the starting year of the insurance or the subscribing year:* all the damages due to polices starting within a 12 months period, irrespectively the date of the damage occurrence during the current year or the next year. Using this definition, it may happen that damages occurring two consecutive years are belonging to the same year of subscription. The disadvantage of the grouping is connected to the large duration of occurrence of damages due to a particular year of subscription, as well as to the duration regarding their reporting. The damages occurred but not reported, the amounts to be received from re-insurances and the re-opened damages are automatically included, provided they are allocated to an insured damage.

▪ Depending on the *reporting year:* all damages which are reported to the insurer within a 12 months period are grouped, irrespectively the year the event generating them occurred. An apparent advantage of the method consists of the fact that no more damages are added to the cohort after the end of the reporting year covering the respective cohort. A major disadvantage of this grouping consists of the fact that the projections will not include the damages occurred but not reported as well as the re-opened damages. The estimation of the un-cleared damages by using this grouping allows the estimation of the reported un-cleared damages. This cohort of damages is typical to the methods of estimating the damage reserves for the insurers of the Republic of Moldova, in accordance with the legal regulations in force.

Contrary to the individual estimation method, the purpose of the statistical method consists of the evaluation of the un-cleared damages for different classes of insurances without the analysis of every file of un-cleared damage individually considered.

The majority of the statistical methods imply the presentation of the data in form of table of the kind: *development table; run-off triangle.*

The detailed model of the data presentation depends on the definition of columns and rows of the table. Usually, the rows are indicating the year (or month, or trimester, etc.) of origin, while the precise definition depends on the definition used for the damages cohort. The columns are indicating the damages development or their reporting and may cover either cumulated damages or non-cumulated damages.

Let's assume that the data are presented as a development table.

The development table of damages grouped according the origin year

Table 1

Origin year	Delay in clearing, as years (development year)			
	0	1	2	3
1995	$D_{95,0}$ ✓	$D_{95,1}$ ✓	$D_{95,2}$ ✓	$D_{95,3}$ ✓
1996	$D_{96,0}$ ✓	$D_{96,1}$ ✓	$D_{96,2}$ ✓	$D_{96,3}$ ✓
1997	$D_{97,0}$ ✓	$D_{97,1}$ ✓	$D_{97,2}$ ✓	$D_{97,3}$ ✓
1998	$D_{98,0}$ ✓	$D_{98,1}$ ✓	$D_{98,2}$ ✓	$D_{98,3}$?
1999	$D_{99,0}$ ✓	$D_{99,1}$ ✓	$D_{99,2}$?	$D_{99,3}$?
2000	$D_{00,0}$ ✓	$D_{00,1}$?	$D_{00,2}$?	$D_{00,3}$?

In the above table, there is the assumption that all the damages are cleared within maximum three years as from the occurrence of the event generating them.

For the cells marked as „√" the value is known. For every cell bearing the symbol „?" the value is unknown and represents the amounts to be paid in the future (assuming that the table is drawn up by 31.12.2000).

The following statements should be obvious:

- $D_{97,2}$ represents the damages compensated in 1999 as a result off events occurring back in 1997;
- $D_{97,0} + D_{97,1} + D_{97,2} + D_{97,3}$ represents the total compensations paid as a result of events occurring in 1997;
- $D_{00,0} + D_{99,1} + D_{98,2} + D_{97,3}$ represents damages compensated in 2000;
- $D_{00,3}$ represents damages to be paid in 2003 for events occurring in 2000;
- The total of the cells marked „?" represents the total amount which will be paid in the future due to the events occurring up to 31.12.2000. In fact, this total is the total of the un-cleared damages by 31.12.2000.
- If the damages are presented in a cumulated form, then $D_{98,2}$ represents the damages compensated before 2000 and during 2000 as a consequence of the events occurring in 1998.

The presentation of data as a run-off triangle implies the use of the data influencing the current year (year 2000).

