BEST ESTIMATE LOSS RESERVING: AN ACTUARIAL PERSPECTIVE

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ABSTRACT

Actuarial analysis is, by its nature, a science in which uncertainty is always a factor. Without uncertainty there is no need for an actuary. Actuarial analysis is, nonetheless, based on rigorous, scientific methods and techniques. A primary goal, as with all science, is to provide the best possible understanding of the truth, in spite of those uncertainties.

Actuarial science is an applied science. Thus, the profession must be concerned with communicating both within the profession and to an outside audience with varied and sometimes conflicting interests. The goal of this paper is to provide some clear yet scientifically based terminology that will help to facilitate this communication.

The paper focuses on one area of actuarial science - the estimation of loss reserves. It examines the need for clear and consistent terminology in this area and proposes two terms. First, the actuarial term “best estimate expected value of unpaid losses” is defined to be the “undiscounted, unmargined, unbiased best estimate of the probability weighted average of all possible unpaid loss amounts”. The second term, “the best estimate loss reserve”, defines the provision for these unpaid losses to be “the present value of the best estimate expected value of unpaid losses”.

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INTRODUCTION

In recent years there has been increased reliance on actuaries to "sign off" on the loss reserves held by insurance companies. Currently the guidelines set forth by the National Association of Insurance Commissioners require that a signed statement of actuarial opinion be included with the Annual Statement submitted to the Insurance Commissioner. Other regulators also make use of actuaries to help determine whether reserves are in accordance with legislation and regulations. Accounting firms use both in-house and consulting actuaries to determine whether reserves held by their insurance company clients make fair provision for claim-related liabilities. This increased reliance is based on the understanding that actuarial analysis provides an independent, scientific evaluation of contingent liabilities.

In this paper we focus on the language used to communicate the results of actuarial analyses. We discuss, in general, the need for clear and consistent terminology. We also introduce two terms that we believe will help fill that need:

- best estimate expected value of unpaid losses
- best estimate loss reserve

THE NEED FOR CONSISTENT TERMINOLOGY

Actuarial science or art?

Actuarial analysis is, by its nature, a science in which uncertainty is always a factor. Without uncertainty there is no need for an actuary. Reserve analysis, for example, involves determination of the uncertain present value of an unknown amount of future loss payments. For a property/casualty insurance company this uncertain amount is

usually the most important number on its financial statement. The care and expertise with which that number is developed are crucial to the company and to its policyholders. It is important not to let the inherent uncertainties serve as an excuse for providing anything less than a rigorous scientific analysis.

Much scientific research deals with questions that have unknown but specific answers. The answer to the question of what happens when two chemicals are combined under specific conditions may be unknown, but once tested it can be established with considerable certainty and the results reliably replicated. Actuarial science deals with future events which are contingent, uncertain, and which generally cannot be replicated with reliability. This uncertainty has lead some to describe actuarial analysis as part science and part art, but this description is inaccurate and does a disservice to the profession.

Art and science do have some things in common. Both require observation, study, and the application of certain skills, but they generally have very different goals. Art seeks to create an image. Often form is more important than substance. Art may be created to express the individuality of the artist or to appeal to the taste of its intended audience. These are legitimate goals of art but they have no place in setting loss reserves.

Both art and science may require judgment. However, science requires judgment that is supported by facts rather than goals. Most scientific analysis reaches a point at which judgment must be imposed to organize data or interpret findings, but a primary goal of science is to model reality accurately. This may require the application of special skills, general knowledge, and supported judgment in addition to scientific techniques, but the result is essentially science and not art.

The field of actuarial science borrows from many other disciplines: mathematics, law and economics, to name a few. The particular focus of actuarial science is the determination of the financial implications of future contingent events. These

determinations are based on methods which reflect decades of research and testing of mathematical and statistical techniques. Yet there are times when the language of actuarial science does not serve the field well. Unclear terminology often leads to the perception that the process described by that terminology is itself poorly thought out, which is not the case.

In this paper we focus on a very specific application of actuarial science - the determination of loss reserves. For simplicity we will base our discussion on three reserve-related terms: The term "ultimate losses" will be used to mean all loss and loss adjustment expense amounts relating to a group of incurred claims. The term "unpaid losses" will mean ultimate losses minus losses paid to date. The term "loss reserve" will be used to mean provision for unpaid losses. While we have confined our discussion to property/ casualty loss reserves, we believe that the issues discussed have application throughout actuarial science.

Serving many masters

Among those who rely on reserve estimates, interests and priorities may vary. To company management the reserve estimate should provide reliable information in order to maximize the company's viability and profitability. To the insurance regulator, concerned with company solvency, reserves should be set conservatively (Appendix B, [17] and [30]) to reduce the chance of insurance company failure. To the tax agent charged with ensuring timely reporting of earned income, the reserves should reflect actual payments as "nearly as it is possible to ascertain them" (Appendix B, and [14]). The policyholder is most concerned that reserves be adequate to pay insured claims, but does not want to be overcharged for that assurance.

Just as the interests and priorities of those relying on reserve estimates may vary, so too do the financial reporting requirements[1]. The actuarial profession finds itself

[1] Appendix B outlines some of the current requirements of various insurance reporting agencies.

trying to satisfy all of these consumers and regulators, often with a single number which we refer to as the "loss reserve".

Unfortunately, the lack of clarity in the omnibus term "loss reserve" can lead to misunderstandings and results which appear to be inconsistent when, in fact, they are not. What is inconsistent is the meaning of the terms themselves. Somewhere in the reserving process, preferably before consideration of the financial reporting context, there must be a point where the actuary can say "This is the result of my analysis. This is the answer to the best of my ability to uncover the truth."

As with most analytical professions, conveying this truth with clarity is essential. If you consult a doctor about an illness, you expect this highly trained professional to be able to explain to you in clear albeit technical language the nature of your medical condition. Generally you do not expect the doctor to ask you what you mean by the term "contusion" or "inoperable condition". You also do not expect those terms to have different meanings from one doctor to another. It is incumbent upon the actuarial profession to provide the language that allows actuarial reserve estimates to be understood.

A clear and consistent concept

One concept that appears frequently both in actuarial literature and in regulations pertaining to loss reserves is the concept of a "best estimate"[2]. This term might provide a good foundation for clear communication, but the profession has not put forth any consistent definition. In fact, there has been no clear terminology set forth by the profession which attempts to define any specific point, such as a "best estimate", within a range of "reasonable" estimates. A "reasonable" estimate is defined simply (and rather

[2] Examples of the use of the term "best estimate" include: Wiser [34, p.221]; Salzmann [25, p.155]; Philbrick [20, pp. 7,22,23,52]; Butsic [4, pp. 150,155,161]; Daykin et al. [5, pp. 300,400]; Hayne [8, pp. 25,36]; Hossack et al. [13, pp 298,209]; Peterson [19, pp. 461,463]; and Rathjen [23, p. 495]. Appearances of the term "best estimate" are also highlighted in the outline of regulations and guidelines contained in Appendix B.

broadly) as an estimate based on reasonable methods and assumptions (Appendix B, and [21]). Yet, the frequent occurrence in the literature of terms like “best estimate”, and the efforts by the consumers of actuarial science to provide their own definitions, suggest that something is lacking.

