Monitoring Renewal Rate Change on Cat-Exposed Excess Property Business

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Abstract

This paper explains why a commonly-used metric of pricing performance, the Renewal Rate Change statistic, might not give true indications of the real rate change on Catastrophe (Cat)-Exposed Excess Property business. At the account level, false readings may arise when the renewal and expiring policies cover different layers or different sets of locations. When that happens, premium changes stemming from such differences are confounded with real changes in rate level. The paper presents a proposal to appropriately reflect coverage layer and location schedule differences. The proposal involves use of Cat Loss Simulation models to estimate the percentage by which the premium for an account should change in response to such differences. Once individual policy rate changes are correctly calculated, there is a potential problem in aggregating the individual results to a correct portfolio total. Concrete examples are presented to demonstrate that weighting with Renewal Premiums is incorrect and will lead to an overly optimistic answer. The paper then proposes alternative weights that lead to an unbiased result.

Keywords Rate Monitor, Renewal Rate Change, Excess Property, Catastrophe Models

1. INTRODUCTION

The Renewal Rate Change is a popular pricing metric, but it can give misleading indications when used to measure the rate change on Catastrophe-Exposed Excess Property business. There are potential problems both at the account level, in defining rate change for an account, and at the portfolio level, in weighting together the individual account rate changes to get a portfolio total.

For an individual account, the nominal change in rates between the renewal and expiring policies will not necessarily provide a valid rate change comparison when those policies cover different excess layers or cover different sets of locations. We will estimate the relative effect such differences should have on rate level by calculating how they impact Technical Premium[1] rates. This will allow us to offset the Nominal Renewal Rate Change for the effect of these differences and thus arrive at a better measure of the real rate change. The necessary Technical Premiums will be computed using results from a Catastrophe (Cat) Loss Simulation model.[2]

At the portfolio level, an optimistic bias is introduced if individual account rate changes are aggregated into a portfolio total using Renewal Premium weights. We will show what is wrong with

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[1] Technical Premium is here used to denote an indicated risk-loaded premium that is calculated directly from a set pricing algorithm without influence of schedule rating or other judgment modification.

[2] A cat loss simulation model runs thousands of modeled events against input locations and insurance coverages to arrive the estimated distribution of insurance losses from specified catastrophe perils. See Burger, Fitzgerald, White, and Woods [2] for a description of this type of model.

Renewal Premium weights and then propose better ones.

1.1 The Lack of Actuarial Literature on the Subject

There are many articles on rates and rate changes, but we have not found any that directly address the concerns we have identified regarding coverage layer changes, location schedule changes, and aggregation averaging. The one paper that is focused on rate monitors notes that "renewal rate change reports often provide misleading indications of rate changes due to changes in the underlying mix of business on each policy,"[3] but does not present a solution to that problem. Price monitors have also been the subject of discussion at several actuarial professional meetings,[4] but those discussions have not yet found their way into the actuarial literature. There also may be internal corporate memos documenting computations similar to those we will present. Unfortunately, those articles are not part of the public domain. Our belief is that this will be the first paper in the literature to directly address the key questions we have identified about renewal rate change computations for excess property business.

1.2 Industry Reported Rate Increases

In the aftermath of the Katrina, Rita, and Wilma hurricanes of 2005, many industry pricing surveys reported significant rate increases on hurricane-exposed property business.[5] Since we do not know how insurance companies computed renewal rate change figures by account or how they aggregated them into portfolio totals, we do not know if there were any distortions in those reported rate change figures. However, if we succeed in our objective, so that our methods, or improved variations, are adopted as industry standard practices, it may help to dispel questions about the computational validity or comparability of reported rate increases following the next major cat event.

1.3 Uses of the Renewal Rate Change Statistic

The Renewal Rate Change statistic is one of the most popular pricing metrics. It is used in two major ways. First, it is used by actuaries as one of several inputs needed to compute on-level premiums and to project rate adequacy. Second, it is used by managers as a gauge of pricing performance.

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[3] Vaughn [8], p. 506.

[4] See the presentations by Kundrot [4], Nyce [5], and Palisi [6].

[5] For example, the May, 2006 Expert Commentary on the First Quarter Market Survey from The Council of Insurance Agents and Brokers (CIAB) [3] had the quote "Overall, rates are down, *except* for property cat exposures (which are) up more than 25 percent…" (Italics in original).

1.3.1 On-Level Factors, New and Nonrenewed Business

In this paper, we will focus on measuring the Renewal Rate Change and only the Renewal Rate Change. So our discussion will only briefly touch on two other important pieces in the measurement of the overall rate: the contribution due to newly written business and the impact resulting from nonrenewed business.

Since the calculation of Renewal Rate Change omits consideration of new business, it provides at best an incomplete picture of the overall rate level.[6] We hypothesize that relative price adequacy between new and renewal business varies with the insurance cycle. When the market is tight and nonrenewed accounts go searching for a new carrier, they are in a weak bargaining position and may pay a large premium. Then a new business account may be more adequately priced than a renewal.[7] On the flip side, when the market softens and companies are flush with capacity, underwriters will agree to cut price to gain new accounts and meet volume targets. Then a new account may be relatively underpriced.

The Renewal Rate Change statistic also neglects any consideration of nonrenewed business. In general, the nonrenewed book is a mix of adequately priced accounts which departed for better deals elsewhere and poorly priced accounts which were cancelled or nonrenewed by company underwriters. The mix between the two likely varies over the insurance cycle and should change when the insurance company revises its pricing and underwriting policies.

A detailed computation of on-level factors would require going beyond looking at rate change on renewal accounts to also consider rate adequacy levels on new and nonrenewed accounts. However, in practice this is seldom done. Most on-level factors are derived solely from rate change statistics on renewal business. This is technically an incomplete treatment that might lead to inaccuracy in computed on-level factors.

1.3.2 Management Uses of Rate Monitors

The Renewal Rate Change statistic is one of several rate change statistics that may be used by company executives to monitor pricing. It is conceptually easy to understand, treats each underwriter fairly, and fosters clear lines of responsibility. These are some of the reasons the

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[6] Vaughn [8] p. 506 states "there are several drawbacks associated with renewal rate change reports. For instance, the renewal rate change report does not monitor the price level changes associated with new-business policies."

[7] Boor [1] describes a scenario that supports our hypothesis. He states "accounts may be 'orphaned' and unable to find coverage. This produces a situation where accounts are willing to accept higher prices for the benefit of having insurance coverage when it is hard to obtain." p. 3.

Renewal Rate Change statistic is generally accepted by both business line managers and underwriters.