Run-off triangle
(damages compensated depending on the origin year)

Table 2

Origin year	Delay in clearing, as years (development year)			
	0	1	2	3
1997	$D_{97,0}$ ✓	$D_{97,1}$ ✓	$D_{97,2}$ ✓	$D_{97,3}$ ✓
1998	$D_{98,0}$ ✓	$D_{98,1}$ ✓	$D_{98,2}$ ✓	$D_{98,3}$?
1999	$D_{99,0}$ ✓	$D_{99,1}$ ✓	$D_{99,2}$?	$D_{99,3}$?
2000	$D_{00,0}$ ✓	$D_{00,1}$?	$D_{00,2}$?	$D_{00,3}$?

The data corresponding to the origin years 1995, 1996 are ignored (these damages are considered as being cleared). The value $D_{97,3}$ covers the estimation of the values for $D_{98,3}$, $D_{99,3}$, $D_{00,3}$.

The statistical methods based on the run-off triangle are using in calculation a basic principle, which is presented by the following figure.

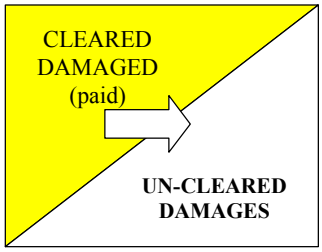

Figure 1. *Basic principle for run-off triangle*

On the basis of the known information as to the cleared damages (the hatched area), it is possible to predict the un-cleared damages corresponding to the un-hatched area of the square. The un-cleared damages are estimated by the statistical methods described below.

2. The Chain-Ladder method is based on the computation of the development factors and their application to the cumulated damages, which served to their calculation. More accurately, the basic chain-ladder method is applying to the development of the *compensated damages* but not adjusted to the inflation, using the damages cohort based on the origin year of the events.

The development factors are reports on the value of damages during successive years of development (or other successive periods of development: month, quarter, half-year).

For a better understanding of the basic chain-ladder method, we use the run-off triangle.

Further on, we shall present the stages needed in order to estimate the reserve for the un-cleared damages (RDN) by 31.12.2000.

Stage 1. Out of the initial table we calculate the cumulated damages for each origin year of the events, as they arise at the end of each year of development.

Run-off triangle (cumulated damages)

Table 3

Origin year	Delay in clearing, as years (development year)			
	0	1	2	3
1997	$D_{97,0}$	$D_{97,0} + D_{97,1} = D_{97,0-1}$	$D_{97,0} + D_{97,1} + D_{97,2} = D_{97,0-2}$	$D_{97,0} + D_{97,1} + D_{97,2} + D_{97,3} = D_{97,0-3}$
1998	$D_{98,0}$	$D_{98,0} + D_{98,1} = D_{98,0-1}$	$D_{98,0} + D_{98,1} + D_{98,2} = D_{98,0-2}$	
1999	$D_{99,0}$	$D_{99,0} + D_{99,1} = D_{99,0-1}$		
2000	$D_{00,0}$			

Stage 2. We calculate the development factors, which are computed as *modification indices* in form of ratios:

$$i_{1/0} = \frac{D_{97,0-1} + D_{98,0-1} + D_{99,0-1}}{D_{97,0} + D_{98,0} + D_{99,0}};$$

$$i_{2/1} = \frac{D_{97,0-2} + D_{98,0-2}}{D_{97,0-1} + D_{98,0-1}};\ i_{3/2} = \frac{D_{97,0-3}}{D_{97,0-2}}.$$

Stage 3. Using the development factors, we estimate the un-cleared damages cumulated for each origin year:

year 2000:

$$D_{00,0-1} = D_{00,0} \times i_{1/0};$$

$$D_{00,0-2} = D_{00,0} \times i_{1/0} \times i_{2/1};$$

$$D_{00,0-3} = D_{00,0} \times i_{1/0} \times i_{2/1} \times i_{3/2}.$$

year 1999:

$$D_{99,0-2} = D_{99,0-1} \times i_{2/1};$$

$$D_{99,0-3} = D_{99,0-1} \times i_{2/1} \times i_{3/1}.$$

year 1998:

$$D_{98,0-3} = D_{98,0-2} \times i_{3/2}.$$

Stage 4. We fill in the run-off triangle (cumulated damages) with the values obtained out of the previous stage. Consequently, we get the following table of cumulated damages:

Compensated and estimated damages depending on the origin year and the run-off triangle (cumulated damages)

Table 4

Origin year	Delay in clearing, as years (development year)			
	0	1	2	3
1997	$D_{97,0}$	$D_{97,0-1}$	$D_{97,0-2}$	$D_{97,0-3}$
1998	$D_{98,0}$	$D_{98,0-1}$	$D_{98,0-2}$	$D_{98,0-3}$
1999	$D_{99,0}$	$D_{99,0-1}$	$D_{99,0-2}$	$D_{99,0-3}$
2000	$D_{00,0}$	$D_{00,0-1}$	$D_{00,0-2}$	$D_{00,0-3}$

Stage 5. The reserve for the un-cleared damages, which should be set up and kept by 31.12.2000 can be calculated as follows:

RDN = the sum of the differences between the cumulated damages by the end of the last year of development and the last known cell of the development triangle for that origin year.

The sum is to be calculated for all the values corresponding to the origin years for which the estimation has been made.

Thus, RDN by 31.12.2000 is:

$$RDN = (D_{00,0-3} - D_{00,0}) + (D_{99,0-3} - D_{99,0-1}) + (D_{98,0-3} - D_{98,0-2})$$

The difference between the cumulated damages by the end of the last year of development and the last known cell of the development triangle for the respective origin year represents the un-cleared cumulated damages for that origin year.

The main hypothesis at the basis of the underlying chain-ladder method assumes that the evolution of the development of damages is stable.

This method is not issuing any explicit hypothesis concerning the damages inflation. The essential distinction between the *Chain-Ladder method modified to inflation* and the previous method consists of the following aspect:

- There is an inflation index applying to the previous damages in order to let them become comparable, in monetary terms, with the damages of the last year;
- A predicted index for the future inflation is applied to the estimated damages.

The *Chain-Ladder method modified to inflation* is similar to the basic method excepting the fact that there are more calculations being needed.

- The initial data concerning the damages, presented in the form of a run-off table depending on the origin year/year of development, are converted into constant monetary terms, most probably those of the last origin year (the damages are multiplied by the inflation index). For this operation, it is necessary that the best estimations for the previous inflation of the damages are available;
- After cumulating the damages for each origin year, the basic chain-ladder method is used on the basis of the table modified by the inflation index, in order to estimate the cumulated damages to be paid during every subsequent origin years/years of development. These amounts will be expressed in constant monetary terms;
- The amounts estimated for being paid during every subsequent year (but not the cumulated one) are then calculated. The predicted future inflation is than added to these amounts in order to convert the sums of every cell corresponding to the subsequent origin year/year of development into the monetary values corresponding to the respective year (the product between the future inflation index and the estimated amounts to be paid).

Using the Chain-Ladder method modified to inflation requires information about the previous rate of inflation of the damages or about the inflation rate of the previous years, in case there are not information concerning the

damages inflation. The inflation over the following years can be set up depending on the previous inflation or can be predicted. Since there is the assumption that the damages are uniformly distributed over the year duration, the calculation takes into consideration a monthly average rate of inflation.

3. The method of the average cost per damage

This method takes into consideration two separate key-elements of the damages, respectively: *the number of damages (n) and the average damage* ($\overline{D}$). This method requires a development table for both the damages value and the number of damages. Using these tables of development, there is another table being built up, namely the table of the average values of the damages, which is obtained by dividing the values of the corresponding cells of the first two tables. The next step consists of getting estimations for both the average values of the damages and the number of damages by multiplying, for each origin year, the estimated value for the average damage by the number of damages.