Why has the profession not moved beyond broad terminology such as “reasonable estimates”? One might argue that any refinement of reserve terminology only places unnecessary restrictions on the freedom of the actuary to exercise professional judgment. In fact, the opposite may be true. The freedom of the actuary to use professional judgment depends very heavily on providing reliable and valuable information to those concerned with reserves. Information can only be valuable when it is clearly communicated. When this is not the case, those who must rely on reserves may seek to create their own consistency by imposing restrictions on the reserving process that may truly limit the actuary’s ability to do the best job.

When results are not clearly communicated, misunderstandings and significant problems can result. Consider, for example, the actuary who signs a reserve opinion for a medical malpractice insurer stating that the reserves “make reasonable provision” (Appendix B, and [18]) for the company’s claim liabilities. According to the actuary’s calculations, the company has booked an amount that is more than adequate and includes a very considerable margin. The reserve seems to meet statutory requirements, which are based on the goal of ensuring the survival of the company. The actuary reports to management that the reserve is reasonable and the opinion is signed.

Later the actuary is called upon to attend a meeting of the company’s board of directors at which a proposed reduction in next year’s premium rates is under consideration. One of the board members points out that the actuary’s reserve report indicates adverse loss experience which, if anything, might require a premium rate increase. The board members are concerned that they may lose some of their better members if premium rates are increased unnecessarily, but they do not want rates to be

inadequate. As the discussions become more heated, it becomes clear that there is considerable misunderstanding about the actuary's reserve opinion.

In this example, the actuarial report includes reserves calculations based on several methods and sets of assumptions. However, there is nothing in the report which indicates whether all methods and assumptions are equally valid, nor the actuary's "best estimate" of the unpaid losses. If the actuary's report had included a "best estimate" of unpaid losses then there would have been less room for misunderstanding the conclusions of the actuary. (There may, of course, still be considerable discussion among the board members and management as to the appropriate reserve to book.)

The ultimate responsibility for booking liabilities on the Annual Statement and other documents belongs with company management (Appendix B, and [28]). It is the auditor's responsibility to evaluate the reasonableness, from an audit perspective, of the loss reserves established by management (Appendix B, and [28]). It should be the responsibility of the actuary to perform rigorous, independent analyses and to communicate the findings in clear, unambiguous language with enough detail so that those relying on the results can understand them. The remainder of this paper is devoted to identifying and defining some basic terms which we believe would help serve this purpose.

THE "BEST ESTIMATE EXPECTED VALUE OF UNPAID LOSSES"

There are many factors which management considers when it is evaluating the liability for claims incurred but not yet paid. Some important questions are set forth below:

- What is the unpaid amount (in nominal dollars), including losses and loss adjustment expenses, related to incurred claims ?

- How much investment income can be earned on the funds set aside to cover the unpaid losses before they are needed to pay the claims?
- How much uncertainty is there in the answers to these questions?

All of the questions posed above are appropriate matters for actuarial analysis. But they are separate questions, not one question, and they deserve separate answers. When we lump all the questions together and provide a single answer (generically referred to as the "loss reserve") then we have failed to fully communicate the results of our work. Providing separate answers to each of these questions will help those who rely on reserve estimates to understand the numbers and to make informed decisions. It may also alleviate the need for consumers to provide their own terminology and definitions in order to elicit the information they need.

The first of the questions posed above is the estimation of unpaid losses related to incurred claims. In terms of a medical analogy, this might be considered the diagnosis. Just as with a medical diagnosis, this is the point at which the answer should be based largely on objective interpretation of the data. If you consulted several doctors because of an illness, you might expect differences of opinion regarding treatment or best and worse case scenarios but you would hope to find agreement on your diagnosis. Similarly, one would expect several competent actuaries, applying appropriate analysis techniques to the same set of data, to arrive at fairly consistent results. That is to say that, while we would expect some variation in the exact amounts of their "best estimates" of unpaid losses, we usually would not expect wide variation as long as the concept is consistently defined.

The "best estimate" of unpaid losses

A consistent definition of the "best estimate expected value of unpaid losses" should:

- identify a target for a point estimate
- define that target unambiguously

- be soundly based in actuarial science
- preclude optimistic or pessimistic skewing
- be explainable to a wide audience.

The phrase “best estimate” accomplishes some of the above objectives. The word “best” implies a particular point (i.e. better than all others) within the range of reasonable estimates. While different actuaries may produce different “best estimate” numbers, the range of best estimates among these actuaries should be considerably narrower than the range of all “reasonable” estimates. What might be considered a “reasonable” estimate of unpaid losses may not be acceptable as a “best estimate” of those losses (e.g. “reasonable but optimistic” does not qualify as a “best estimate”). For a particular actuary, there should be only one “best estimate” as of a given reserve date.

The concept of “best estimate” by itself, however, is ambiguous and does not have any particular tie to the scientific foundation of the reserving process. “Best” is a loaded word which leads to the question: “best by what standard?” If two potential users have different ideas of the purpose of a reserve, then their understandings of “best” might also differ. Thus, while the concept of “best estimate” may elicit an intuitive understanding, this understanding will not necessarily be the same from one person to the next. Something more is needed.

The definition of “best estimate” must demand a high degree of objectivity. A definition that allows for excessive subjectivity cannot produce clear and consistent results. To find a consistent standard by which “best” can be measured we must look, not to the potential uses of the reserve, but to the scientific foundation of the reserving process. In particular, statistics provides us with concepts and terminology which are well-suited for this purpose.

The mathematical foundations of the reserving process

Over the years actuarial methods and techniques have evolved considerably. New methods have been introduced, old ones have been refined. For the actuarial profession, classical statistics did not provide all the tools that were needed. Bayesian analysis, credibility theory, risk analysis, modeling, all became part of the arsenal available to actuaries in their search for the “best estimate” of unpaid losses.

Beneath all the methods and techniques, the primary goal of the reserving process can be stated quite simply. As of a given date, an insurer is liable for all claims incurred through that date. Costs associated with these claims fall into two categories: those which have been paid and those which have not. The primary goal of the reserving process is to estimate those which have not yet been paid (i.e. unpaid losses).

As of a given reserve date, the distribution of possible aggregate unpaid loss amounts may be represented as a probability density function. Much has been written about the statistical distributions that have proven to be most useful in the study of risk and insurance. Although research is ongoing regarding the applicability of particular distributions, we would like to discuss specific statistical points (used to describe distributions in general) and of what use each might be in determining the “best estimate” of unpaid losses.

First we have the **endpoints** of the distribution. The information provided by these points seems apparent, as they describe the least amount and the greatest amount that the insurer stands to lose as a result of a certain group of claims. Practically, however, these points are not very useful for the purpose of determining a best estimate of the unpaid losses. The low point is easy to identify (it is generally zero). The upper limit is more difficult to determine, especially if one includes unlimited amounts of loss adjustment expense. The probability of either of these extremes is usually quite low. The **midpoint**, which is the point halfway between these two extremes, provides no additional information about the distribution.