Rate monitors are used in different ways by executives in managing insurance companies. Some executives set monitor targets and explicitly look at price monitor performance when evaluating underwriters and business units. These executives believe a connection between monitor performance and compensation will act as a powerful incentive for underwriters to push the line on price as far as it can go. Other executives disagree. They feel that too much emphasis on a statistic may distract underwriters from sound underwriting and may even spur them to find ways to "game" the system. We will not argue one way or the other about how rate change statistics should be used in managing a company. Our intent is to make actuaries aware that there may be widely divergent philosophies in different companies. Further, our discussion of the Renewal Rate Change statistic should not be construed as an endorsement or criticism for using that statistic, or any pricing statistic, as a measure of underwriter performance.

1.4 Loss Ratios Instead of Rate Monitors?

Since what really matters are results, one might play devil's advocate and question whether rate monitors have any use at all in managing the business. Why not just look at loss ratios? Isn't the proof of price performance ultimately in the results? Why supplement the loss ratio perspective with anything else? There are several general answers to this line of questioning. First, there is the matter of timing. Rate monitors are a leading indicator that can help us predict what loss ratio to expect on the business we are writing.[8] Loss ratios are a backward look at results on what has been written. So rate monitors give management a more timely indication of possible problems ahead. Second, there is the point that loss development introduces a lag before loss ratios results can be estimated with reasonable accuracy. When the lag runs into years, there may be some legitimate question about who is responsible for current results. Consider any long-tailed casualty line, where an underwriter can switch companies every few years and, with any luck, will stay one step ahead of the loss tail. Why should current underwriters be held to account for the shipwreck caused by a prior crew? In contrast, a price monitor would typically show the pricing achieved by current underwriters over the most recent prior month or quarter, with perhaps a lag of a month or two.[9]

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[8] Wang and Faber [9] support this view stating, "What the insurance industry needs is leading indicators…" and that "…companies need to diligently track rate level changes" (p. 59).

[9] Price monitor values can also age over time due to late bookings, premium audits, endorsements, and retro adjustments. In most cases, price monitor development is essentially complete after a few months.

The final problem with focusing solely on the loss ratio is that it can be too volatile. On this point, Cat-Exposed Excess Property is a good example. The loss ratio is usually quite low for every insurance company and underwriter, except when a catastrophe occurs. Then everyone's loss ratio is in the stratosphere. With so many underwriters doing poorly that year, it is hard to legitimately single out a specific underwriter for having had a poor showing. Of course, this is an oversimplification: a good underwriter will carefully control exposure aggregation, will write a geographically diversified mix of business, and utilize other underwriting practices which should translate into better results in any particular year and over the cycle. Nonetheless, the point still stands: a good cat underwriter will often lose money in a bad year and a poor cat underwriter will often make money in a good year.

1.5 Organization of the Paper

In Chapter 2, we will define the Renewal Rate Change statistic at the account level and show how to make the necessary adjustments. Then, in Chapter 3 we will examine how to aggregate the individual account rate changes into a portfolio average. All key formulas are documented in Appendix A, while Appendix B contains a discussion of data issues.

2. RENEWAL RATE CHANGE BY ACCOUNT

In this chapter we will first explain why it is necessary to go beyond the Nominal Renewal Rate Change on Cat-Exposed Excess Property business. Then we will walk through a hypothetical Excess Property example and show how to make account level adjustments for coverage layer and location schedule differences between the renewal and expiring policies. To avoid complications, we will assume all accounts have Specified Peril catastrophe coverage.[10]

2.1 Coverage Layer and Location Schedule Changes

For Cat-Exposed Excess Property business, it is not at all unusual for accounts to have renewal and expiring policies that provide different layers of coverage or that have different schedules of insured locations. For many other types of insurance business, the vast majority of accounts renew policies with coverage layers that are the same as the expiring ones and that have minimal or

[10] Accounts often have policies that cover Flood, Fire, Terrorism and other perils. Some polices may provide All-Risk Coverage or they may provide Difference in Conditions (DIC) Coverage.

predictable changes in exposure. Why is the Cat-Exposed Excess Property business different? Our answer is that Property Cat market has inherent characteristics which push the insured and the insurance company to initiate changes more frequently than for many other lines. In addition, much of this business is placed through Surplus Lines brokers. It is possible that accounts in the Nonadmitted market are subject to more frequent program changes than Admitted market accounts.

2.1.1 Changes Initiated by the Insured

The insured typically decides to revise its insurance program[11] in response to market price swings or capacity fluctuations. These are endemic to the Cat-Exposed Property market. In the aftermath of a significant cat, capacity gets tight, and the rate on Cat-Exposed Property skyrockets. The insured, who may be strapped for cash following a cat, is in no position to pay the huge premium increase needed to renew its expiring program. The insured may thus feel forced to retain more risk, either by changing the layer of insurance it purchases or, less frequently, by removing some locations from its insurance program. After a few years, prices will drop as naive capacity floods the market, and the process will reverse itself.

2.1.2 Changes Initiated By the Insurance Company

There are several situations in which an insurance company might initiate changes. A company faced with a downgrade by a rating agency, for instance, may need to reduce its exposed limits. To do this, it might reduce its percentage shares of layers with large limits or write different layers with lower limits. In another scenario, changes on individual accounts flow from a deliberate change made in the company's underwriting strategy. For example, the company might have been writing large shares of high excess layers that kept it above the "working layer." When the account is up for renewal, the company may have adopted a "ventilation" strategy under which it aims to write modest percentages of several disconnected layers, including some working layers.

2.1.3 Changes Initiated By the Surplus Lines Broker

A broker may sometimes be the driving force behind changes in an account's insurance program. It is possible that splitting a large layer in two or combining two small layers into one can result in an overall price reduction to the insured. As well, a broker may want to introduce new carriers to help

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[11] Beyond changing coverage layers and location schedules, changes are also made with respect to per location deductibles, per occurrence deductibles, occurrence hour range definitions (contiguous 96 hours versus 128 hours, etc.), location or peril sublimits, Business Interruption (BI) waiting periods and limits, and so forth.

spur competition for the account. This might necessitate cutting back on the shares of the incumbent writers or splitting layers to make room for the new carriers. A broker also may feel the need to make such changes in order to stave off competition from another Surplus Lines broker. Note that some program structure revisions can be made without altering the customer's overall layer of insurance coverage, even though they will alter the specific layers written by particular insurance companies.

2.2 Defining Real Rate Change

Before making adjustments to a nominal rate change figure in order to obtain the real rate change, we should first discuss the concept of a "real" rate change. When the expiring and renewal policies have identical coverages and location schedules, the real rate change is the same as the nominal rate change: both equal the change in the charged rate.[12] When they are not identical, we need to eliminate the portion of the nominal rate change which stems from differences in the layer of coverage or differences in the schedule of locations. What remains is the "real" rate change.