The reserve for the un-cleared damages is calculated as the difference between the final estimated damages (cumulated) and the compensated (paid) damages by the time of the evaluation.

Synthetically, the above discussion may be presented as in the following figure:

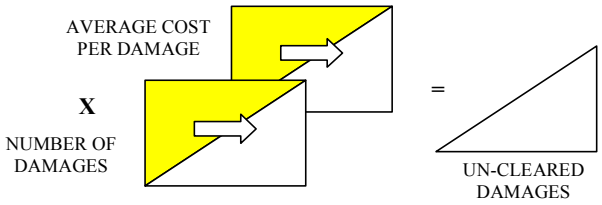

Figure 2. *Average cost per damage estimation*

The method of the average cost per damage is not defined in an unique manner. The method applies to damages cohorts based on the origin year, the damages being either paid damages (DP) or occurred damages (DA), or to a cohort based on the reporting year. Consequently, it is very important to keep the relationship between the types of damages, paid or reported, and the number of damages either cleared or reported. Consequently:

- The paid damages are connected to the number of cleared damages;
- The occurred damages are connected to the number of reported damages.

The situation gets somehow more complicated due to the spread out payments (partial payments) or to the damages which, although cleared up, are not backed by any payment. Changes the treatment of these damages may lead to disturbances as far as the application of this method is concerned.

The table of the number of damages can contain various information regarding the damages. This information may refer to:

- The number of the cleared damages;
- The number of the reported damages.

The method, as described above, is ignoring any adjustment to inflation. Such an adjustment may be done in a similar way with the one applied to the basic chain-ladder method. In practice there is an adjustment which is applied in order to take into account the inflation, both the previous and the predicted one.

The stages being required for the estimation of RDN through the method of average cost per damage, modified to inflation, are the following:

Stage 1. The procedure starts from the usual triangle of the damages paid depending on the origin year and the year of development.

Stage 2. As well as in the case of the chain-ladder method modified to inflation, the amounts out of the table are converted into constant monetary amounts, by using the estimations for the previous inflation of the damages or the estimations for the previous rate of inflation, corresponding to each previous year.

Stage 3. The triangle of the number of recorded damages is then formed depending on the origin year and the year of development. There are now two corresponding triangles: one of them containing the value of the damages and the other containing the number of damages.

Stage 4. The value of the damages is divided to the corresponding number of damages in order to get the third triangle, the triangle of the average damages.

Stage 5. Working out with the triangle of the average damages, we can calculate the average damage for each year of development.

Stage 6. The basic chain-ladder method is then applied in order to estimate the number of damages accounted for every origin year/year of development.

Stage 7. The value of the average damage for every year of development (as calculated by the stage 5), is multiplied by the estimated number of damages (as calculated by the stage 6), in order to get the estimated value of the damages for every subsequent origin year/year of development.

Stage 8. The estimated damages are then adjusted to the future inflation, in order to convert them into estimated monetary values.

4. The method of the damage rate

The damage rate (RD) is the ratio between the occurred damages (DA) and the cashed premiums (PI), calculated for a given period of time. The analysis of the damage rate for each of the origin years should indicate a certain stability, assuming that there were no disturbing effects and that, basically, there were not significant alterations of the premium tariffs.

A typical example of disturbing effect is a disaster (calamity). The issue may be sorted out by not including the calamity damages in the damages used for the calculation of the damage rate. The insurer's cycle is another example of disturbing effect for the damage rate. The damage rate would change along the cycle, depending on the evolution of the premium tariffs, i.e., increasing or decreasing tariffs.

Consequently, the damage rate, based on the evolution of the previous data, on the opinion of the persons carrying out the subscribing activity or based on the data our of the insurances market, can be used as a basis for estimating eventual losses and, hence, the un-cleared damages.

The type of premium used for calculating the damage rate must be in accordance with the damages cohort. The cashed premiums are in accordance with a cohort based on the year the event arouse, while the subscribed premiums are in accordance with the cohort of damages based on the subscription year. A cohort of damages based on the reporting year is difficult to use by this method.