The **mode** of the distribution is of interest since this is the point which has the highest probability, (i.e. it is the most likely outcome.) This appears to be a fine candidate for a "best estimate". Why look any further? There are several reasons. First, if a distribution is multimodal, the mode is not a unique point. Second, even when there is a single mode, the probability at this point may be only marginally higher than many other points so that the concept of "most likely" is really only "a little more likely". Third, the most likely outcome may not provide a useful starting point for the purpose of setting insurance reserves. Consider, for example, the common situation in which the most likely outcome is actually zero.

The **median** is another interesting statistic. This identifies a point which is equally likely to be too high or too low as an estimate of the actual unpaid loss amount. This point has a lot of intuitive appeal as a target point for a "best estimate" of unpaid losses. Mathematically, however, it is not convenient to work with. For example, most reserve estimates involve summing the results for several subsets of the company's full book of business (e.g. results by line, by accident year, etc.), each with its own distribution. Unless these subsets are symmetrically distributed, (which they seldom are) the sum of their medians will not produce the median of the aggregate loss distribution. (Appendix A)

The **mean**, or the **expected value**, is a useful statistic. This point is defined as the probability-weighted average of all possible outcomes for aggregate unpaid losses. It differs from the median in that it considers not only the distribution of probability but also the dollar amounts associated with each probability. Thus, if an aggregate unpaid loss distribution includes the potential for very high losses, even if at low probabilities, the expected value will take account of that potential and will generally produce a higher number than the median[3]. The expected value is also mathematically convenient. The expected value of an aggregate loss distribution will equal the sum of the expected values

[3] This usually holds true for insurance applications, where distributions are often positively skewed.

of its subsets whether or not those are symmetrically distributed[4]. In addition, other important concepts, such as variance, can be defined in terms of the expected value.

Appendix A provides a more detailed discussion of the features of mean, median and mode and the suitability of each of these statistics to provide a target for the determination of a "best estimate" of unpaid losses. Of course it is not necessary for the "best estimate" to be defined in terms of any of these statistical measures, but without such a foundation we believe it is extremely difficult to identify a clear, consistent definition. Our evaluation leads us to conclude that the "expected value" provides a good target for the determination of a "best estimate".

Therefore, we propose the expanded term "best estimate expected value" as a starting point for the determination of an unpaid loss estimate. The "expected value" portion of the term identifies the target of the estimation process: i.e. the probability weighted average of possible outcomes (of unpaid loss amounts). It clarifies the meaning of "best" in that it identifies the purpose - best for the purpose of estimating the mean value of the unpaid loss distribution. All other considerations are then separate from and downstream from the determination of the "best estimate expected value of unpaid losses".

The concept of a "best estimate expected value of unpaid losses" does not imply that every actuary will arrive at the same number to satisfy this definition. As in any statistical analysis, there may be several possible estimators of the expected value. Further, each estimation process, applied by different analysts, may produce somewhat different results. The outcomes of these estimators will vary, but as with any estimator, they should converge to the desired number.

BEYOND CLASSICAL STATISTICS

[4] This additivity holds true as long as the subsets are independent of one another.

Does a clear and clinical definition such as the "best estimate expected value unpaid losses", firmly rooted in statistical concepts, produce a narrow range of results that depends little upon the judgments of the individual actuary? Generally not. Differences in results may be reduced but they will not be eliminated. The processes by which actuaries estimate the expected value of unpaid losses require judgment in ways that differ from the classical application of statistical methods. There are three key ways in which the actuary brings experience and judgment to bear on the estimation process:

- *A priori* assumptions are often made to fill in where the actuary has prior relevant knowledge, and the actual experience for the subject block of business is either sparse or unavailable.

- The actuary may also have knowledge about circumstances which would cause the results of a particular block of claims to be different from the indications of historical patterns. If so, he or she may elect to "bend the curve" to account for this information.

- The actuary generally has data which allows for the application of several estimation methods. The question of how much weight to give to each method may require additional analysis as well as supported judgment.

Exactly how to incorporate each of the points mentioned above requires professional judgment. However, in each case, guidelines can be developed and followed to help meet the goal of determining a "best estimate expected value of unpaid losses". The following three sections discuss these points in more detail.

"A priori" assumptions

Bayesian analysis has long been a part of the analysis techniques used to set insurance company reserves. Simply stated, Bayesian analysis begins with an assumed (*a*

priori) distribution and tests that assumed distribution against observed data. The more voluminous and reliable the actual data becomes the more weight it is given.

A priori assumptions can be seen in many aspects of the standard methodologies now used in the reserving process. One commonly used method, the Bornhuetter-Ferguson method [3], is founded in this concept. Each accident year within the experience period is assigned an *a priori* expected loss ratio. As claims are reported and paid, actual experience is combined with the *a priori* loss ratios to calculate new estimates of ultimate losses as of each valuation date. By this process the estimated ultimate loss amount converges to the actual paid amount when the accident year has been fully closed.

While it may not be as apparent as in the method described above, traditional development methods also involve making use of prior expectations. For example, in the paid loss development analysis, each accident year's paid loss amount is assumed to develop over the coming years according to a pattern which reflects past experience for this block of business. When the actuary selects the pattern for a particular line of business, certain factors may be based on expectation that is supported by prior knowledge (e.g. industry experience, extrapolation from development factors at earlier ages). The following year the actuary will have additional data with which to test the assumed pattern. That data will be given some weight and the assumption will be adjusted accordingly.

How *a priori* expectations are developed and how much weight they are given are decisions the actuary must make. However, the following guidelines should be applied to the use of *a priori* assumptions to assist in accomplishing the goal of determining a "best estimate expected value of unpaid losses". *A priori* assumptions should be:

- based on data and experience for types of business that are as similar as possible to that being analyzed
- unbiased (neither optimistic nor pessimistic)

- appropriately modified or given very little weight when those expectations are contradicted by the emerging data.

Assumptions, or prior expectations, are important whenever the data needed to perform an analysis is either not available or is not adequate. The first guideline above applies to any industry or other external data which is being used to support assumptions. The second guideline is important to maintain the goal of targeting the expected value. The third, and perhaps most difficult, guideline addresses the question of when *a priori* assumptions should be abandoned. When the data being analyzed has substantial credibility of its own, this information should replace prior expectations. Sometimes, even before the data is well developed, preliminary indications may make it clear that initial expectations are no longer reasonable. If so, these expectations should be revisited and revised.

Bending the curve

Just as the actuary often has prior expectations about a block of business, it is also possible that the actuary will be aware of changes in circumstances that would affect incurred claims causing them to settle differently than historical patterns might indicate. Examples of changes that could have this kind of impact include changes in claim handling procedures, strengthening of reserves, and changes in retention levels. When changes can be identified and reasonably supported, correcting for their impact (bending the curve) becomes an important part of determining the best estimate of unpaid losses. Again, while the actuary must decide how these adjustments will be made, certain guidelines should be used if one is looking for a “best estimate expected value of unpaid losses”:

- Seek clear support for “bending the curve”.
- Be alert to offsetting factors.

