Earning by Exposure

Insurance loss ration and exposure analysis

Management analyses: The eternal triangle

When non-life insurers analyse a portfolio, the typical factors used are loss ratio, claims, and premiums. Of these, the loss ratio has been the focus of most attention, as it is seen as an indicator of the health of the portfolio. However, the insurer cannot directly affect the loss ratio; these are indirectly affected by a combination of factors. This can be represented as the eternal triangle of analysis shown in Figure 1.
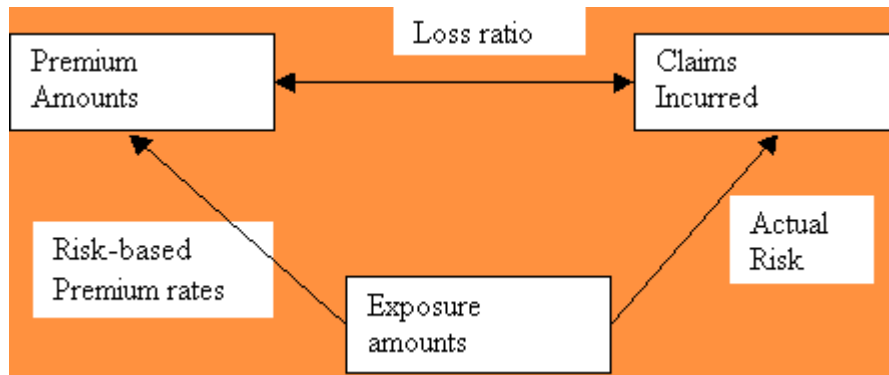

Figure 1: The triangle of analysis

Some underlying factors that affect the loss ratio are risk classifications and risk premium rating. While classifying and assessing risk is a key issue for surveyors, and underwriters, the risk itself is not often the focus of financial management analysis due to problems in aggregation. Instead, management analysis focuses on the exposure, and sometimes - on the risk category into which the risk has been classified. Premium rating, in many cases, has been controlled by tariffs set by the government. Thus, it has often not been the focus of management analysis. Instead, the loss ratios of the past have been used to substantiate the argument that existing tariff rates are insufficient to cover the associated risks.

The informational bases:

The management analyses can be understood by the informational basis: the information that is used for the analysis. By understanding this, we can understand the limitations of the approach.

The key pieces of information typically used are claims, premiums and exposure amounts. Claims paid, claim incurred and claim outstanding are common inputs. Since claim paid refers only to the cash outflow rather than the loss incurred, the claim incurred is most appropriate for analysis of performance during a period. Claim outstanding is a period-end snapshot. Consequently, this is not a good indicator of performance or work done during the period.

For premium too, various amounts are available: received, booked and earned. Since the premium received refers only to the cash inflow, the premium booked is a better indicator of business conducted. However, the premium is typically booked for the entire period of the policy; therefore the most appropriate measure of income during a period is the premium earned.

For exposure, the amount used is the exposure amounts at the beginning and the end of the period being analysed. Curiously, this is a snapshot figure (like claim outstanding) and is not a figure for the period (as claim incurred and earned premiums are). Even more interestingly, this is an accumulation of the exposures on all the risks at that point of time, each of which has been insured for different periods of time during the period being analysed.

Since the informational basis for exposure does not seem to take into account the time for which the exposure on the risk has been in force, it would appear to be inadequate for any analysis that focuses on time, premium and exposure.

The impact of neglecting times of risks-in-force

To understand the impact of neglecting the time for which the risk has been in force, let us take a simple example. We shall assume that the common information for a simple portfolio is available, and ask a simple question. We shall examine how that question can be answered with the available information. Then, we shall explore how - if we had different scenarios which all meet the same initial information constraints - we would consider that each scenario would yield a different result. This will show the inadequacy of the information provided initially.

The information available is that during a given year, the company GenSure Co. has earned $ 11m. The exposure for the portfolio at the beginning of the period was $ 1.0 billion, and at the end of the period was $ 1.2 billion. Let us assume that the figures above relate to the same part of the portfolio, in the same class of risks, thus enabling aggregation.

The question asked is: What was the average premium rate that was charged for the above portfolio during this year?

