Premium Reserving in General Insurance Part II

Anurag Rastogi

In the earlier part of this write up we talked about three kinds of premium reserves, viz, Unearned Premium Reserve (UPR), Unexpired Risk Reserve (URR) and Premium Deficiency Reserve (PDR) and then discussed about the UPR for some lines of business which broadly had a uniform spread of risk through the policy period. Now we take the discussion forward with some thoughts on a line where the risk spread can not be assumed uniform through the policy period. Later the discussion continues about URR, PDR and related regulatory issues.

1. UPR for Erection All Risk (EAR) And Contractors' All Risk (CAR) Insurance

   These policies have the following unique characteristics

   - The risk exposure is not uniform throughout the period of insurance but builds up from zero to 100% during the period of insurance.
   - Period of insurance is usually longer than one year, but can be shorter than a year for small projects.
   - The value at risk builds up till the erection is completed followed by 2-3 months of pre-commissioning, testing and commissioning period during which risk exposure is uniform at 100%

The issue at stake is – *"How is the risk build-up distributed during the period of insurance?"*

Each project will have its peculiar risk development pattern depending upon several factors including:

1. The nature of machinery and civil work involved
2. Availability of material and labour
3. Experience of the contractor in previous such kinds of projects
4. Problems faced in the process of erection, e.g. labour, financial, nature related, political etc

Anurag Rastogi

Senior Manager (Actuarial)
Bajaj Allianz General Insurance Co. Ltd
Anurag.Rastogi@bajajallianz.co.in

It is indeed hazardous to take a position in regard to the distribution that the risk build-up may follow for disparate projects of varying complexity carried out by contractors of different levels of expertise and know-how. The problem is compounded by non-availability of industry-wide data for different kinds of projects and their risk distribution.

A possible approach is presented below which is a result of a series of discussions with engineering insurance underwriters, claims managers and other industry experts. In the absence of credible data, the approach has been to construct theoretical distributions and see which one approximates best to the real life situation for this kind of insurance. The possible distributions are given below in the table. The calculations to arrive at this table are given in the annexure A followed by their graphical representation in Annexure B&C

Cumulative Value Build Up						
Month	Exponential	Cubic	Square	Parallel Line	x^1.5	Sum of digits
1	0.0000545	0.0006485	0.0072464	0.0833333	0.0244688	0.0133333
2	0.0001482	0.0051881	0.0289855	0.1666667	0.0692083	0.0400000
3	0.0004027	0.0175097	0.0652174	0.2500000	0.1271437	0.0800000
4	0.0010947	0.0415045	0.1159420	0.3333333	0.1957506	0.1333333
5	0.0029758	0.0810636	0.1811594	0.4166667	0.2735698	0.2000000
6	0.0080891	0.1400778	0.2608696	0.5000000	0.3596168	0.2800000
7	0.0219884	0.2224384	0.3550725	0.5833333	0.4531690	0.3733333
8	0.0597707	0.3320363	0.4637681	0.6666667	0.5536663	0.4800000
9	0.1624736	0.4727626	0.5869565	0.7500000	0.6606583	0.6000000
10	0.4416491	0.6485084	0.7246377	0.8333333	0.7737722	0.7333333
11	0.7208245	0.8242542	0.8623188	0.9166667	0.8868861	0.8666667
12	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000

Table 1.6.1

In annexure B, the value build up is shown on an incremental basis and horizontal line represents the equal distribution of risk throughout the contract period, something similar to one year fire insurance or motor insurance contract. Of course this is not a preferred risk development pattern for EAR/CAR insurance. All the curves taper off into a parallel line to x-axis after 10 months, which represents the Testing period for most CAR/EAR policies. During this period, the risk usually does not increase further, but remains at the fully built up value for the entire testing period. Annexure C shows the cumulative value build up for these curves.

These distributions presume a contract period of 12 months, for the sake of illustration. However, the logic can be extended to contracts of any length of period. Similarly, we can visualize the following complications in a real life project life cycle

- Premium payment by installments, which is a norm for this class of business
- Longer project periods
- Extension of project period midway, thereby changing the course of risk build up midway
- Suspension of work during the course of erection and thus extension of project period, etc.

All these can be addressed by suitably modifying the curve to represent each of these situations.

If we now decide to go by the risk curve agreed to by the Engineering underwriters, i.e., the Cubic curve, we can look up the cumulative value build up table to find out the earned premium at different stages

of the project. According to this, the earned premium at the end of one month will be just 0.06%, growing to 14% by the end of 6 months, 82.42% by the end of 11 months and 100% by the end of 12 months (the values in table are given in decimals; to arrive at percentage, please multiply by 100).