- When possible, make corrections to the data before analysis, rather than making ad hoc, downstream adjustments.
- If possible, avoid relying heavily on affected methods until the impact of changes can be verified and measured.
- Make needed adjustments in a manner which is neither optimistic nor pessimistic.

Abandoning historical indications in favor of bending the curve should be done only after careful consideration of the first two guidelines listed above. It is far too easy to see those things (and only those things) we wish to be true. When changes have clearly occurred, on the other hand, it would be inconsistent with determining the expected value to ignore the impact of those changes if the impact can be reasonably quantified. One should avoid making significant ad hoc adjustments based only on qualitative information. In situations where quantification cannot be done, it is generally preferable to avoid using the affected methods.

Weighting multiple estimators

Ordinarily more than one method will be used in the process of estimating unpaid losses. Each method relies on certain data and makes certain assumptions. To the extent that the assumptions made in one method may be weak, the application of other methods will help to indicate, and correct for, the problem. There are other benefits to using more than one estimator of unpaid losses. For example, the amount of disparity in the results of several methods will help to identify the degree of uncertainty surrounding a particular estimate.

Since all methods may not be equally reliable or credible, it is the responsibility of the actuary to determine how much weight should be given to each method. The following guidelines should be considered in making use of multiple methods to determine a “best estimate expected value of unpaid losses”:

- Apply as many methods as time and data permit that will add value to the estimate, giving each appropriate consideration.
- The weight given to each method should reflect the relative credibility and reliability of the methods for the purpose of determining the expected value of unpaid losses.
- Methods which are equally credible and reliable should be given equal weight.

Thanks to the increased capacity and speed of computers, it is now possible to collect more data and perform many more calculations than ever before. This gives the actuary the freedom to apply many methods and variations on methods in a relatively short period of time. The first guideline above suggests that a method should be applied only if it adds value to the estimation process. Alternatively, if several estimations have been made using methods that are essentially the same, this should be taken into account when weighting the methods[5].

Deciding how much weight to give to each method may entail analysis beyond application of the methods themselves. The credibility of a method depends on the volume and maturity of the data it utilizes. Reliability depends on the extent to which the assumptions which underlie the method are met (e.g. consistent reserving practices) and on how well the method performs in a particular situation. Testing can be done which may help establish whether underlying assumptions are met and also whether a particular method has performed well in past evaluations.

WHAT "BEST ESTIMATE EXPECTED VALUE OF UNPAID LOSSES" IS NOT

As one can see from the discussion in the previous section, a good deal of judgment is needed to develop a "best estimate expected value of unpaid losses", no matter how clearly and consistently defined. However, the phrase "actuarial judgment" is

[5] It should be noted that the methods commonly used by actuaries to estimate unpaid losses do not necessarily individually produce an unbiased estimate of the expected value. Often this can be the result of simplifying assumptions, such as assuming independence where some dependence may be possible.

one that is overused and often abused in a profession founded in scientific analysis. It is important to remember that judgment that is not based on facts (or is contradicted by the facts) does not constitute reasonable actuarial judgment. Professional judgment is an important part of selecting and applying the techniques and methods available to actuaries, but it should not replace them.

While recognizing the role of supported judgment, we have attempted to identify the meaning of the "best estimate expected value of unpaid losses" (and hence ultimate losses) as a starting point for the development of understandable loss reserves. Often in defining a term with somewhat elusive qualities, it can be as useful to define what it is not as well as defining what it is. The "best estimate expected value of unpaid losses":

- is not discounted for investment income
- does not include a margin for contingencies
- is not skewed by use of pessimistic or optimistic assumptions
- is not skewed by giving undue weight to unreliable methods or *a priori* assumptions which are not supported by the data
- and, unless your losses are symmetrically distributed, it is probably not the most likely outcome (the mode) nor equally likely to be too high as too low (the median).

It is the <u>undiscounted, unmargined, unbiased, best estimate of the probability weighted average of all possible unpaid loss amounts.</u>

THE REST OF THE JOB

The process described above brings us to a clear and consistent definition of one piece of the reserve estimating process, i.e. the "best estimate expected value of unpaid

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Examining ways in which individual methods may be adjusted to better target the "expected value" is beyond the scope of this paper.

losses". It is a very important piece. It is the foundation for everything that follows. If anything needs to be clearly communicated it is this starting point.

However, determining the expected value of unpaid losses is seldom the end of the actuary's job. As indicated earlier in this paper, there are other questions relating to a company's loss liabilities which are important and which the actuary must often address. For example, what about the reserve?

The "best estimate loss reserve"

Having reached a conclusion as to the meaning of the "best estimate expected value of unpaid losses" we now face the issue of the best estimate provision for unpaid losses (i.e. "best estimate loss reserve").

As with the "best estimate" of unpaid losses, the "best estimate" reserve raises the question "best by what standard"? The question takes on a new dimension as one moves from diagnosis to treatment because now the particular circumstances of the patient have bearing on the answer. Still, if the actuary is to provide a definition of this term that can be clearly and consistently understood, it must be independent of the perspectives of individual consumers. The most useful actuarial definition is therefore based on the "best estimate expected value of unpaid losses". The "best estimate loss reserve" may be simply defined as "the present value of the best estimate expected value of unpaid losses".

In order for the reserve estimate truly to represent the actuary's "best estimate" of the needed reserve, both the determination of the expected value of unpaid losses and the appropriate discount should reflect the actuary's best estimates (i.e. should not be dictated by others or by regulatory requirements). The issues surrounding the selection of the appropriate discount, if any, for reserve purposes are the subject of much discussion and are beyond the scope of this paper. However, since the reserve is a provision for the

future payment of unpaid losses, we believe the actuarial "best estimate loss reserve" should reflect the time value of money.

The term "best estimate loss reserve" is useful in many situations, including:

- insurance company appraisals
- negotiating commutations and loss portfolio transfers
- assessing profitability and pricing
- identifying risk based capital needs
- dynamic financial analysis

Ideally the "best estimate loss reserve" would also be acceptable for regulatory reporting. However, many current regulations do not permit it:

- Statutory accounting rules generally require that loss reserves be carried at their undiscounted value in the Annual Statement.
- Federal tax code requires discounting but the discount rate and the payment pattern must follow specific guidelines which may not be consistent with the actuary's "best estimate loss reserve".
- For GAAP financial statements the "best estimate loss reserve" would be acceptable. However, currently most companies use the same loss reserve for GAAP and statutory reporting purposes.

The question of whether or not discounting should be permitted and, if so, to what extent, continues to be a subject of debate. In the meantime, the "best estimate expected value of unpaid losses" as we have defined it in this paper provides a reasonable and consistent starting point (i.e. prior to discounting) for meeting all of the regulatory requirements.