It may be argued that this is not a meaningful question, since risk characteristics differ from risk to risk. However, the question of average premium rate can be asked of any subset of the portfolio, say all marine shipments of a specific type of cargo between two specific ports, thus ensuring a level of uniformity of risk characteristics. Also, premium rating is increasingly done parametrically rather than subjectively, and the regime of controlled tariffs is increasingly giving way to each insurance company's rating systems. This question is just one example of questions that focus on risk, risk rates or premium rates during a period.

Common answers:

So, if we ask what the average rate was, we may claim the average rate was
a) Rate (method 1) = $ 11m / $1.0 b = 11 per mille

b) Rate (method 2) = $ 11m/ $1.2 b = 9.2 per mille

As you can see, the rates vary by 20%. A third person may say that a middle figure may be taken e.g.

Average exposure = ($1.0b + $1.2b)/2 = $1.1b

C) Rate (method 3) = $11m/ $1.1 b = 10 per mille

It is often assumed - implicitly - that the real rate for the portfolio will at least lie in between the two extremes of Method 1 and Method 2.

Three scenarios

Now, let us look at three different scenarios of how the exposure changed during the year. These are shown in Figure 2.
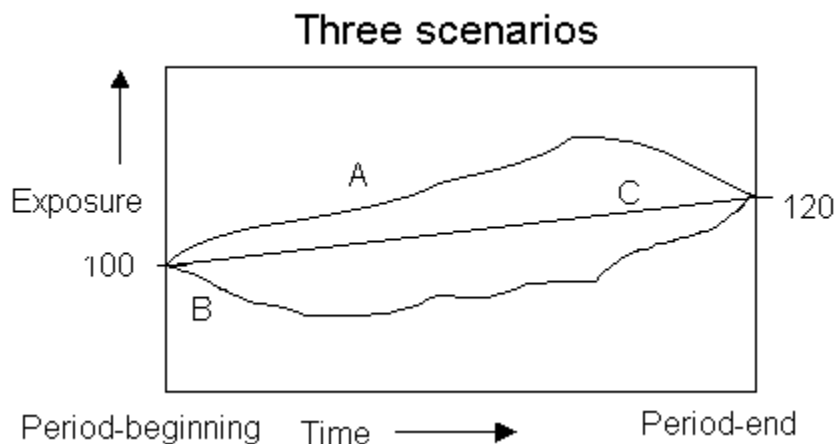

Figure 2: Three scenarios of Exposure

In all these three scenarios in Figure 2, the information matches the data provided initially (exposure at period-beginning and period-end). Thus, the actual scenario could be any of these scenarios (or indeed many others).

During the entire period, on every day, scenario A has more exposure than scenario C, and scenario B has the least exposure. Since the premium earned is identical, we recognize that scenario A has taken the most risk (neglecting for the moment the risk characteristics) and thus the lowest average premium rate for its portfolio, and scenario B the highest average premium rate.

The average rate of scenario B may be higher than that calculated in method 1 (11 per mille), and that of scenario A may be lower than that calculated in Method 2 (9.2 per mille). Thus, even the assumption that the real rate lies somewhere between the two

"extremes" of method 1 and method 2 is not valid. It is unknown and the information available cannot be used to arrive at an answer to the question of the average rate charged.

Thus, to understand even some of the simplest questions of past performance (what is the average underwriting rate on this portfolio or part of the portfolio?), the information used is inadequate.

Unearned premiums for future exposures :

Similarly, we can look at the unexpired risks, and the exposures, and compare with the unearned premiums. For this, we would know - with traditional informational basis for analysis - the current exposure and the unearned premiums. There would be a mix of unexpired annual, short-term and long-term risks (say, for engineering or construction), which expire at different points of time. To add to the complexity of this analysis, there would be no known end point for this future period. Thus, with the same available information, the scenarios could be many, some of which are shown in Figure 3.
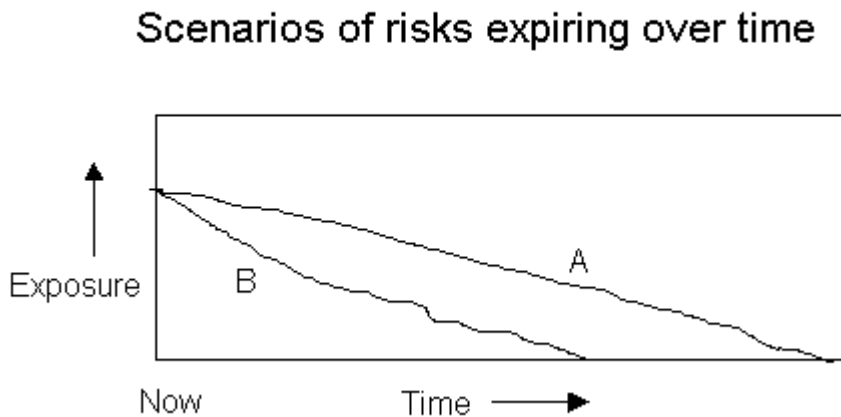
Scenarios of risks expiring over time