To introduce some theoretical precision about what portion of a rate change should be attributed to changes in the coverage layer and the location schedule, suppose we had a single manual showing perfectly adequate rates for both the expiring and renewal coverage layers and location schedules. By the phrase, "perfectly adequate rates," we mean a set of actuarially sound indicated rates that satisfy all rules of mathematical consistency and which within those rules faithfully reflect the risk-return preferences of the company.[13] In principle, the company should be equally willing to write any coverage layer and location schedule combination at the perfectly adequate rates listed in the theoretical manual. In this sense, all the rates in the manual are at the same rate level.

Our proposed conceptual approach is to use rate relativities from this hypothetical manual of perfectly adequate rates in order to ascertain the effect of coverage and location schedule differences between the renewal and expiring policies. For instance, if the manual says there is a 10% rate difference between the renewal and expiring layers, then we will back out that 10% rate difference when computing the real rate change.

We should note that perfectly adequate manual pricing does <u>not</u> imply the manual rates are

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[12] A rate in this context is the premium per unit of exposure.

[13] In defining perfect adequacy, we make reasonable assumptions as needed to avoid complications due to minimum premium rules, commission differences, and other similar factors.

calibrated to produce the same expected loss ratio for all coverages. Depending on how we price risk, we might reasonably have lower expected loss ratios for high excess layers than for ground-up limited layers.

Also, it should be emphasized we are using only one manual, the current one, in evaluating perfectly adequate premiums and in deriving the impact of coverage layer and location schedule changes. To be specific, we will assume the current manual is perfectly adequate as of the effective date of the renewal policy, even though it contains rates for layers and locations from the expiring policy. Note the manual of adequate rates could change from year to year -- for instance, due to the effect of trend. An account with no real rate change might thus end up with a renewal policy less adequately priced than the expiring policy.

To implement this framework, we have to clear a major hurdle: the lack of a manual of perfectly adequate rates for a Cat-Exposed Excess Property account. The proposal we will later present entails using Cat Loss Simulation models to generate Technical Premium rates that will serve as the best available estimates of perfectly adequate rates.

2.3 A Hypothetical Example Account

We will now look at an example in which there are both coverage layer and location schedule differences. To begin our example, suppose Wayne's Widgets is a major widget manufacturer and vendor. Assume it has a factory, a warehouse, and several retail stores in two hurricane-exposed states. Suppose our insurance company has written cat coverage on Wayne's Widgets for two years running. Table 2.3.1 summarizes the premiums, coverages, and exposures for the expiring and renewal policies.

Table 2.3.1

Premium, Coverage, and Exposure Summary
Wayne's Widgets

	Expiring	Renewal
Premium	$50,000	$40,000
Coverage	$5m p/o $25m x $5m	$2.5m p/o $10m x $15m
Company Limit	$5,000,000	$2,500,000
Layer 100% Limit	$25,000,000	$10,000,000
Attachment	$5,000,000	$15,000,000
Exposure (TIV)	$30,000,000	$25,000,000

The coverage for the expiring policy is $5 million part of $25 million excess of $5m and is written as "$5m p/o $25m x $5m," This means the insurance company has a 20% share of the $25m x $5m layer. The exposure is the Total Insured Value (TIV) of locations covered under the policy. This value is gross of deductibles.

Based on this data, we calculate the Nominal Rate, where the Nominal Rate equals the 100% Layer Premium Per $100 of TIV. The 100% Layer Premium is the premium for the full layer. To calculate it, we take the company premium and divide by the share. The reason the rate change is calculated with rates on a 100% basis is that this prevents changes in share from being incorrectly counted as rate changes. The Nominal Rate Change for our sample account is shown in Table 2.3.2.

Table 2.3.2

Nominal Rate Change
Wayne's Widgets

	Expiring	Renewal
Premium	$50,000	$40,000
Coverage	$5m p/o $25m x $5m	$2.5m p/o $10m x $15m
Company Limit	$5,000,000	$2,500,000
Layer 100% Limit	$25,000,000	$10,000,000
Attachment	$5,000,000	$15,000,000
Exposure (TIV)	$30,000,000	$25,000,000
Company Share	20%	25%
Layer 100% Premium	$250,000	$160,000
Rate per $100 TIV	$0.8333	$0.6400
Nominal Rate Change		-23%

2.3.1 Coverage Layer Differences

Our initial conclusion, based on the negative Nominal Rate Change, is that pricing has slipped. Yet this initial conclusion does not seem right. While the rate has dropped 23%, the 100% layer limit has dropped by 60%, from $25 million to $10 million. This suggests the charged rate could also fall by 60% without reducing rate level.

The beneficial effect of limit reduction is directly incorporated in another pricing statistic, the Rate on Line (ROL).[14] For the expiring policy, the 100% premium is $250,000 and the 100% limit is

[14] ROL is defined as the 100% Layer Premium divided by 100% of the limit of the layer to be insured.

$25,000,000. So, the ROL is $10,000 per million. Similarly we can derive an ROL of $16,000 per million for the renewal policy. The ROL statistic thus indicates an improvement of 60%.

Raising the attachment reduces loss in many scenarios and this also points towards an improvement in the real rate level. Taken together, the reduction in the limit and the increase in the attachment would lead us to conclude the real rate change is positive, not negative.

2.3.2 Location Schedule Differences

A location schedule shows the location and Total Insured Value (TIV) of covered structures. Separate TIVs are shown for Structures, Contents, Business Interruption (BI), Extra Expense, and possibly other coverages. The location schedule should also have age of structure, construction type, occupancy class, protection rating, and other information about each location. The location

Table 2.3.2.1

Location Schedules

Wayne's Widgets

Location Schedule			**Expiring Policy**				
Loc Number	Description	Year Built	Street Address	City	State	ZIP	TIV
1	Co HQ	2005	12 Shady Lane	Pleasantville	AA	12345	$3,000,000
2	Warehouse	1977	Industrial Park Center	East Town	AA	12222	$8,000,000
3	Factory	1995	22 Fast Lane	Grime	AA	12288	$7,000,000
4	Retail Store A	2001	Harbor St Marina	ShoreHarbor	AA	10225	$3,000,000
5	Retail Store B	1998	Pier 7	Lighthouse	AA	10245	$3,000,000
6	Retail Store C	1982	Beach Lane Landing	Cape Shark	AA	10255	$3,000,000
7	Retail Store D	1999	Dock 15	Fishtown	BB	31288	$3,000,000
7	Total						$30,000,000

Location Schedule			**Renewal Policy**				
Loc Number	Description	Year Built	Street Address	City	State	ZIP	TIV
1	Co HQ	2005	12 Shady Lane	Pleasantville	AA	12345	$3,000,000
3	Factory	1995	22 Fast Lane	Grime	AA	12288	$7,000,000
4	Retail Store C	1982	Beach Lane Landing	Cape Shark	AA	10255	$3,000,000
5	Retail Store D	1999	Dock 15	Fishtown	BB	31288	$3,000,000
8	Retail Store E	1993	13 Canal Street	SandyShore	AA	12255	$3,000,000
9	Retail Store F	2003	81 Peninsula Drive	WaveCrest	BB	31224	$3,000,000
10	Retail Store G	1992	Seashore Mall	Seashore	BB	31288	$3,000,000
7	Total						$25,000,000

schedules for our fictitious account are shown in Table 2.3.2.1.