2. Unexpired Risk Reserve (URR)

Unexpired Risk Reserve is different from UPR in that it is a measure of likely amount of claims liabilities on the unexpired portion of the policies at the end of an accounting year. The amount of unexpired risk reserve can be substantially different from UPR in the situations discussed below:

1. If the insurance policies have been underpriced, it is strongly likely that the expected claims on these policies plus Loss adjustment expenses (including allocated and unallocated expenses) shall be more than the premium for these policies. This indicates that the expected claims plus loss adjustment expenses on the unexpired portion of the policies (which is URR) is also likely to be more than UPR. This situation can also be visualized when an insurer anticipates a worsening claims trend in the coming accounting year due to some recent developments affecting claims which was not built in the premiums when writing the policies in the earlier accounting period (say, a recent regulatory or judicial decision adversely affecting the liabilities on claims happening from a particular date, which was not factored in the premiums)
2. On the other hand, if the insurance policies have been overpriced (which may be a hypothetical situation, at least in free pricing regime), or the insurer anticipates a favourable claims trend in the coming accounting year (although, such anticipation may not be advisable), URR may be lower than UPR

2.1. Calculation of URR

While UPR can be calculated by using simple mathematics for the unexpired period of risk, calculation of URR requires actuarial intervention. This is because URR requires estimation of likely claims on the unexpired portion of policies. There are appropriate actuarial techniques to estimate URR, some of which are;

- Ultimate Loss Ratio method, which can be used to estimate the ultimate amount of losses on UPR
- Risk models, from which the estimated cost of claims can be calculated on the unexpired portion of policies
- Chain ladder method on an underwriting year cohort

However, the discussion on these methods is beyond the scope of this write up.

3. Premium Deficiency Reserve (PDR)

Premium Deficiency Reserve is the difference between URR and UPR. It is the estimated deficiency in the UPR in case URR is higher than UPR. The Indian regulator mandates upon the insurer to estimate this deficiency and provide a reserve for this at the end of every accounting period

PDR is also known as Additional Unexpired Risk Reserve in some insurance jurisdictions and most actuarial literature.

4. Regulatory Provision on Premium Reserves

Section 64V of the Insurance Act, 1938 provides that for the purpose of examining solvency margin, the reserve for unexpired risks should be:

- *50% of the premium net of reinsurances for Fire and Miscellaneous business;*
- *50% for Marine Cargo business; and*
- *100% for Marine Hull business.*

Hence the act requires a minimum URR in accordance with the proviso above. This means that the total of UPR and PDR should be a minimum as prescribed in the Act, and that too only for the purpose of calculating solvency. The act does not require either URR or UPR to follow these floors for the purpose of insurers' financial statements. Let's now look at the regulations for financial statements.

The Preparation of Financial Statements Regulations, 2002 requires as below

"A reserve for unexpired risks shall be created as the amount representing that part of the premium written which is attributable to, and to be allocated to the succeeding accounting periods and shall not be less than as required under section 64 V(1) (ii) (b) of the Act. "

What the regulation seems to require here is a provision for UPR, which is clear from the wordings *"amount representing that part of the premium written which is attributable to, and to be allocated to the succeeding accounting periods"*. However, this has been referred to in the regulations as URR. For the sake of discussion and to avoid confusion between UPR and URR, let us call it UPR here.

If, according to the regulations, UPR has to follow the floor prescribed by the act, the very purpose of calculating UPR by the technically superior methods gets defeated. For marine insurance policies and other short term policies, the technically calculated UPR typically will be very small, but this gets defeated if insurers have to provide the minimum of 50% prescribed by the regulations. On the other hand most insurers provide only the regulatory minimum UPR for project insurance policies (EAR, SCE ETC), whereas on a technical basis it may be much higher than the regulatory minimum of 50%. For the purpose of solvency calculations, the insurers have to follow the floors prescribed by the act, but for the purpose of preparing financial statements, they should be allowed to reserve for UPR on technical basis rather than the regulatory minimum.

I believe there is a need for a relook at the ways different insurers calculate their UPR, URR and PDR. At the same time, the regulations clearly need to spell out all these three reserves and promote a more technical computation and provision for them.

Annexure A

Cumulative Value Build Up Table-Calculations

This table has been constructed in two steps.