Uncertainty and the role of ranges

The third area of concern for someone relying on a reserve estimate is the degree of confidence that the actual amount of unpaid losses will turn out to be close to the "best estimate expected value of unpaid losses". A related concern might be how much higher (or lower) the unpaid losses might turn out to be if the assumptions prove to be incorrect. These are significant questions, for management, regulators, and other users of actuarial reserve estimates.

There are several techniques that actuaries use to provide information relating to uncertainty, including:

- setting ranges based on the application of multiple methods
- scenario testing based on applying alternative sets of assumptions
- modeling based on assumed distributions and parameters.

There are many legitimate uses for this kind of analysis. For management, it provides information useful in making informed decisions about issues such as surplus requirements. Also, in rare situations the actuary may feel unable to render a "best estimate expected value of unpaid losses". If so, then several alternative scenarios may be the best information that the actuary can provide. However, calculations done to provide uncertainty information should not be used to avoid or obscure the "best estimate expected value of unpaid losses". For example:

- Ranges may represent a set of "reasonable" results, but should not be presented as a range of "best estimates".

- Scenario testing provides valuable information regarding the sensitivity of the reserve calculation to changes in assumptions, but again, the results should not be put forth as representing alternative "best estimate expected values".

Property/casualty insurance includes many types of coverage, some of which are inherently more volatile than others. Uncertainty in reserve estimates can also vary considerably depending on the maturity and the stability of a company's data. It is not uncommon for companies to add a contingency margin to the reserves when there is a high level of uncertainty. However, assessing this margin depends not only on the uncertainty in the reserve estimate, but also on the risk profile of the company. There is a significant amount of subjectivity involved in making this determination, and there is a good deal of disagreement as to how and where such margins should be booked.

If actuaries are to maintain clear and consistent communication, then it is important to separately identify any contingency margin and the "best estimate expected value of unpaid losses".

CONCLUSIONS

Currently, and perhaps for some time into the future, the requirements of those relying on reserve estimates may be expected to vary. It is possible that, as legislation and regulations evolve, varying reserve requirements will be brought into closer alignment with one another. Examples of areas where this might be possible are the treatment of discounting and contingency margins. Changes have already occurred in some areas (e.g. treatment of anticipated salvage and subrogation).

In the meantime (and even beyond) actuaries can best serve the needs of all concerned parties, including the profession itself, by separating the components of the reserve estimate and clearly defining what each represents. The concept of a "best estimate" can be a very important part of this process. We conclude that "best estimate" is most meaningful when used in conjunction with a point estimate that represents the "expected value" of unpaid losses.

We also conclude that a definition of the actuarial “best estimate loss reserve” should be based on the “best estimate expected value of unpaid losses” and should be discounted using assumptions that the actuary (with input as needed) believes to be most appropriate for determining the true present value of these unpaid amounts.

Other reserve related concepts do not lend themselves well to a “best estimate” definition. Contingency margins, for example, depend on several factors including the risk profile of an individual company. The actuary can make effective use of ranges in discussing the results of his or her analysis but, even with the ongoing refinement of statistical analysis of loss distributions, there is a good deal of subjectivity in the determination of ranges. Neither of these concepts belong in the actuarial definition of a “best estimate loss reserve”.

With this paper we hope to have provided a starting point for clear and consistent terminology with which the actuarial profession can describe the results of reserve analyses. Clear terminology should not be incompatible with serving a variety of needs. We believe that the definitions of that terminology are best provided by those making the estimates, but it must be understandable and useful to those who rely on them. It is for their benefit that these estimates are made.

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APPENDIX A

PROPERTIES OF THE MODE, MEDIAN, AND MEAN

The aggregate unpaid losses that may be sustained as a result of a particular group of insurance claims may be distributed in many ways. However, there are a few characteristics that are common to most lines of insurance. First, the range of outcomes is bounded below at zero and unbounded above (particularly when loss adjustment expenses are included). Second, the distribution is positively skewed. That is, the distribution is asymmetric with a longer "tail" to the right. Finally, the distribution approximates a continuous distribution.

Figure 1 depicts an unpaid loss distribution which has the general characteristics described above, and which if fairly typical for a liability line of coverage. Somewhere within that range is the actual unpaid loss amount, but exactly where will not be known with certainty until all claims have been closed. In the meantime, the job of the actuary is to provide his or her "best estimate" of what the amount will be.

Three separate statistical points are marked on Figure 1. These three points represent common statistical indicators which can be estimated and which tell us something about the underlying distribution. The points are:

- The mode - point A
- The median - point B
- The mean - point C

These points are meaningful in a statistical sense, but do any of them provide a reasonable target for the estimation of the "best estimate" of unpaid losses? In the following sections we discuss the properties of these statistics and examine the suitability

of each for estimating insurance loss amounts. Throughout this discussion the function f(x) will be used to represent the probability density function of unpaid loss amounts.

The Mode

The mode is represented by point A on Figure 1. It is the point of greatest probability, i.e. the most likely outcome. For a continuous distribution, the mode may be expressed mathematically as follows:

$$\text{Mode} = \text{ the value of x for which } \frac{df(x)}{dx} = 0, \text{ and } \frac{d^2 f(x)}{dx^2} < 0$$

This point is appealing as a best estimate in situations where the possible outcomes are discrete and there is no value attached to being close to, but missing, the actual outcome. Betting on a poker hand is a good example of this. For insurance reserving purposes, however, estimates that are close to the actual outcome have a great deal of value. In fact, it would be extremely unlikely that the actuary's estimate would be the same as the actual outcome of unpaid losses.

There are some characteristics of the mode which make it unsuitable as a target for the best estimate of unpaid losses. First, for distributions such as are typical of aggregate insurance losses, the "most likely" outcome is only slightly more likely than many other points (a dubious distinction). Second, if a distribution is multimodal (more than one maximum) the point is not unique. This raises the prospect of having more than one target, which is useless if one reserve estimate is needed. Finally, the point of greatest probability may actually be zero for some types of business - but zero would generally be a poor choice for a reserve.

In addition to the characteristics described above, the mode is difficult to work with mathematically in situations where the distributions resemble that in Figure 1. For,

unless distributions are symmetric (i.e. nonskewed), the sum of the modes of several distributions does not equal the mode of the combined distribution. (This is illustrated in the two examples given at the end of this appendix.) For purposes of insurance reserving, additivity of distributions is an important property. This is discussed further in the section on the "mean".

The Median

The median is represented by point B on Figure 1. It is the point on the distribution which equally divides the probabilities. For a continuous distribution the median may be described mathematically as:

$$\text{Median = the value of } x_i \text{ for which } \int_{-\infty}^{x_i} f(x)dx = \tfrac{1}{2}$$

The median is appealing as a best estimate in situations where the goal is to have an estimate which is equally likely to be too high as too low. The median has the useful feature that the occurrence of an unusually high or low reading in the sample will not unduly affect the results of the estimate. For this reason it is often used in describing distributions like the typical home value in an area.

However, the median also has some characteristics which make it less than ideal as a target for the best estimate of unpaid losses. While the median defines the point which equally divides the probabilities, it takes no account of the dollar amounts associated with the probabilities other than for the purpose of ranking the values. Also, for the discrete distribution, the point is not necessarily unique. Finally, medians, like modes, are not additive unless the distributions being combined are all symmetric. (See examples following this text).

