Considerations Regarding Materiality and Range of Reserves in Connection With Actuarial Standard of Practice #36

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Abstract

The Actuarial Standard of Practice No. 36 has highlighted several issues which have been implicitly considered by property/casualty actuaries for years. For the first time, the types of statements of actuarial opinion have been standardized and listed for categorization by property/casualty actuaries. However, many other areas which the actuary needs to be familiar with are not documented in standard actuarial literature. This paper examines the interrelationship of materiality and range of reasonable reserves. Some common rules of thumb are formulated in regards to the range of reasonable reserve estimates. Accounting literature, such as The American Institute of Certified Public Accountants ("AICPA") Professional Standards and the Security Exchange Commission Staff Accounting Bulletins, are referenced in order to provide the actuary some reference materials while issuing opinions. In addition, some practical considerations regarding necessary work steps needed to issue a statement of actuarial opinion are outlined.

Introduction

The Actuarial Standard of Practice No. 36 has highlighted several issues which have been implicitly considered by property/casualty actuaries for years. For the first time, the types of statements of actuarial opinion ("SAO") have been standardized and listed for categorization by property/casualty actuaries. However, many other areas which the actuary needs to be familiar with are not documented in standard actuarial literature. This paper examines the interrelationship of materiality and range of reasonable reserves. Some common rules of thumb are formulated in regards to the range of reasonable reserve estimates. Accounting literature, such as American Institute of Certified Public Accountants ("AICPA") AICPA Professional Standards and the Security Exchange Commission Staff Accounting Bulletins, are referenced in order to provide the actuary some reference materials while issuing opinions. In addition, some practical considerations regarding necessary work steps needed to issue a statement of actuarial opinion are outlined.

I. Actuarial Standards of Practice

Actuarial Standards of Practice are promulgated by the American Academy of Actuaries' Actuarial Standards Board ("ASB"). In the Preface to Actuarial Standards of Practice, it is stated that the ASB is provided with the sole discretion of promulgating actuarial standards of practice. The objectives of the ASB include direction, management, exposition and promulgation of actuarial standards of practice by its operating committees, and to provide continuous reviews of existing standards of practice.

Since 1990, the National Association of Insurance Commissioners ("NAIC') requires that for most property casualty insurers (with some minor exceptions) a statement of opinion be signed by

a *qualified actuary,* as outlined in the NAIC Instructions for Completing the statutory Property/Casualty Annual Statement blank. This statement contains an opinion expressed by a qualified actuary regarding the reasonableness of the carried statutory loss and loss adjustment expense reserves as shown in the statutory annual statement blank. The focus of this paper is in regards to the NAIC required opinions for statutory purposes.

There are numerous other situations which require statements of actuarial opinion, some of which are:

- Through December 31, 2001, the state of Minnesota statutory insurance laws triennially require an independent actuary to opine on the reasonableness of the carried loss and loss adjustment expense reserves of non-Minnesota domiciled carriers.
- Underwriting pools and associations may require an actuarial opinion regarding the carried loss and loss adjustment expense reserves for the benefit of the members of the pool.
- The state of Vermont requires a statement of actuarial opinion regarding the reasonableness of the loss and loss adjustment expense reserves of Vermont domiciled captive insurance companies.
- The U.S. Department of the Treasury has requested statement of actuarial opinions in connection with insurance companies which write surety bonds.

The widespread use of these statement of actuarial opinions contributed to the need for additional guidance for statements of actuarial opinion. ASOP36 is the professional standard of practice which governs the issuance of these actuarial opinions as well.

II. General Overview of Actuarial Standard of Practice #36 ("ASOP36")

ASOP36 was adopted for written statements of actuarial opinion with respect to loss and loss adjustment expense reserves valued on or after October 15, 2000 (Section 1.4 of ASOP36). Several definitions are provided in Section 2 of ASOP36 which can guide the actuary through the Standard of Practice. The standard introduced many new requirements. Some of the more important new features are

- a requirement that the actuary evaluate whether there are specific risks and uncertainties which could result in material adverse deviation in the loss and loss adjustment expense reserves (Section 3.3.3);
- a requirement that the actuary evaluate materiality in the evaluation of loss and loss adjustment expense reserves , with consideration to the intended uses for the statements of actuarial opinion (Section 3.4); and
- specific guidance as to the nature and extent of disclosures required for statements of actuarial opinion. (Section 4).

III. Discussion of Three Areas of Interest: Types of ASOP36

A. Types of Opinions (3.3.2)

ASOP36 defines five types of statements of actuarial opinion, with conditions for each noted:

a. Determination of Reasonable Provision

When the stated reserve amount is within the actuary's range of reasonable reserve estimates

b. Determination of Deficient or Inadequate Provision

When the stated reserve amount is less than the minimum amount that the actuary believes is reasonable, the actuary should disclose the additional amount necessary to equal the minimum amount that the actuary believes is reasonable (4.6.d)

c. Determination of Redundant or Excess Provision

When the stated reserve amount is greater than the maximum amount that the actuary believes is reasonable, the actuary should disclose the amount by which the stated amount exceeds the maximum amount that the actuary believes is reasonable (4.6.e)

d. Qualified Opinion

When the stated reserve amount includes a certain item or items in question because they cannot be reasonably estimated or the actuary is unable to render an opinion on those items

An opinion on the liabilities associated with the stated reserve except for the qualified item(s) should be rendered in accordance with a. through c.