For convenience and simplicity, we have summarized the TIVs to a single number and omitted the construction code, occupancy class, and other such information. For any real application, such information could have a material effect on the answer and should not be omitted. In comparing renewal and expiring schedules in our example, we note the insured removed the warehouse and two of its retail stores from the program, and replaced them with three other stores. We also observe that more of the TIV is concentrated in state BB for the renewal than it was for the expiring policy. The impact of these mix changes is not knowable in advance. However, the Nominal Rate Change will misconstrue as real rate change any rate movement that might arise from such location schedule differences.

2.4 Technical Premium Based on Cat Loss Simulation Model Statistics

As previously outlined, our proposed solution entails quantifying the impact that coverage layer and location schedule differences have on Technical Premium rates. In our application, a Technical Premium denotes an indicated premium computed by machine algorithm without schedule rating or other judgment modification. We will assume the Technical Premium includes provision for risk-loaded loss. We will also suppose that it does not reflect any minimum premium or minimum rate on line constraints.

Our proposal is to compute Technical Premiums using results from a cat loss simulation model. The pure loss provision in the premium will be equal to the Average Annual Loss (AAL) from the model and the risk load could be based on any of a variety of risk metrics generated by the model. These risk metrics include the Variance, Standard Deviation, Probable Maximum Loss, and Tail Conditional Expectation. We will neither define all these metrics nor discuss their particular advantages or disadvantages here.[15] Instead, in order to demonstrate our proposal, we will focus on one widely accepted risk metric, the Probable Maximum Loss (PML),[16] and compute our risk load as 5% of the PML. Including a loading factor of 1.50 for expenses, we arrive at the following illustrative Technical Premium formula:

$$\text{Technical Premium} = 1.5 \bullet \left(AAL + .05 \bullet PML \right) \tag{2.4.1}$$

[15] See Robbin and DeCouto [8] for one discussion of various risk metrics.
[16] In the sense that we are using it, the PML is associated with a return period. For example, the 100-year PML is the size of cat loss that on average occurs no more frequently than 100 years.

2.5 Cat Loss Simulation Model Runs

As previously outlined, our proposed solution entails quantifying the impact that coverage layer and location schedule differences have on Technical Premium rates. To avoid confusing a change in share with a change in the 100% coverage layer, we will refer to a difference in the 100% layer of coverage as a difference in Coverage Structure. In our example, there is a Coverage Structure change from the 25m x 5m layer to the 10m x 15m layer.

We will also decompose location schedule differences into Exposure Magnitude and Location Mix components. In our example, there is an Exposure Magnitude movement in the TIV reduction from $30m to $25m. There are also Location Mix changes in the types of structures covered and in the distribution of the structures between states and within states.[17]

We will separately quantify the effects of Coverage Structure and Location Mix differences. One could estimate the combined impact of changes in Coverage Structure and Location Mix with one overall factor. However, it is useful to have a breakdown of their separate effects. Especially when these adjustments point in different directions, it may be somewhat unconvincing to provide a single number summary without showing the offsetting contributions made by Coverage Structure and Location Mix differences.

To implement this "separate effects" approach, we will make a series of runs with our Cat Loss Simulation model. We will start with the Expiring Location Schedule and Expiring Coverage Structure, then change the location schedule and finally change the 100% coverage layer. Thus, the sequence of cat runs we are proposing is as shown in Table 2.5.1.

It is important to emphasize we are using only one version of a cat loss simulation model in evaluating the impact of these changes. Typically we would employ the most recent version of the model as it incorporates the latest knowledge and advances in methodology. To switch models would be analogous to switching measuring sticks between two measurements: we would be unsure how much of any difference was due to a real difference and how much was due to the switch in our measuring stick.

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[17] For a limited excess layer, a uniform change in the values of all locations does not necessarily lead to the same proportionate change in the 100% layer loss.

Table 2.5.1

Cat Runs for Renewal Rate Change Monitoring

Number	Location Schedule	100% Coverage Layer	Cat Model
1.	Expiring	Expiring	Current
2.	Renewal	Expiring	Current
3.	Renewal	Renewal	Current

2.6 Adjustment Factor Formulas

To translate the 100% Layer Technical Premiums from the three cat runs listed in Table 2.5.1 into Technical Rates, we divide by the appropriate TIVs. We will then define Location Mix and Coverage Structure Adjustment Factors (MXAF and CSAF respectively) by taking the following ratios of Technical Rates:

$$MXAF = \frac{\text{Rate based on Renewal Location Schedule and Expiring 100\% Coverage Layer}}{\text{Rate based on Expiring Location Schedule and Expiring 100\% Coverage Layer}} \quad (2.6.1)$$

$$CSAF = \frac{\text{Rate based on Renewal Location Schedule and 100\% Renewal Coverage Layer}}{\text{Rate based on Renewal Location Schedule and 100\% Expiring Coverage Layer}} \quad (2.6.2)$$

The derivation of adjustment factors for our sample account is shown in Table 2.6.1. Note under our definitions the Location Mix Adjustment Factor will be unity if there is no change in the location schedule and the Coverage Structure Adjustment Factor will be unity if there is no change in the 100% layer of coverage. An adjustment factor value above unity means that some of the Nominal Renewal Rate increase is absorbed in covering the impact of the associated location schedule or coverage layer change. See Appendix A for more compact versions of these formulas.

