

Substantiating the Incurred but not Reported Reserve

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***Abstract.** In order to handle past and future liability taken by insurance contracts concluded, any insurance company must constitute and maintain technical reserves. Substantiating technical reserves is done through actuarial methods and its over-evaluation or under-evaluation influence solvency and financial performance of the insurance companies, in the sense of reducing solvency through over-evaluating reserves and, respectively, influencing profit (hence of outstanding tax) through under-evaluating reserves. An important reserve for insurance companies is represented by the incurred but not reported reserve, as it allows the estimation of the liability the company may confront in the future, generated by events occurred in the past, which are not currently known in the present but will be reported in the future.*

Keywords: incurred but not reported reserve; chain-ladder method; run-off triangle; development factors; reported but not settled.

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The operation of estimating technical reserves presents a special importance to insurers as funds generated by them are invested in various profitable markets and the profits obtained are an important source of income.

For liability to the insured, determined by the prejudice which occurred and the insurer was informed about, insurance companies form their RBNS – reported but not settled. There are although prejudice from insurance contracts generated by the occurring of the insured risk which happened, weren't reported to the insurance because of various reasons and may be made known to the insurance in the future. In order to cover this liability from not reported prejudice, the insurer must constitute the incurred but not reported reserve – IBNR. Determining this reserve is done using one of the following methods: the “rate of prejudice” method (there are no triangles used), basis chain-ladder, chain-ladder method to which is applied the inflation correction and the method of average cost per prejudice. According to the legislation in our country (The Order of the President of the Commission for supervising Insurers no. 3.109/2003 with the latter modifications and completions), the incurred but not reported reserve is created and is adjusted at least at the end of financial activity, if internal regulations of the insurer do not foresee otherwise, based on its estimations, statistical

data or actuarial calculus for incurred but not reported.

Due to the importance the incurred but not reported reserve has for insurance companies, within this article we aim at highlighting a way of estimating it substantiated on the basis chain-ladder method. This method consists of evaluating liability (prejudice) which are going to be paid in the following years to come, generated by the liability occurred in the past years the insurance company doesn't know about. This is achieved using computing development factors in run-off triangles.

In the first stage the run-off triangles are built through identifying known prejudice in every year of development for every year of origin of the events and introducing them into a table (with the shape of Table 1). The values above the diagonal represent prejudice incurred in year x (year of origin) and paid after y years. Table 2 contains the data recorded by the insurance companies between 2004-2008 for motor vehicles insurance, data referring to the prejudice incurred in the year of origin and paid with a delay of 5 years at most (developments years). Thus, the first line of the run-off triangle contains the prejudice paid with a delay of 0, 1, 2, 3 or 4 years for events from 2004. The sum of values on the diagonal represents the total amount paid in 2008 for events which were reported to the insurer between 2004-2008.

Table 1

The run-off triangle for reported events depending on the year of developments

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	14,994,009.2	1,936,197.14	680,265.54	98,182.33	48,260.88
2005	31,465,290.92	5,820,101.68	805,882.48	1,211,588	?
2006	51,570,088.63	8,905,005.56	1,526,465.83	?	?
2007	45,062,868.48	6,834,431.18	?	?	?
2008	23,603,987.8	?	?	?	?

According to the basis chain-ladder method in the next step the values of the prejudice for each year of origin are cumulated, depending on each development year. The first column in Table 2 is identical to the first column in Table 1 and beginning with the 2nd column

the data are summed up obtaining the values of cumulated prejudice. Thus, the data in each cell on the diagonal represents the value of all prejudice paid in the period of time between their apparition and 2008 and which appeared in the year of origin.

Table 2

The run-off triangle for reported events cumulated for the years of developments

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	14,994,009.2	16,930,206.34	17,610,471.88	17,708,654	17,756,915.09
2005	31,465,290.92	37,285,392.6	38,091,275.08	39,302,863	?
2006	51,570,088.63	60,475,094.19	62,001,560.02	?	?
2007	45,062,868.48	51,897,299.66	?	?	?
2008	23,603,987.8	?	?	?	?