Step 1

The first step was to construct a table of values derived from applying these distributions to the number of months (variable x). The first table is given below

Cumulative Value Build Up						
Month	Exponential	Cubic	Square	Parallel Line	x^1.5	Sum of digits
1	0.0000167	0.0005787	0.0069444	0.0833333	0.0240563	0.0128205
2	0.0000454	0.0046296	0.0277778	0.1666667	0.0680414	0.0384615
3	0.0001234	0.0156250	0.0625000	0.2500000	0.1250000	0.0769231
4	0.0003355	0.0370370	0.1111111	0.3333333	0.1924501	0.1282051
5	0.0009119	0.0723380	0.1736111	0.4166667	0.2689572	0.1923077
6	0.0024788	0.1250000	0.2500000	0.5000000	0.3535534	0.2692308
7	0.0067379	0.1984954	0.3402778	0.5833333	0.4455282	0.3589744
8	0.0183156	0.2962963	0.4444444	0.6666667	0.5443311	0.4615385
9	0.0497871	0.4218750	0.5625000	0.7500000	0.6495191	0.5769231
10	0.1353353	0.5787037	0.6944444	0.8333333	0.7607258	0.7051282
11	0.2208835	0.7355324	0.8263889	0.9166667	0.8719325	0.8333333
12	0.3064317	0.8923611	0.9583333	1.0000000	0.9831392	0.9615385

Exponential curve:

The values from month 1-10 in the exponential column are derived from the formula

Exp (month)/Exp (12)

The value in the 11th month is

2 X value for 10th month –value for 9th month……..(1)

The value for 12th month is

Value for 11th month + value for 10th month–value for 9th month .....(2)

The values for 1-10 months for different curves are derived using the following formulae, while the values for 11th and 12th month are using the formula given at (1) & (2). .

Cubic Curve *(Month/12)^3*

Square Curve *(Month/12)^2*

X^1.5 *(Month/12)^1.5*

Sum of digits If xi denotes the ith month, then value for ith month = $\sum_{1}^{x_i} x_i \Big/ \sum_{1}^{12} x_i$

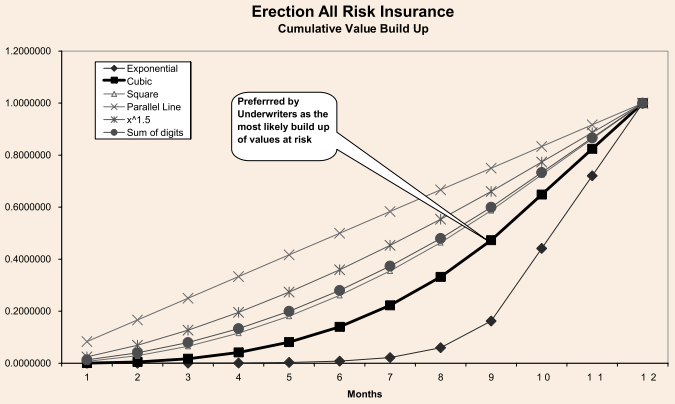
Step 2

In the second step, the values for each month have been rebased by dividing them by the value of the 12th month in each column to give the following table shown as table 1.6.1

Cumulative Value Build Up						
Month	Exponential	Cubic	Square	Parallel Line	x^1.5	Sum of digits
1	0.0000545	0.0006485	0.0072464	0.0833333	0.0244688	0.0133333
2	0.0001482	0.0051881	0.0289855	0.1666667	0.0692083	0.0400000
3	0.0004027	0.0175097	0.0652174	0.2500000	0.1271437	0.0800000
4	0.0010947	0.0415045	0.1159420	0.3333333	0.1957506	0.1333333
5	0.0029758	0.0810636	0.1811594	0.4166667	0.2735698	0.2000000
6	0.0080891	0.1400778	0.2608696	0.5000000	0.3596168	0.2800000
7	0.0219884	0.2224384	0.3550725	0.5833333	0.4531690	0.3733333
8	0.0597707	0.3320363	0.4637681	0.6666667	0.5536663	0.4800000
9	0.1624736	0.4727626	0.5869565	0.7500000	0.6606583	0.6000000
10	0.4416491	0.6485084	0.7246377	0.8333333	0.7737722	0.7333333
11	0.7208245	0.8242542	0.8623188	0.9166667	0.8868861	0.8666667
12	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000	1.0000000

This is nothing but rescaling all the values in each column by the 12th month value, so that by the 12th month, each curve reaches 100%

Annexure B



Annexure C