The estimation of the reserve for un-cleared damages using this method is based on the hypothesis that the damage rate is a correct one. This is an over-simple hypothesis but, even thus, the method is providing useful information which can be used for comparing the results with the outcomes produced by more sophisticated methods.

In its most ordinary form, the methods is applied as follows:

- The damage rate for a class of insurances is estimated by prediction;
- The cashed premiums (PI) for each origin year are multiplied by the damage rate (RD), in order to get the occurred damages (DA) for each origin year.

$DA = PI \times RD$;

- The updated paid damages are then deducted in order to get the reserve for the un-cleared damage:

$RDN = DA - DP$.

The damage rate can be estimated out of the previous data but it can also be calculated or can include the subjective judgment of the persons who concludes and subscribes insurance contracts.

5. The method of estimating the reserve for damages occurred but not reported (RDAN)

The reserve for damages occurred but not reported (RDAN) must be estimated and accounted because of the following main reasons:

- Evidencing the technical reserves by categories offers more information to the decisional factors and helps the management decisions to be taken;
- The separate evidence is necessary also for the financial annual reporting to the supervision authority;
- It may happen that the method being used for calculating the reserve for the un-cleared damages produces an outcome which is not including the RDAN.

The majority of the statistical methods utilized for calculating the reserve are estimating the final total value of the un-cleared damages. In this case, by deducting the updated paid damages we get the reserve for the un-cleared damages, including RDAN as well, while by deducting the updated reported damages we are in the position to calculate the RDAN.

The reserves calculated by using the individual estimation of the liabilities for each un-cleared damages would not include, by definition, the RDAN.

The purpose of this method consists of the estimation of the size of damages to be finally paid out for the events occurring till the end of the financial year without being reported until the end of the financial period.

There are different statistical methods used for estimating the RDAN separately of the total value of the reserve for un-cleared damages. The choice of the method depends on the tendency (short or long) as well as on the relative size of the insurances class.

For the insurances class of short tendency, as well as for the relatively small insurances classes, the insurer may use simple methods as RDAN is not significant and there is a smaller uncertainty.

More detailed methods are used for insurances classes of long tendency as well as for relatively large insurances classes.

The basic methods used for the estimation of the RDAN are the following:

1. the method based on a simple proportion;
2. the method of the delaying table;
3. the projection method.

The method based on a simple proportion assumes the estimation of RDAN as a percentage of an objective value. For instance, we may use a percentage of:

- the cashed premiums;
- the reported damages;
- the un-cleared damages.

Corresponding to a certain class of insurances. Each one of these values can be obtained out of the annual accounting documents or, typically, out of the monthly or quarterly internal situations. The applied percentage can be obtained out of the previous experience of the respective class of insurances. This method may be used in the case of:

- an insurances class which is not important as size comparatively to other classes of insurances;
- a class of insurances of a very short tendency;

- using it as an approximate method of checking in the case of using a method of calculation much more complex.

However, the methods based on simple proportions are not very solid. A slight change of the working hypothesis may invalidate the estimations being done. For instance, the methods based on the cashed premiums are dependent on a stable damage rate. The methods based on the damages utilization are probably better but they can be disturbed also by slight changes of the damages experience.

The delaying table method assumes the estimation of the number of damages occurred but not reported after *t* months from their occurrence as well as of the average damage occurred but not reported.

The number of damages occurred but not reported is estimated by using previous data in order to set up the cumulated percentage of the damages which are reported after certain periods of time and by following up the evolution of these percentages over years or over periods within a year. The periods of development may be measured in weeks, months or quarters of the year, depending on the tendency of the class of insurances.