Table 2.6.1

Technical Premiums, Technical Rates and Adjustment Factors

Wayne's Widgets

	Expiring Exposure Expiring Layer	Renewal Exposure Expiring Layer	Renewal Exposure Renewal Layer
Coverage	$5m p/o $25m x $5m	$5m p/o $25m x $5m	$2.5m p/o $10m x $15m
Exposure (TIV)	$30,000,000	$25,000,000	$25,000,000
Company Share	20%	20%	25%
100% AAL	$50,000	$40,000	$15,000
100% PML	$15,000,000	$11,000,000	$5,000,000
Technical Premium	$300,000	$225,000	$97,500
Technical Rate	$10.00	$9.00	$3.90
Adjustment Factor		0.900	0.433

2.7 Renewal Rate Change Formula

We are now finally ready to calculate the Renewal Rate Change (ΔR) by netting the impacts of the Location Mix and Coverage Structure changes from the Nominal Renewal Rate Change (ΔN).[18] The formula is:

$$\Delta R = \frac{(1+\Delta N)}{MXAF \cdot CSAF} - 1 \qquad (2.7.1)$$

Here ΔN is the Nominal Rate Change, MXAF is the Location Mix Adjustment Factor, and CSAF is the Coverage Structure Adjustment Factor.

In Table 2.7.1, we apply this formula to Wayne's Widgets. Table 2.7.1 shows how the Nominal Renewal Rate decrease in our example has been transformed into a sizeable (adjusted) Renewal Rate increase. We think this more accurately represents the real rate change.

[18] An alternative terminology is to call ΔR the Effective Renewal Rate Change and refer to ΔN as the Renewal Rate Change. We choose to call ΔR the Renewal Rate Change and refer to ΔN as the Nominal Renewal Rate Change.

Table 2.7.1

Renewal Rate Change

Wayne's Widgets

	Expiring	Renewal
Premium	$50,000	$40,000
Coverage	$5m p/o $25m x $5m	$2.5m p/o $10m x $15m
Exposure (TIV)	$30,000,000	$25,000,000
Company Share	20%	25%
Layer 100% Premium	$250,000	$160,000
Rate per $1000 TIV	$8.33	$6.40
Nominal Rate Change		-23%
Location Mix Adjustment Factor (MXAF)		0.9000
Coverage Structure Adjustment Factor (CSAF)		0.4333
Renewal Rate Change		97%

2.8 Premium Reconciliation

It is useful to reconcile the Expiring and Renewal Premiums. The reconciliation proceeds mathematically as follows:

$$P_{REN} = P_{EXP} \cdot \frac{s_{REN}}{s_{EXP}} \cdot \frac{TIV_{REN}}{TIV_{EXP}} \cdot MXAF \cdot CSAF \cdot (1 + \Delta R) \tag{2.8.1}$$

In words, to go from the Expiring Premium to the Renewal Premium, we need to adjust for changes in Share, Exposure Magnitude, Exposure (location) Mix, Coverage Structure (100% layer), and then reflect the true Renewal Rate Change.

For our example account we get:

$$40,000 = 50,000 \cdot \frac{.25}{.20} \cdot \frac{25}{30} \cdot .90 \cdot .433 \cdot (1.97) \tag{2.8.2}$$

From this perspective, we see the overall premium change has been split between a real rate level change component and other components that are not counted as real rate change contributors. These non-rate change factors include volume scaling factors such as change in Share and change in Exposure Magnitude. They also include rate movement factors due to Location Mix and Coverage Structure changes.

2.9 Notional Expiring Premium

We can also infer what the Expiring Premium would have been if it were based on the same location schedule and layer of coverage as the Renewal policy. We will call this the Notional Expiring Premium and denote it as $P_{NXP.}$[19] Following the definition, it is derived by starting with the Expiring Premium and adjusting for Share, Exposure Magnitude, Location Mix, and Coverage Structure changes. It is not hard to see this is equivalent to the Renewal Premium net of the Renewal Rate Change.

$$P_{NXP} = P_{EXP} \cdot \frac{TIV_{REN}}{TIV_{EXP}} \cdot \frac{s_{REN}}{s_{EXP}} \cdot MXAF \cdot CSAF = \frac{P_{REN}}{(1+\Delta R)} \tag{2.9.1}$$

For our Wayne's Widgets example, we find that P_{NXP} =40,000/ (1.97) = \$20,312. This is far less than the actual Expiring Premium of \$50,000.

2.10 Account Renewal Rate Change Summary

To summarize our derivation of Renewal Rate Change for an account, we first put the rates on a 100% basis to eliminate any distortion due to change in share. Then we adjusted the Nominal Rate Change for Location Mix and Coverage Structure changes. The adjustments were derived by using a Cat Loss simulation model to compute, in sequence, the impact such changes would have on Technical Premium rates. We assumed the relationship between Technical Premiums rates should apply to the charged premium rates. So, for example, if changing the 100% coverage layer moved the Technical Premium Rate by 10%, then we assumed 10 points of any Nominal Rate Increase would be attributable to the difference in Coverage Structure. The final Renewal Rate Change is the Nominal Rate Change net of these Location Mix and Coverage Structure adjustment factors. We have also seen how the Renewal Rate Change thus defined can be reconciled with the absolute change in premium.

2.11 Alternative Renewal Rate Change Estimates

Once we go beyond the simple calculation of Nominal Renewal Rate Change and attempt to reflect the impact of differences between the Renewal and Expiring policies, we introduce questions about how to evaluate the rate impact of such differences. So, while all actuaries should arrive at the

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[19] Another name for what we call the Notional Expiring Premium is the Renewal Premium at Expiring Rates.

same Nominal Rate Change for an account, they might arrive at alternative estimates of the Renewal Rate Change. Such divergent estimates could arise from the use of alternative Cat Simulation Models and Technical Premium formulas.[20]

On working excess layers, we have found that most models and formulas produce percentage adjustments often within a few points of one another, and seldom more than five to ten points apart. In contrast, on very high excess layers, we may see significantly different results when different models and formulas are used. As Cat Simulation Models improve over time, we would expect the range of differences to become narrower and we would also expect major differences to be found on smaller sets of accounts.[21] A key point is that all actuarially sound models and formulas should produce consistent results, even for high excess layers. For example, if the 100% layer limit is reduced and all else remains unchanged, the Coverage Structure Adjustment Factor will always be less than unity since the reduced coverage and reduced risk imply a reduced rate.

While it is disheartening not to have an indisputable exact answer, the use of estimates is common in many aspects of current actuarial practice. Part of the art inherent in actuarial science is in selecting appropriate parameters, formulas, and models in order to derive a reasonable range of estimates and then in selecting a final pick within that range. Such is the case in the procedure we are proposing for estimating the real rate change.