For a better estimation of the incurred but not reported reserve we must take into consideration the reported but not settled reserve because the evolution of the balance of this reserve influences the value of the company's future liability. When a prejudice is reported, it is moved in this reserve and when payments are made for that event, the reserve is diminished with the values of the payments and what remains in reserve at a given time expresses the company's liability to the insured which incurred the respective prejudice. The main hypothesis of the chain-ladder method consists of assuming that in the past there was a stable evolution of both the prejudice and the balance of the reserve of reported events and that this stability will be kept in the future. There

are situations in which the evolution of the reported reserve's balance or of the paid amounts is not uniform and this fact distorts the estimation of future liability of the insurer regarding the incurred but not reported prejudice. In these cases either the developments factors are adjusted or the paid amounts and reported reserve prejudice are adjusted. In the second case, the insurer may exclude very large prejudice, the cases that are included in the reported reserve and which were rejected later on or other cases for which the company has a pertinent motivation. The run-off triangle which contains the values of the reported ones in balance at the end of each year of development for insured events incurred in every year of origin has the following form (Table 3):

Table 3

The run-off triangle for reported events in balance

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	1,501,400.2	1,687,020.4	1,750,047.8	1,760,345	1,778,701
2005	3,247,029.2	3,429,349.6	3,578,175.8	3,634,283	?
2006	5,231,088.3	6,000,504.1	6,100,230.2	?	?
2007	4,702,868.8	5,007,259.6	?	?	?
2008	2,104,587.8	?	?	?	?

The next stage consists of creating a new delay table (Table 4) in which we introduce the accumulated values of paid prejudice for each year of delay to which we add the balance of reported events. Thus, $C_{0x,y}$ for example, represents the prejudice incurred in 2000+x accumulated to the year of development y including it plus the balance of reported events for the same moment. From this table we compute the development factors $D_{x,y}$ after the relationships:

$$D_{0,1} = \frac{C_{04,1} + C_{05,1} + C_{06,1} + C_{07,1}}{C_{04,0} + C_{05,0} + C_{06,0} + C_{07,0}}$$

$$D_{1,2} = \frac{C_{04,2} + C_{05,2} + C_{06,2}}{C_{04,01} + C_{05,1} + C_{06,1}}$$

$$D_{2,3} = \frac{C_{04,3} + C_{05,3}}{C_{04,02} + C_{05,2}}$$

$$D_{2,3} = \frac{C_{04,4}}{C_{04,03}}$$

It is observed that the development factors represent the degree of growth of prejudice which were paid by the company, from one year to the another.

The value of the prejudice which are going to be reported in the future ($C'_{0x,y}$) is computed by multiplying the last accumulated value for the prejudice occurred in the year of origin x with the development factor corresponding to the y year of delay:

$$C'_{08,1} = C_{08,0} \times D_{0,1} \quad C'_{08,2} = C'_{08,1} \times D_{1,2}$$

$$C'_{08,3} = C'_{08,2} \times D_{2,3} \quad C'_{08,4} = C'_{08,3} \times D_{3,4}$$

$$C'_{07,2} = C_{07,1} \times D_{1,2} \quad C'_{07,3} = C'_{07,2} \times D_{2,3}$$

$$C'_{07,4} = C'_{07,3} \times D_{3,4}$$

$$C'_{06,3} = C_{06,2} \times D_{2,3} \quad C'_{06,4} = C'_{06,3} \times D_{3,4}$$

$$C'_{05,4} = C_{05,3} \times D_{3,4}$$

The run-off triangle built based on the development factors is presented in Table 4:

Table 4

The run-off triangle model

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	$C_{04,0}$	$C_{04,1}$	$C_{04,2}$	$C_{04,3}$	$C_{04,4}$
2005	$C_{05,0}$	$C_{05,1}$	$C_{05,2}$	$C_{05,3}$	$C'_{05,4}$
2006	$C_{06,0}$	$C_{06,1}$	$C_{06,2}$	$C'_{06,3}$	$C'_{06,4}$
2007	$C_{07,0}$	$C_{07,1}$	$C'_{07,2}$	$C'_{07,3}$	$C'_{07,4}$
2008	$C_{08,0}$	$C'_{08,1}$	$C'_{08,2}$	$C'_{08,3}$	$C'_{08,4}$
Development factors		$D_{0,1}$	$D_{1,2}$	$D_{2,3}$	$D_{3,4}$