Suppose $N_{i,t}$ as number of the damages occurred in the month i and reported after t months from the occurrence. We can use a function U_d, which care represents the cumulated ratio of the damages reported after d months from their occurrence:

$$U_d = \frac{\sum_{t=0}^{d} N_{i,t}}{\sum_{t=0}^{\infty} N_{i,t}} .$$

For the classes of short tendency, U_d is tending rapidly towards one if d increases. After setting up the cumulated ratio, the number of the damages occurred but not reported after t months from the occurrence can be calculated as follows:

$$N_{DAN,t} = \frac{N_{DR,t}}{C_d} - N_{DR,t},$$

where:

N_{DAN} – number of damages occurred but not reported;

$N_{DR,t}$ – number of damages reported on the account of the damages occurred t months earlier;

C_d – the cumulated percentage of the damages reported until the month d.

The number of damages occurred but not reported thus obtained is multiplied by the average damage or by the average cost of a damage occurred but not reported, getting thus finally the RDAN, namely:

$$RDAN = N_{DAN} \times \overline{DA_N},$$

where:

$\overline{DA_N}$ – average cost of a damage occurred but not reported.

The average cost of the damages occurred but not reported may be estimated taking into account the evolution of the size of the notified damages and the previous relation between the RDAN and the size of the reported damages.

For classes of long tendency, the method of the delaying table is not offering trustful results. In its most ordinary form, the projection of the non-cumulated occurred damages does not differ as against the method of the delaying table.

The projection method may be used by deducting the damages occurred and reported out of the total value of the un-cleared damages obtained by using a statistical method. Hence, if the reserve of the un-cleared damages, calculated by the chain-ladder method is set up in dependence with the cohort of damages after the year of the event occurrence (the origin year of the damage) or after the year the insurance started, then it includes in its amount both the reserve for damages reported but un-cleared (RDRN) and the reserve for damages occurred but not reported (RDAN).

The reserve for damages occurred but not reported (RDAN), calculated by the projection method, can be set up if data concerning the reserve for damages reported but un-cleared (RDRN) are available, distributed for each origin year of the damages.

If we consider the previous example, on the basis of the information we get the following results:

Reserves for un-cleared damages, reported but non un-cleared damages and for occurred but not reported damages

Table 5

Origin year	Known (paid) cumulated damages	Calculated (estimated) cumulated damages	Reserve for un-cleared damages (RDN)	Reserve for reported but un-cleared damages (RDRN)	Reserve for occurred but not reported damages (RDAR)
0	1	2	3	4	5 = 3 – 4
1998	$D_{98,0-2}$	$D_{98,0-3}$	$RDN_{98}=D_{98,0-3} - D_{98,0-2}$	$RDRN_{98,2}$	$RDN_{98} - RDRN_{98,2}$
1999	$D_{99,0-1}$	$D_{99,0-3}$	$RDN_{99}=D_{99,0-3} - D_{99,0-1}$	$RDRN_{99,1}$	$RDN_{99} - RDRN_{99,1}$
2000	$D_{00,0}$	$D_{00,0-3}$	$RDN_{00}=D_{00,0-3} - D_{00,0}$	$RDRN_{00,0}$	$RDN_{00} - RDRN_{00,0}$
TOTAL	**Suma coloanei**	**Suma coloanei**	**Suma coloanei**	**Suma coloanei**	**Suma coloanei**

The reserve for occurred but not reported damages by 31.12.2000 is given by the total of the column 5.

When establishing the methodology of calculating the reserves, it is necessary to consider the characteristics of the insurances classes (the damage type, the tendency of the insurance class, the quantity and the quality of the statistics being available), for which the reserves are calculated and set up. Consequently, it is to assume that different methodologies are applied to different insurances classes subscribed by an insurer. Meantime, it is possible that various methods are applied to different parts of the same insurances class. For instance, the reserve of premiums for polices of short or long duration would be separately set up as well as the reserve for damages of short tendency or long tendency.

The outcomes of any method of setting up the technical reserves must be analyzed and verified in comparison with the reserves set up through a different method.

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

Anghelache, C-tin, Pârțachi, I., Verejan, O. (2006). *Analiza actuarială în asigurări*, Editura Economică, București

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

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