3. PORTFOLIO AVERAGE RATE CHANGE

Once we have the Renewal Rate Change for each policy, the question then is how to aggregate results to get the portfolio average Renewal Rate Change. It is a common practice to simply take a weighted average of the rate changes, where Renewal Premiums are used as weights. However, as we will demonstrate, this practice leads to an overly optimistic estimate of rate change. The bias goes one way: rate level improvements are not as substantial as indicated and rate level decreases are worse than indicated. Weights based on Expiring Premiums are better, but they give an out-of date and potentially distorted picture. We will present an alternative in which the weights are based on the Notional Expiring Premiums defined in Chapter 2. We will walk through a series of hypothetical

[20] This problem is not unique to Cat-Exposed Property insurance. Using increased limits factors, one could derive coverage structure adjustments for casualty accounts and different sets of factors would lead to different rate change estimates.
[21] Other implementation and data issues are discussed in Appendix B.

scenarios comparing the weighted average rate changes that result from these weights.

3.1 Renewal Premium Weighting Bias

Suppose we have a portfolio of four risks. Assume for the base case that the Exposure

Table 3.1.1

Portfolio Weighted Average Rate Change
Base Case

	Expiring			**Renewal**					
Risk	Prem (000)	Share	TIV mill	Prem (000)	Share	TIV mill	Nominal Rate Change	Rate Change	NXP Prem (000)
A	$200	25%	100	$280	25%	100	40%	40%	$200
B	$200	25%	100	$120	25%	100	-40%	-40%	$200
C	$50	25%	200	$70	25%	200	40%	40%	$50
D	$50	25%	50	$30	25%	50	-40%	-40%	$50
Total	$500	25%		$500	25%				$500
Weights									
Renewal Prem							16%	16%	
Expiring Prem							0%	0%	
NXP Prem							0%	0%	

Magnitude stays constant, as does the Share, Location Mix, and Coverage Structure. Only the rates change as shown in Table 3.1.1.

In the Base Case we have rate changes by account that end up generating the same overall premium for the expiring and renewal portfolios. Despite the fact that we are getting the same exact money to cover the same exact exposures overall, the weighting of rate changes on Renewal Premiums incorrectly indicates there is a sizeable overall rate increase. This happens because the Renewal Premium weighting algorithm inherently gives undue emphasis to those policies that had rate increases while deemphasizing those that had decreases. In other words, it overcounts rate increases and undercounts rate decreases. As a consequence, the result from weighting with Renewal Premium is biased. It paints an overly optimistic picture of any actual portfolio level increase and masks the true extent of any portfolio level decrease.

3.2 Expiring Premium Weighting Inaccuracy

In the Base Case, there was no difference between the actual Expiring Premium and the Notional Expiring Premium. Now we will modify our example by increasing our share on the accounts that had rate increases. These share increases boost Renewal Premiums, but they do not impact the individual account rate increases. This "Shares Up on Accounts with Rate Increases" scenario is shown in Table 3.2.1.

Table 3.2.1

Portfolio Weighted Average Rate Change
Shares Up on Accounts with Rate Increases

	Expiring			**Renewal**					
Risk	Prem (000)	Share	TIV mill	Prem (000)	Share	TIV mill	Nominal Rate Change	Rate Change	NXP Prem (000)
A	$200	25%	100	$560	50%	100	40%	40%	$400
B	$200	25%	100	$120	25%	100	-40%	-40%	$200
C	$50	25%	200	$140	50%	200	40%	40%	$100
D	$50	25%	50	$30	25%	50	-40%	-40%	$50
Total	$500	25%		$850	43%				$750
Weights									
Renewal Prem							26%	26%	
Expiring Prem							0%	0%	
NXP Prem							13%	13%	

Since more business is from accounts that had increases, we should expect to see a rate increase for the overall portfolio. However, because changing shares has no impact on the Expiring Premium, a weighting on Expiring Premium is the same as in the Base Case and yields no portfolio rate increase.

Next, in Table 3.2.2, we look at an example in which the TIVs increase only for the accounts that had rate increases.

Table 3.2.2

Portfolio Weighted Average Rate Change

TIVs Up on Accounts with Rate Increases

	Expiring			**Renewal**					
Risk	Prem (000)	Share	TIV mill	Prem (000)	Share	TIV mill	Nominal Rate Change	Rate Change	NXP Prem (000)
A	$200	25%	100	$504	25%	180	40%	40%	$360
B	$200	25%	100	$120	25%	100	-40%	-40%	$200
C	$50	25%	200	$126	25%	360	40%	40%	$90
D	$50	25%	50	$30	25%	50	-40%	-40%	$50
Total	$500	25%		$780	25%				$700
Weights									
Renewal Prem							25%	25%	
Expiring Prem							0%	0%	
NXP Prem							11%	11%	

In Table 3.2.2, we assume the TIV changes only impact the Exposure Magnitudes. Therefore these exposure differences do not alter the rate change for any account, yet they do change the relative weight of an account within the portfolio. With more weight now given to accounts that had rate increases, we should now expect to see an overall rate increase. This overall rate increase does appear when Notional Expiring Premium weights are used. In contrast, the weighted average as computed with Expiring Premium weights incorrectly shows no overall rate increase. This is not surprising. By definition, the Expiring Premium weights cannot respond to this TIV-driven change in portfolio mix.

Finally, in Table 3.2.3 we look at a scenario where accounts have Renewal Rate Changes that offset one another in such a way that the total Notional Expiring Premium equals the total Renewal Premium. This means there has been no overall rate change.

Table 3.2.3

Portfolio Weighted Average Rate Change
Offsetting Coverage Strucuture Changes

	Expiring			**Renewal**					
Risk	Prem (000)	Share	TIV mill	Prem (000)	Share	TIV mill	Nominal Rate Change	Rate Change	NXP Prem (000)
A	$200	25%	100	$280	25%	100	40%	75%	$160
B	$200	25%	100	$120	25%	100	-40%	-50%	$240
C	$50	25%	200	$70	25%	200	40%	17%	$60
D	$50	25%	50	$30	25%	50	-40%	-25%	$40
Total	$500	25%		$500	25%				$500
Weights									
Renewal Prem							16%	31%	
Expiring Prem							0%	9%	
NXP Prem							-5%	0%	

When we weight on Notional Expiring Premiums, we correctly end up with that 0% overall portfolio rate change. Weighting with either Expiring or Renewal Premium incorrectly overstates the rate increase. Further, this scenario demonstrates that a weighted average taken with Notional Expiring Premiums does not have to fall between the corresponding weighted averages computed with Renewal Premiums and Expiring Premiums respectively.