The Mean

The mean is represented by point C in Figure 1. The mean (or expected value) is the probability weighted average of all possible outcomes. For a continuous distribution, this point can be described mathematically as:

$$\text{Mean} = \int_{-\infty}^{\infty} x f(x) dx \quad (= \text{E(x), the expected value of x})$$

The mean has a number of characteristics which make it the most useful target statistic for determining the best estimate of unpaid losses. First, the mean incorporates information regarding both the probability distribution and the dollars associated with each probability. Even the most unlikely outcome is reflected and given appropriate weight. Second, the mean provides a point which is unique and determinable for most distributions. (For certain discrete distributions it may produce a point of zero probability, but this does not present a problem in reserve analysis.) Finally, the mean provides a foundation for calculating other statistics such as variance about the mean. In insurance reserving this characteristic is particularly useful because it helps to identify and describe uncertainty.

Unlike modes and medians, the means of independent distributions are both additive and multiplicative. That is, the sum of n random variables from n independent distributions is distributed such that the mean (expected value) of the sum equals the sum of the means of the individual distributions. This property depends on the independence but not on the symmetry of the distributions. For the reserve analyst, this means that data can be analyzed by line or by accident year and the results added, to produce the expected value of unpaid losses for all lines and accident years combined. The ability to separate claim data into such homogeneous groupings forms the foundation of most reserving methods.

The following pages provide two examples which help to illustrate the properties of the mode, median and mean with respect to additivity. The first uses a simple discrete distribution and the second uses a gamma distribution. The gamma distribution was selected to illustrate the continuous case because it resembles a typical loss distribution (i.e. bounded below and positively skewed), and because of the simplifying feature that the sum of n independent gamma random variables with a common scale parameter is itself a gamma distribution.

Example #1 - Discrete Distribution

Consider three bags each containing 15 coins valued as follows:

- Bag A: 1, 1, 1, 1, 1, 5, 5, 5, 10, 10, 10, 25, 25, 25, 25
- Bag B: 5, 5, 5, 5, 5, 5, 10, 10, 25, 25, 25, 25, 25, 25, 25
- Bag C: 5, 5, 5, 5, 5, 5, 10, 10, 10, 10, 25, 25, 25, 25, 25

The three bags represent three independent discrete distributions with the following means, medians, and modes:

	Mode	**Median**	**Mean**
Bag A	1	5	10
Bag B	25	10	15
Bag C	5	10	13
Sum	31	25	38

In order to test the additivity of each of these statistics, we assume that one coin is drawn from each of the bags and pose the following questions:

1. Is the most likely outcome (mode) for the sum of these three coins equal to the sum of the modes for the three bags (31)?

2. Is the point at which there are an equal number of outcomes higher as lower (median) equal to the sum of the medians for the three bags (25)?

3. Is the probability weighted outcome (mean) for the sum of these three coins equal to the sum of the means for the three bags (38)?

Since there are 3 bags with 15 coins in each, the number of combinations possible using one coin from each bag is 15^3 or, 3375. The sums of these combinations produce 16 different values distributed as follows:

Value	11	15	16	20	21	25	30	31	35	36	40	45	51	55	60	75
Freq	180	108	180	216	40	132	24	360	360	190	474	146	175	393	257	140

Mode = 40

Median = 36

Mean = 38

A comparison of these results with the sums indicated in the table above indicates that the modes and medians are not additive, but the means are.

Example #2 - Continuous Distribution

Consider the continuous distribution represented by a Gamma distribution with the following properties:

- The Gamma function, $\Gamma(\alpha)$

$$\Gamma(\alpha) = \int_0^\infty x^{\alpha-1} e^{-x}\, dx \quad \text{where: } x > 0, \alpha > 0$$

- The probability density function, p.d.f.:

$$f(x) = \frac{\lambda^\alpha x^{\alpha-1} e^{-\lambda x}}{\Gamma(\alpha)}$$

- The distribution function, d.f.:

$$F(x) = \Gamma(\alpha; \lambda x) = \frac{\int_0^{\lambda x} y^{\alpha-1} e^{-y}\, dy}{\Gamma(\alpha)}$$

- The mode:

$$\text{mode} = 0,\ \alpha \le 1; \quad \frac{\alpha - 1}{\lambda},\ \alpha > 1$$

- The median:

$$\text{median} = x_i, \text{ where } \int_0^{x_i} f(x)dx = \tfrac{1}{2}$$

- The mean, E[X]

$$E[X] = \frac{\alpha}{\lambda}$$

Suppose we have three independent Gamma random variables A, B, and C with the following parameter values:

Variable	**α**	**λ**
A	4	½
B	5	½
C	6	½

We define the random variable, Z, as the sum of the three random variables above:

$$Z = A + B + C$$

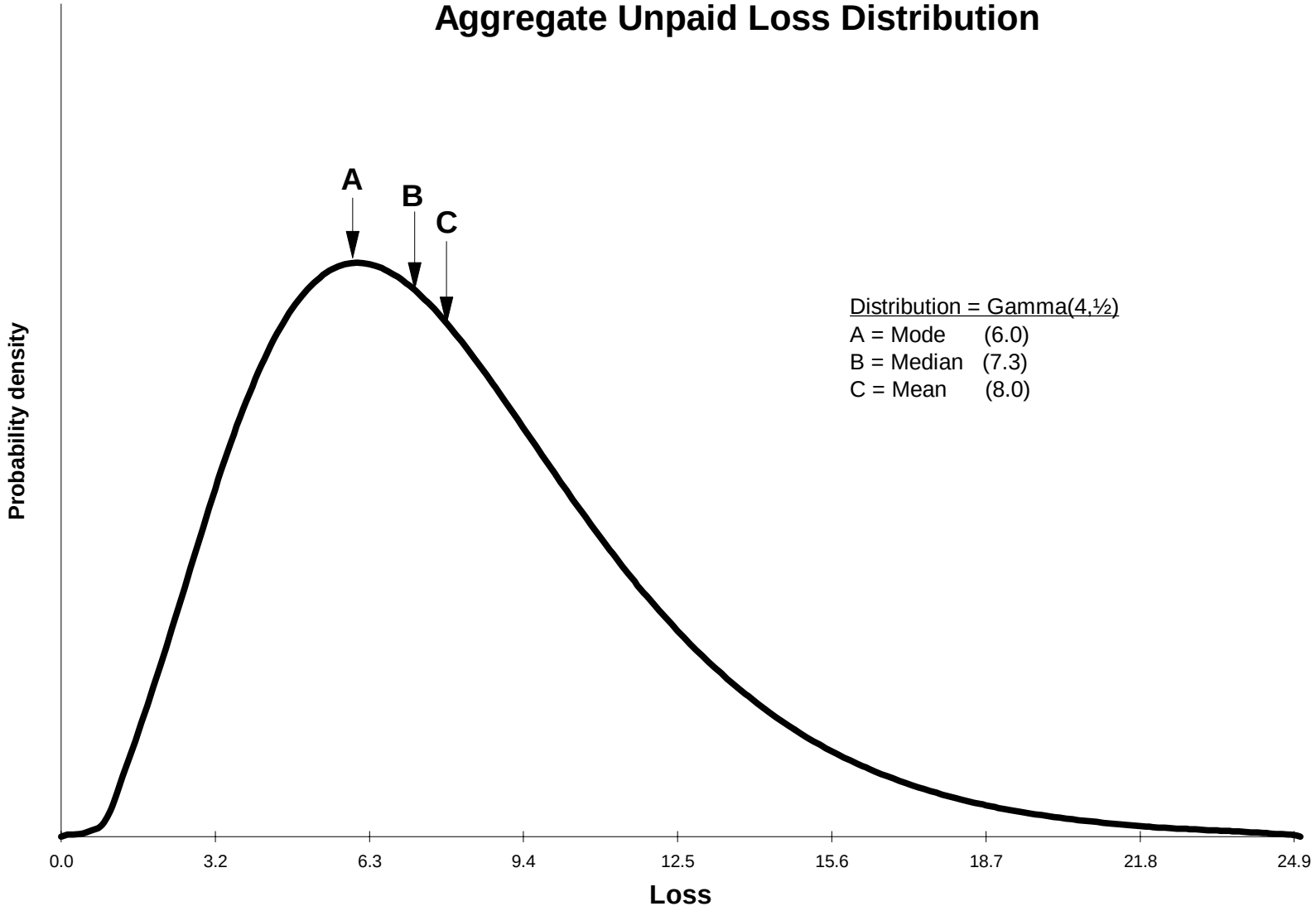
Since the sum of n independent Gamma distributions with respective parameters (α_1, λ), (α_2, λ), (α_3, λ),..., (α_n, λ) is Gamma distributed with parameters ($\sum_{i=1}^{n} \alpha_i$, λ), then Z is Gamma distributed with $\alpha = 15.0$ and $\lambda = 1/2$.