Figure 3: Scenarios of risks expiring over time

It is clear from the above that there is greater exposure at all times in scenario A than in scenario B. In both cases, the unearned premium for the portfolio may be identical, which indicates that there is a lower rate for the unexpired risks in scenario A than in scenario B. Even a substantial increase in unearned premium in scenario A may not offset the greater unexpired risk in scenario A. None of this can be deduced from the information normally provided.

Thus, to understand the unexpired exposure (what is the average underwriting rate on unexpired risks?), the information used is inadequate.

Patterns over time :

As we see from the above illustrations, since the informational basis for exposure does not take into account the time for which the exposure on the risk has been in force, or the time it will be in force, it is inadequate for any analysis which focuses on time, premium and exposure. The pattern of exposure over time needs to be seen, not just the end-points for any such analysis e.g. average rate for a period in the portfolio, average rate for unexpired risks, and average rate for a subset of risks in the portfolio.

It is interesting to note that the impact of time has been factored into analysis of premium by taking unearned premiums instead of booked premiums. This was led by the dictum of conservative accounting, and has subsequently been picked up by management analysts. However, the same has not happened for the exposure amounts.

Equally curiously, the time factor is used together with the risk factor and exposure amount for calculating the premiums when the risk is underwritten, but is neglected for periodic management analysis for exposure, and rates.

It is possible - likely - that this had not been earlier chosen for analysis because of the extraordinary level of calculation and record keeping involved in tracking the exposure patterns for the portfolio. Without computerized systems, it is practically impossible to do so. A similar change has slowly happened on unearned premiums - with the increased use of 1/365th method with computerization.

Earning exposure

During any period, the insurer has continuous exposure; by taking these risks, the insurer earns the premiums. To compare the earned premium against the exposure, the insurer needs to identify the exposure on which the premium is earned, and the time for which the exposure has been taken; this is called earned exposure. This can be annualised to arrive at the "average" exposure per day; this is called annualised exposure. Earned exposure (EE) is measured in a combination of amounts and time, while annualised earned exposure (AEE) is measured in amounts (e.g. million $). AEE can be added easily across classes, like earned premium, even if methods applied for calculating the AEE are different for each class.

For consistent comparison, the methodology of calculating earned exposure should be identical to that used for calculation of earned premium. Just as there are different methods for earned premium accounting, there need to be different (and equivalent) methods for earned exposure calculations. The basic assumption that needs to be applied to calculate earned exposure should always be the same assumption that is used for calculating earned premiums.

1/365th method

For 1/365th method, the underlying assumption is that the booked premium is earned equally day by day during the period of the policy. Thus, Earned Premium (1/365th) = Policy Premium * No. of days covered so far/ No. of days of the policy

Using the same basis, each day has an exposure equal to the Policy amount.
Earned Exposure (1/365th method) = Policy Exposure * No. of days covered so far
Annualised Earned Exposure (1/365th) = Policy Exposure * No. of days covered so far/365

1/24th method

If the 1/24th method is used for earned premium, the underlying assumption is that all premiums booked during a particular month can be approximated by an annual policy that incepts during the middle of the month. Thus, the booked premium for month 1 is spread across 13 months as follows:

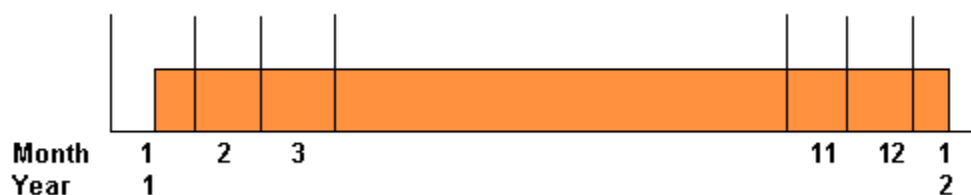| Month	1	2	3	...	11	12	13
Spread	1/24	1/12	1/12	...	1/12	1/12	1/24

Figure 4: Exposure/premium added during Month 1 approximated by 1 policy

Using the same assumption, the risk is also spread across months in the same proportion. The exposure added during the month can be approximated by:
Exposure added = Period-end Exposure - Period-beginning Exposure

Assuming that the month (period) started with exposure of 1.00b and ended with 1.24b, with booked premium of 2.4million, the transactions during the month are approximated by a single annual policy with exposure of 0.24b with booked premiums of 2.4million. This policy is assumed to incept at the middle of the month.

Thus, the earned premium, earned exposure, and annualised earned exposure are:

Month	1	2	3	...	11	12	13
Spread	1/24	1/12	1/12	...	1/12	1/12	1/24
E. Premium	0.1m	0.2m	0.2m	...	0.2m	0.2m	0.1m
E. Exposure	120	240	240	...	240	240	120
A.E.Exposure	10	20	20	...	20	20	10

The earned premium is in millions, the Earned exposure is in million month, and the Annualised Earned Exposure is in Millions.

Note : Explanation for calculation of Earned Exposure :

Since the single annual policy with exposure of 0.24b starts at the middle of the month, Earned exposure for the first and last months = Exposure * ½ month

Earned exposure for other months = Exposure * 1 month

To calculate annualised earned exposure, the earned exposure is divided by the number of months for which the policy is valid viz. 12.

Thus, AEE = 1/24 * Exposure for the first and last month

And AEE = 1/12 * Exposure for the other months.

As is done with the 1/24th method for earned premium, the earned exposure during a particular month has to be calculated by adding all the earned exposure during that month arising out of risks over the previous 12 months. A standard presentation for calculating the earned premiums at the year-end based on monthly premiums is available. A similar presentation for calculating the earned exposures based on month-end exposure can be done.

Other methods

There are other risks (e.g. marine cargo) that are typically not based on duration. The earned premiums are approximated by assuming that a specific share (say 40%) is earned immediately and the remainder after a specific period (say 3 months). A similar assumption would yield an earned exposure method of 40% for the risks on which the earned premium is 40%, and 100% for those on which the premium is fully earned.

Some uses of earned exposure:

By using earned exposure, the three basic factors viz. exposure, premium, claim are converted to comparable measures. Earned premium, claims incurred, and earned exposure have a time dimension; this allows comparison of the three. For example, questions such as the following can be answered:

a) What is the average underwriting rate on this portfolio / sub-set of this portfolio?
b) What has been the average rate of loss against exposure for the portfolio?
c) During the period, what is the average exposure in this portfolio?

Answers to questions such as these can help us better understand the past performance of the portfolio.

Earned exposure can also help focus on identifying and managing cost (rate of loss against exposure) and pricing (rate against exposure) independently. Without earned exposure, there is no firm basis to compare incomes (premiums) and losses (claims) against the risk taken. It should be noted that exposure alone is not a measure of the risk; the risk characteristics and category need to be looked at. It must be reiterated that the aggregate measures used are for a subset of the portfolio where such aggregation is reasonable e.g. all fire risks with the same cover, and in the same risk category.

Earned exposure also solves one of the classical problems in analysis: the non-additive nature of exposure. Exposure could be added across several characteristics e.g. territories and branches, but not across time. Therefore, exposure - and any analysis that used

exposure - had to be treated differently from the claims incurred and earned premiums, which are additive. However, earned exposure can be added across periods, branches or zones in the same way as earned premiums and claims incurred can be, thus simplifying the process of analysis.

Concluding remarks:

Given the nature of changes arising from liberalisation in non-life insurance, it is important to move towards greater analysis of costs and incomes, vis-à-vis risk taken. A suggested measure - annualised earned exposure - seems to provide a basis for consistent and comparable analysis of premiums, claims and exposure. Based on this measure, key performance indicators need to be defined for analysing portfolios.

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