3.3 Notional Expiring Premium Weighting

We have seen through concrete examples that Notional Expiring Premium weights are demonstrably superior to either Renewal Premium or actual Expiring Premium weights. They do not overcount rate increases and undercount rate decreases like Renewal Premiums do. They do not ignore changes in the weight of an account within the portfolio as actual Expiring Premiums do. There is an intuitive appeal to derive weights by taking the Renewal Premiums and backing out the Renewal Rate Changes. The resulting weights will be appropriately sensitive to relative importance of an account within the current portfolio. As noted in Equation (2.9.1), the resulting premiums are algebraically equivalent to the Notional Expiring Premiums. To summarize, our proposal is to compute the overall portfolio rate change ($\Delta R(TOT)$) using Equation (3.3.1).

$$\Delta R(TOT) = \frac{\sum P_{NXP}(i) \cdot \Delta R(i)}{\sum P_{NXP}(i)} = \frac{\sum \frac{P_{REN}}{1+\Delta R(i)} \cdot \Delta R(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} \tag{3.3.1}$$

3.4 Weighted Harmonic Average Interpretation

We have felt it intuitively appealing to present our procedure as the computation of an arithmetic weighted average of rate changes and to focus our attention on arriving at the proper weights. This allowed us to directly demonstrate the error in using Renewal Premium weights when computing the arithmetic weighted average rate change and to further argue that Notional Expiring Weights should be used instead. Another approach is to retain the Renewal Premium Weights, but to use a different type of average, called the harmonic average. This interpretation is mathematically presented in the derivation shown in Equation (3.4.1).

$$\Delta R(TOT) = \frac{\sum \frac{P_{REN}}{1+\Delta R(i)} \cdot \Delta R(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} \tag{3.4.1}$$

$$= \frac{\sum \frac{P_{REN}}{1+\Delta R(i)} \cdot (1+\Delta R(i))}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} - 1 = \frac{\sum P_{REN}(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} - 1$$

The latter ratio of sums in Equation (3.4.1) is the Weighted Harmonic Average of the Renewal Rate Change Factors with weights based on Renewal Premiums. Some actuaries may be more comfortable with this interpretation.

We may also use a mathematical argument based on harmonic averages to buttresses our intuitive reasoning about why the Renewal Premium Weighted Average of Rate Changes is biased upward. It can be easily shown that the Weighted Harmonic Average is always less than or equal to the

Weighted Arithmetic Average. The inequality in Equation (3.4.2) holds.

$$\Delta R(TOT) = \frac{\sum P_{REN}(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} - 1 \le \frac{\sum P_{REN}(i)\cdot(1+\Delta R(i))}{\sum P_{REN}(i)} - 1 = \frac{\sum P_{REN}(i)\cdot \Delta R(i)}{\sum P_{REN}(i)} \tag{3.4.2}$$

It follows from Equation (3.4.2) that weighting Renewal Rate Changes with Renewal Premium weights produces an overly optimistic result.

4. CONCLUSION

We have presented solutions to the two major actuarial problems that can cause the Renewal Rate Change metric to be misleading on Cat-Exposed Excess Property business. Our first problem was to figure out how to adjust the nominal rate changes so as to properly account for differences in the layer structure and location mix of the renewal and expiring policies. Our solution was to derive Technical Premiums with the latest cat loss simulation model, first changing the locations and then changing the coverage layer. From these we computed Technical Premium rates and then derived adjustment factors by taking appropriate ratios between these rates.

Our second major problem was to find which weights to use when computing the overall portfolio rate change as a weighted average of the individual account rate changes. We found there is an optimistic bias in the results when Renewal Premium weights are used. We also demonstrated that weighting on Expiring Premiums is flawed, as it is insensitive to changes in Share and to portfolio level TIV mix changes. Our solution was to weight on premiums adjusted to be at the expiring rate level, but based on the renewal location schedule, share, and layer structure. We called these the Notional Expiring Premiums. We have seen these are equivalent to Renewal Premiums Net of Rate Change. We have also shown our approach is equivalent to taking the Weighted Harmonic Average of Rate Changes while using the Renewal Premiums as weights.

We hope some practical benefit will come from our efforts to resolve actuarial questions about how to calculate Renewal Rate change statistics on Cat-Exposed Excess Property business. Accounts in this business have been subject to large rate swings, the magnitude of which may have been obscured by changes in location schedules and coverage layers and by actuarially incorrect ways of aggregating individual account rate changes. It is our intent to foster development of a uniform and actuarially valid approach to computing the Renewal Rate change on this business so as to increase the accuracy and public credibility of reported rate change statistics. While the use of different Cat Simulation models may lead to different Renewal Rate Change estimates, a reasonable range of estimated effects due to changes in Coverage Structure and Location Mix is better than ignoring the effects of such changes altogether. We would encourage others to write on these and other actuarial issues inherent in rate monitoring statistics so that a more extensive literature on price monitors develops over time.

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Disclaimers

The opinions expressed are solely those of the author and are not presented as a statement of the position of Endurance American Insurance Company or any parent or affiliated company. The reader is warned that the author assumes no liability for any damages that may result directly or indirectly from use of the methods presented in this paper.

Appendix A – Notation and Formulas

In Table A.1, we define our basic notation:

Table A.1

Basic Notation

P	Premium at Company Share
P100	Premium at 100%
K	Company Limit
K100	100% Layer Limit
T	Total Insured Value
S	Company Share
N	Nominal Rate

For the i[th] policy, Equations (A.1),)A.2), (A.3), and (A.4) hold:

$$s(i) = K(i)/K100(i) \tag{A.1}$$

$$P(i) = s(i) \cdot P100(i) \tag{A.2}$$

$$N(i) = P100(i)/T(i) \tag{A.3}$$

$$P(i) = N(i) \cdot s(i) \cdot T(i) \tag{A.4}$$

Use subscripts EXP and REN to denote whether a variable is for the expiration or renewal policy respectively. Define the Nominal Renewal Rate Change for the i[th] policy as:

$$\Delta N(i) = \frac{N_{REN}(i) - N_{EXP(i)}}{N_{EXP}(i)} \tag{A.5}$$

We will suppress the policy "(i)" notation to simplify the formulas and derivations that follow unless it is needed for clarity.