The value of the incurred but not reported reserve at the end of 2008 is computed through deducting the last known values for the last years of origin from the cumulated value of the reserve at the date of the calculation. Concretely, the value of IBNR computed on 31st of December 2008 is:

$$IBNR_{2008} = C'_{08,4} - C_{08,0} + C'_{07,4} - C_{07,1} + C'_{06,4} - C_{06,2} + C'_{05,4} - C_{05,3}$$

In case of the insurance company for which we wish to determine the value of the incurred but not reported reserve (variant a), the development table of the reported events as well those of unreported ones present the accumulated prejudice for years of development (Table 5 – variant a):

Table 5

The table of reported and unreported prejudice presented as a sum of development years – variant a

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	16,495,409.4	18,617,226.74	19,360,519.68	19,468,999	19,535,616.09
2005	34,712,320.12	40,714,742.2	41,669,450.88	42,937,146	43,084,063.41
2006	56,801,176.93	66,475,598.29	68,101,790.22	69,637,428	69,875,705.95
2007	49,765,737.28	56,904,559.26	58,408,139.47	59,725,194	59,929,554.95
2008	25,708,575.6	29,772,011.56	30,558,672.74	31,247,745	31,354,665.18
Development factors		1.158057608	1.026422843	1.022549	1.00342169

The reserve for incurred but not reported which the company must come up with at the end of 2008 is $IBNR_{2008} = 10591919$ mil. ROL. In the future, the insurance company is expecting to face prejudice occurred in the past about it knows nothing about in the present of approximately 10591919 mil. ROL. This amount can be settled due to the reserve it made up.

Another variant of the chain-ladder method used in insurance practice (variant b) assumes not taking into consideration the reserve balance, the methodology of calculus being similar to the one previous

presented. The use of various methods for determining the incurred but not reported reserve leads to various results, sometimes registering significant differences between them, which is normal as the main aim is estimating a value which depends on a lot of factors, some of them unquantifiable. If we don't take into consideration the reported reserve and wish to determine the value of incurred but not reported reserve, then the development table (Table 6 – variant b) of the reported and unreported events in variant b will be different from the one in variant a:

Table 6

The table of reported and unreported prejudice presented as a sum of development years – variant b

– Thousands of ROL –

Year of origin	Delay in paying the prejudice (year of developments)				
	0	1	2	3	4
2004	14,994,009.2	16,930,206.34	17,610,471.88	17,708,654	17,756,915.09
2005	31,465,290.92	37,285,392.6	38,091,275.08	39,302,863	39,409,973.76
2006	51,570,088.63	60,475,094.19	62,001,560.02	63,459,464	63,632,408.02
2007	45,062,868.48	51,897,299.66	53,260,501.15	54,512,868	54,661,430.12
2008	23,603,987.8	27,479,760.44	28,201,579.31	28,864,711	28,943,374.99
Development factors		1.164199909	1.026267291	1.023514	1.002725271

The incurred but not reported reserve the insurance company must constitute through applying variant b of chain-ladder method at the end of 2008 is 9841477 mil. ROL. It is observed that the result obtained with the second variant is similar to the one obtained in the first case, being lower than it because we didn't take into consideration the reported events reserve. Choosing the method for determining the incurred but not reported reserve remains at the insurer's freedom to decide and is influenced by financial objectives as well as its attitude towards risk. In the case of our company it is recommended that the determined reserve should be constituted using the first method as it takes into consideration the incurred but not reported reserve and the risk the insured

is subjected to from the future prejudice coming from past events the insurer knows nothing about is lower.

Insurers in Romania make up this reserve for a few years now through different methods they embraced and in the present, the legislation states the use of a form of the chain-ladder method, just in cases of auto civil responsibility. For other classes of insurance, the insurance companies still have the possibility to choose the calculus method of the incurred but not reported reserve. The correct estimation of the incurred but not reported reserve is very important for the insurer as it allows him, besides knowing what to expect in the future, to have a bigger and more realistic picture of the company's financial status.

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