We now wish to calculate the mode, median, and mean of each random variable. Using the appropriate equations from above yields the following results:

Variable	α	λ	Mode	Median	Mean
A	4	½	6.0	7.3	8.0
B	5	½	8.0	9.3	10.0
C	6	½	10.0	11.3	12.0
Sum			24.0	28.0	30.0
Z	15	½	28.0	29.3	30.0

A comparison of statistics for the random variable Z with the sum of random variables A, B, and C indicates that only the means are additive.

Figure 1
Aggregate Unpaid Loss Distribution



APPENDIX B

THE CURRENT STATUS OF REGULATIONS AND GUIDELINES

This appendix provides a brief summary of current regulations and guidelines for estimating or recognizing liabilities for loss and loss adjustment expenses[6]. Readers unfamiliar with the references cited in this appendix may find it useful to review them in their entirety. The cited authorities are:

1. Statutory Accounting Principles
2. Generally Accepted Accounting Principles
3. Securities and Exchange Commission guidelines
4. Auditing guidelines
5. Internal Revenue Service code and regulations

Statutory Accounting Principles

NAIC Current Requirements

The Annual Statement is computed in accordance with Statutory Accounting Principles (SAP). The NAIC Property and Casualty Accounting Practices and Procedures Manual [17] provides the following guidance regarding statutory accounting for loss reserves:

> "Whatever methods are selected for establishing unpaid losses, the goal should always be reserve adequacy."

Although adequacy is not defined, statutory accounting requirements are generally conservative. (For example, statutory accounting generally requires that the reserve for unpaid losses be held at the full undiscounted value.)

[6] Underlining has been added to highlight certain key words in the regulations and guidelines.

> "Statutory accounting practices may be conservative in some respects but they are not unreasonably conservative over the span of economic cycles or in recognition of the primary statutory responsibility to regulate for financial solvency."

NAIC Codification

The NAIC's codification project is in the process of compiling its statutory accounting principles into a number of Statements of Statutory Accounting Principles (SSAP's). The proposed codification paper number 55, "Unpaid claims, losses, and loss adjustment expenses" [31], provides new guidelines for accounting for loss reserves:

> "For each line of business, management shall record its best estimate of its liability for unpaid claims, unpaid losses and loss adjustment expenses. Because the ultimate settlement of claims (including IBNR for death claims and accident and health claims) is subject to future events, no single loss or loss adjustment expense reserve can be considered accurate with certainty. Management's analysis of the reasonableness of loss or loss adjustment expense reserve estimates shall include an analysis of the amount of variability in the estimate. If, for a particular line of business, management develops its estimate considering a range of loss or loss adjustment expense, the best estimate of the liability within that range shall be recorded. The high and low ends of the range shall not correspond to an absolute best-and-worst case scenario of ultimate settlements because such estimates may be the result of unlikely assumptions. Management's range shall be realistic and therefore shall not include the set of all possible outcomes but instead only those outcomes that are considered reasonable.
>
> In the rare instances when, for a particular line of business, after considering the relative probability of the points within the estimated range, it is determined that no point within the range is a better estimate than any other point, the midpoint within the range shall be accrued. It is anticipated that using the midpoint in a range will be applicable only in the rare instance when there is a continuous range of possible values, and no amount within

that range is any more probable than any other. This guidance is not applicable when there are several point estimates which have been determined as equally possible values, but those point estimates do not constitute a range. If there are several point estimates with equal probabilities, management should determine its best estimate of the liability."

Note that the phrase "best estimate" is used three times in the proposed guideline including the requirement that the recorded liability reflect managements "best estimate". However, the basic proposed requirements remain generally conservative. The Statement of Concepts [30] states:

"Financial reporting by insurance enterprises requires the use of substantial judgments and estimates by management. Such estimates may vary from the actual amount for numerous reasons. To the extent that factors or events result in adverse variation from management's accounting estimates, the ability to meet policyholder obligations may be lessened. In order to provide a margin of protection for policyholders, the concept of conservatism should be followed when developing estimates as well as establishing accounting principles for statutory reporting.

Conservative valuation procedures provide protection to policyholders against adverse fluctuations in financial condition or operating results. Statutory accounting should be reasonably conservative over the span of economic cycles and in recognition of the primary responsibility to regulate for financial solvency. Valuation procedures should, to the extent possible, prevent sharp fluctuations in surplus."

Statement of Actuarial Opinion

The statement of actuarial opinion, which accompanies the Annual Statement, varies depending on the form of the Statement Blank. Currently, the Property and Casualty statement of opinion addresses the reasonableness of loss reserves. Rules regarding the Statement of Actuarial Opinion can be found in the NAIC Property and Casualty Annual Statement Instructions [18]. In the Opinion, the actuary must state the following:

"In my opinion, the amounts carried in the scope paragraph on account of the items identified

A. meet the requirements of the insurance laws of (state of domicile).

B. are computed in accordance with accepted loss reserving standards and principles.

C. make reasonable provision for all unpaid loss and loss expense obligations of the Company under the terms of its policies and agreements."