To make mix and coverage change adjustments, we define the following 100% Technical Premium Rates:

Table A.2

Technical Premium Rate	**100% Layer**	**Exposures**
$Q_{REN,REN}$	Renewal	Renewal
$Q_{REN,EXP}$	Renewal	Expiring
$Q_{EXP,EXP}$	Expiring	Expiring

The Location Mix and Coverage Structure adjustment factors are defined as follows:

$$MXAF = \frac{Q_{REN,EXP}}{Q_{EXP,EXP}} \quad \text{(A.6)}$$

$$CSAF = \frac{Q_{REN,REN}}{Q_{REN,EXP}} \quad \text{(A.7)}$$

The Renewal Rate Change, ΔR, is given as:

$$\Delta R = \frac{(1+\Delta N)}{MXAF \bullet CSAF} - 1 \quad \text{(A.8)}$$

In words, to get the Renewal Rate Change we start with the Nominal Rate Change and net out the Mix Change and Coverage Structure Change adjustments. Next we define the Notional Expiring Premium by taking the Expiring Premium and adjusting for changes in Exposure Magnitude, Share, Location Mix, and Coverage Structure.

$$P_{NXP} = P_{EXP} \cdot \frac{TIV_{REN}}{TIV_{EXP}} \cdot \frac{s_{REN}}{s_{EXP}} \cdot MXAF \cdot CSAF \quad \text{(A.9)}$$

It follows from these definitions that:

$$P_{NXP} = \frac{P_{REN}}{(1+\Delta R)} \quad \text{(A.10)}$$

Weighting with the Notional Expiring Premium, we define the overall portfolio Renewal Rate Change as:

$$\Delta R(TOT) = \frac{\sum P_{NXP}(i) \cdot \Delta R(i)}{\sum P_{NXP}(i)} \quad \text{(A.11)}$$

The overall portfolio Renewal Rate Change can be equivalently express as the Weighted Harmonic Average of the Renewal Rate Change Factors using Renewal Premium weights:

$$\Delta R(TOT) = \frac{\sum P_{REN}(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} - 1 \tag{A.12}$$

To see this consider that

$$\frac{\sum P_{NXP}(i)\cdot \Delta R(i)}{\sum P_{NXP}(i)} = \frac{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}\cdot \Delta R(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} \tag{A.13}$$

$$= \frac{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}\cdot ((1+\Delta R(i))-1)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} = \frac{\sum P_{REN}(i)}{\sum \frac{P_{REN}(i)}{1+\Delta R(i)}} - 1$$

APPENDIX B - DATA AND MODELING ISSUES

The reliability of the Renewal Rate Change statistic depends heavily on having accurate data. The database fields for the calculations we have outlined include premium, coverage layer (attachment, company limit, and layer limit) parameters, and location schedule information for "matched" renewal and expiring policies. Most experienced actuaries will have their own ways of checking the data for reasonability and flagging questionable data items. Our purpose here is to point out a few data issues beyond the usual ones. We also want to mention a few of issues that might arise is using Cat Loss simulation models in the rate monitoring process.

B.1 Matching

The matching is often more difficult than it might first appear. Sometime an account will have a check mark in a renewal status field, yet its expiring policy may be missing. The account name and number may have changed, and there may be no easy automated way to pair up wayward accounts. Coverages must also be matched, as a renewal and expiring account may sometimes have different coverages. For example, Business Interruption (BI) may be covered on the expiring policy but not the renewal. In that case, the premium allocated for BI on the expiring policy should be removed.

B.2 Annualized Premium

Another issue is that the expiring and renewal policy may have different durations. One way to handle this is to compute rates with annualized premiums and exposures. Though it is an unnecessary duplication for many accounts, it is worth having a separate annualized premium field. This field can also be used to adjust for midterm endorsements. While annualized premiums are recommended for use in computing rates and rate changes, the actual and not the annualized premiums should be used when weighting rate changes to obtain the portfolio average rate change.

B.3 Aging of Statistics

The actuary may also find it instructive to look at how the monitor statistics "age" over time. In a rush to get the latest pricing statistics, management may insist on getting monitor statistics produced as quickly as possible after a period closes. Yet this may miss many pricing changes, new business bookings, and nonrenewals that come in later. There may also be a spate of endorsements, extensions, cancellations, or back-outs of endorsements. Producing refreshed versions of monitor statistics may reveal a characteristic pattern where, for example, a 10% increase on first look declines to 2% over the next two months as booking is "trued up" in the system. Studying a series of refreshed monitors may also turn up specific offices, lines of business, or underwriters with stellar initial statistics that evaporate over time.

B.4 Quality of Location Schedule Data

The data on location schedules is usually checked by cat modelers during the cat modeling process. However, as with any data from whatever source, the actuary would be well advised to check it. The cat modeler will typically do statistical data checks to tell, for example, that 90% of the locations are geo-coded to the zip code level or better. With large location schedules, having another set of human eyes review the data can often turn up potential anomalies the machine may miss. For example, duplicate entry errors may be masked by street addresses with names or numbers that differ slightly. The actuary should also check the TIV data. Locations with small TIVs should not be ignored. The TIVs for some of those locations may have been incorrectly entered in units of thousands. A comparison should also be done of the new schedule against the prior one. If both schedules have identical location addresses and values, the actuary should request an update. If some locations in the new schedule are missing street addresses, the actuary may find them in the prior schedule. Data fields on Construction, Occupancy, and other characteristics are also shown on the location schedule. Having accurate entries will usually have a material impact on the quality of answers coming out of any cat loss simulation model. It is thus worthwhile to ask the underwriter to contact the broker for more definitive information if for example half the construction types are listed as "unknown." Overall, the key to achieving better data quality is to work cooperatively with underwriters and cat modelers.

B.5 Implementation Issues

Before attempting to implement the procedures suggested in this paper, the actuary would be well advised to run sensitivity tests and sample computations for a large set of renewal accounts. When evaluated on actual accounts, a Technical Premium formula that is superior to another in theory may turn out to be inferior in practice. A robust formula that always yields sensible results that move in the right direction may be preferable to one that for unknown reasons produces bizarre results on a small percentage of accounts even while performing in stellar fashion on the others.

Part of the problem is that current cat loss simulation models are not quite up to the task we have set for them. They were designed for portfolio analysis and they do a reasonably credible job costing reinsurance treaties. However, anomalous results can sometimes crop up for individual insureds, especially for those with a small number of locations. With currently available models, portfolio impact statistics[22] on individual accounts also tend to misbehave more than comparable stand-alone statistics. Advances in cat loss simulation modeling should mitigate problems of this sort over time.

[22] The portfolio impact version of a statistic is the difference between its value on the portfolio after adding the additional insured and its value on the initial portfolio.

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Abbreviations and Notations

Cat, Catastrophe
ROL, Rate on Line
PML, Probable Maximum Loss
TIV, Total Insured Value
AAL, Average Annual Loss
NXP, Notional Expiring Premium

Biography of the Author

Ira Robbin is currently Senior Vice-President and Chief Pricing Actuary for the US and London at Endurance Worldwide Insurance. Ira received a Bachelor's Degree in Math from Michigan State University and a PhD in Math from Rutgers University. Then he took an actuarial research position with the Insurance Company of North America (INA) and has been working at insurance and reinsurance companies ever since. He has headed large risk property and casualty pricing units, developed pricing algorithms, and produced a number of price monitors. He has authored several Proceedings, Forum, and Study Note papers on a range of subjects, taught exam preparation classes, and made numerous presentations at actuarial meetings.