The amounts carried in the scope paragraph include the reserve for unpaid loss and loss adjustment expenses on both a net and a direct and assumed basis.

Additional guidance (See also [28]) is provided by the American Academy of Actuaries in the Property and Casualty Practice Note: Statements of Actuarial Opinion on P&C Loss Reserves as of December 31, 1997 [21].

> "The committee believes that a reserve makes 'reasonable provision' if it is within the range of reasonable estimates of the actual outstanding loss and loss expense obligations. The range of reasonable estimates is a range of estimates that would be produced by alternative sets of assumptions that the actuary judges to be reasonable, considering all the information reviewed by the actuary. Note that the range of reasonable estimates typically is narrower, perhaps considerably, than the range of possible outcomes of the ultimate settlement value of the reserve. A reserve booked at the low end of the range of possible outcomes would ordinarily not be within the range of reasonable estimates and so would not make a reasonable provision for all unpaid loss and loss expense obligations."

Generally Accepted Accounting Principles (GAAP)

The application of GAAP accounting with respect to insurance loss reserves is mainly addressed in the Statement of Financial Accounting Standards Number 5 and 60 (FASB 5 and FASB 60) and the FASB Interpretation Number 14 (FIN 14).

FASB 5 [26] addresses the requirements for accrual of loss contingencies (i.e. loss reserves).

> "An estimated loss from a loss contingency shall be accrued by a charge to income if both of the following conditions are met:
>
> a) Information available prior to issuance of the financial statements indicates that it is probable that an asset had been impaired or a liability had been incurred at the date of the financial statements. It is implicit in this condition that it must be probable that one or more future events will occur confirming the fact of the loss.
>
> b) the amount of loss can be reasonably estimated."

If the amount cannot be reasonably estimated, it still might be required to be disclosed in the financial statement. FIN 14 [7] provides more guidance regarding this issue:

> "Condition (b) does not delay accrual of a loss until only a single amount can be reasonably estimated. To the contrary, if condition (a) is met and information available indicates that the estimated amount of loss is within a range of amounts, it follows that some amount of loss has occurred and can be reasonably estimated.
>
> If condition (a) is met with respect to a particular loss contingency and the reasonable estimate of the loss is a range, condition (b) is met and an amount shall be accrued for the loss. If some amount within the range appears at the time to be a <u>better estimate</u> than any other amount within the range, that amount shall be accrued. If no amount within the

range is a better estimate than any other amount, however, the minimum amount in the range shall be accrued. (Even though the minimum amount in the range is not necessarily the amount of loss that will be ultimately determined, it is not likely that the ultimate loss will be less than the minimum amount.)"

Note the use of the concept of "better estimate". Clearly the "best estimate" is better than any other estimate.

FASB 60 [27] addresses the recognition of loss reserves as follows:

"The liability for unpaid claims shall be based on the estimated ultimate cost of settling the claims (including the effects of inflation and other societal and economic factors), using past experience adjusted for current trends, and any other factors that would modify past experience."

FASB 60 also states the disclosure requirements if the time value of money is considered in estimating the liabilities for unpaid claims. Companies are specifically required to disclose:

"The carrying amount of liabilities for unpaid claims and claim adjustment expenses relating to short-duration contracts that are presented at present value in the financial statements and the range of interest rates used to discount those liabilities."

Securities and Exchange Commission (SEC)

The SEC has generally recognized FASB standards and GAAP accounting as authoritative. According to the FASB:

"The SEC has authority to establish financial accounting and reporting standards for publicly held companies under the Securities Exchange Act of 1934. Throughout its history, however, the Commission's policy has been to rely on the private sector for this

function to the extent that the private sector demonstrates ability to fulfill the responsibility in the public interest."

The only significant actions that the SEC has taken with regard to financial statements have focused on increased disclosures.

Audit Guidelines

The Statement of Position 92-4, "Auditing Insurance Entities' Loss Reserves" [28], provides assistance "in developing an effective audit approach when auditing loss reserves of insurance entities."

> 2.39: "Management is responsible for making the accounting estimates included in the financial statements."
>
> 4.32: "Management must select a single loss reserve estimate that represents its best judgment about the most likely circumstances and events. If management develops a reasonable range, the amount recorded should be the best estimate within that range."
>
> 4.8: "It is management's responsibility to record its best estimate of loss reserves in the financial statements."
>
> 4.34: "It is the auditors responsibility to evaluate the reasonableness of the loss reserve established by management."
>
> 4.8: "If the auditor reviews and tests the process used by management to develop its estimate, and management's estimate differs significantly from the recommendations developed by its specialists, appropriate procedures should be applied to the factors and assumptions that resulted in the difference between

management's estimate and the specialists recommendations. Such procedures should include discussion with management and its specialists."

4.36: "SAS No. 47 also states, "Since no one accounting estimate can be considered accurate with certainty, the auditor recognizes that a difference between an estimated amount best supported by the audit evidence and the estimated amount included in the financial statements may be reasonable, and such difference would not be considered to be a likely misstatement."

4.29: "According to SAS No. 47, if the auditor believes the estimated amount included in the financial statements is unreasonable, he should treat the difference between the estimate and the closest reasonable estimate as a likely misstatement and aggregate it with other likely misstatements. Therefore, if the recorded loss reserve is outside the realistic range, the difference between the recorded reserve and the nearer end of the realistic range should be treated as an audit difference."

Again, note the use of the phrase "best estimate".

Internal Revenue Service (IRS)

Tax laws are established by Congress and are contained in the Internal Revenue Code. The rules in sections 831 through 835 govern the taxation of property and casualty insurance companies. Section 832 of the Code [15] provides for a deduction of "losses incurred" as stated below.

Section 832-(b)(5) "Losses incurred - the term "losses incurred" means losses incurred during the taxable year on insurance contracts, computed as follows:

(A) To losses paid during the taxable year, add salvage and reinsurance recoverable outstanding at the end of the preceding taxable year and deduct salvage and reinsurance recoverable outstanding at the end of the taxable year.

(B) To the result so obtained, add all unpaid losses outstanding at the end of the taxable year and deduct unpaid losses outstanding at the end of the preceding taxable year."

Procedures describing how to comply with this Code are found in the Code of Federal Regulations [14] from the Department of Treasury. Treasury regulation 832 describes the standards for deducting "unpaid losses" as mentioned in 832 above.

1.832-4(a)(5): "In computing "losses incurred" the determination of unpaid losses at the close of each year must represent actual unpaid losses as nearly as it is possible to ascertain them."

1.832-4(b): "Every insurance company to which this section applies must be prepared to establish to the satisfaction of the district director that the part of the deduction for "losses incurred" which represents unpaid losses at the close of the taxable year comprises only actual unpaid losses stated in amounts which, based on the facts in each case and the company's experience with similar cases, can be said to represent a fair and reasonable estimate of the amount the company will be required to pay. Amounts included in, or added to, estimates of unpaid losses which, in the opinion of the district director, are in excess of a fair and reasonable estimate will be disallowed as a deduction."