If the item(s) are not believed to be material, a qualified opinion is not required

e. No Opinion

If no opinion can be reached due to deficiencies in data, analyses, assumptions, or related information

Comments Regarding Types of Actuarial Opinions and Potential Impact on Actuarial Work Processes

Before the issuance of ASOP36, no binding professional guidance existed for types of actuarial opinions. The "Property and Casualty Practice Note" as published by the Committee on Property and Liability Financial Reporting ("COPLFR") of the American Academy of Actuaries for the past several years provides guidance regarding Statements of Actuarial Opinion for statutory loss and loss adjustment expense reserves; however, the practice note "...has not been promulgated by the Actuarial Standards Board nor is it binding on any actuary".

The determination of the reasonable provision, which states that carried reserves must be within a reasonable range of reserves (discussed below), introduces precision recently not required. Before ASOP36, an actuary might opine that a Company whose carried reserve is "slightly" above the high end of a reasonable range "conservative"; under ASOP36, the actuary must opine that the Company's reserves are redundant or excessive, and quantify the amount.

Another example shows an additional potential impact of ASOP36. Before ASOP36, the actuary might have stated that loss and loss adjustment expense reserves were "reasonable but conservative " if a company's carried loss and loss adjustment expense reserves were slightly below the maximum amount that the actuary believes is reasonable. Under the guidance of ASOP36, such an opinion would now be "reasonable".

Additionally, the disclosure of the amounts of the deficiencies or redundancies (III. A. b. and III. A. c. above) necessitate possible changes in work processes for opining actuaries under NAIC statutory regulations. Currently, March 1 is the statutory filing due date for financial statements ending December 31 of the prior calendar year, accompanied by the statement of actuarial

opinion. Subsequently, the due date for the delivery of the actuarial report to the company is May 1 (or prior to May 1 within two weeks of the request by the state insurance department). Prior to ASOP36, the actuary could determine by the statutory filing date the type of opinion which would be rendered, and subsequently refine precisely the range and point estimate (if determined) by the due date for the delivery of the report. Due to ASOP36's requirement that the disclosure of the precise amount of deficiency or redundancy be included for deficient/redundant opinions, the actuary must now determine the precise low end of range (for deficient provisions/opinions) or the precise high end of range (for redundant provisions/opinions) by the statutory filing date.

B. Range of Reasonable Reserve Estimates (3.6.4)

Following the definitions of the types of opinions as outlined above, ASOP36 iterates that the actuary may determine a range of reasonable reserve estimates that reflect the uncertainties associated with analyzing reserves. "A *range of reasonable estimates* is a range of estimates that could be produced by appropriate actuarial methods or alternative sets of assumptions that the actuary judges to be reasonable. The actuary may include risk margins in a range of reasonable estimates, but is not required to do so, except as may be required by ASOP No. 20. A range of reasonable estimates, however, usually does not represent the range of all possible outcomes."

Discussion of Range

Accounting literature has discussed methods to account for contingencies which are of interest to the actuary. Statement of Financial Accounting Standards No. 5 ("FASB 5") [of the Financial Accounting Standard Board's ("FASB") *Statement of Standards*] "Accounting for Contingencies" establishes accounting requirements for U.S. Generally Accepted Accounting Principles ("GAAP") which are relate to property casualty loss reserve liabilities. Paragraph 8 of FASB5,

"Accrual of Loss Contingencies", states that an estimated loss from a contingency shall be accrued by a charge to income as long both of the following conditions are met:

a. It is probable that an asset has been impaired or a liability has been incurred at the date of the financial statements, and
b. The amount of loss can be reasonably estimated

An important interpretation of FASB5 has impacted the concept of range, and the way that accountants view the "range of reasonable reserve liabilities". "FASB Interpretation No. 14, Reasonable Estimation of the Amount of a Loss an interpretation of FASB Statement No. 5", states that " When some amount within the range appears at the time to be abetter estimate than any other amount within the range, that amount shall be accrued. When no amount within the range is a better estimate than any other amount, however, the minimum amount in the range shall be accrued."

The difference between an actuary's view of a best estimate and range can be differentiated from the perspective of an accountant. When an actuary determines a point estimate as well as a range of reasonable reserve estimates, that point estimate has a higher degree of certainty than other points within the range. Similarly, under FASB5, that greater degree of certainty implies that the point estimate should be established.

However, the accountant might view all points in a reasonable range of reserves as equally likely. However, an actuary may opine that the point estimate is the most likely scenario, with points within a reasonable range of reserves becoming less probable as one moves towards either end of the range. This distinction is important to be noted in actuarial and accounting interactions.

Similar guidance relating to accrual of liability for statutory purposes is outlined in the *NAIC Accounting Practices and Procedures Manual*, effective January 1, 2001. The adoption of this statutory accounting framework culminated a multi-year effort of the NAIC Accounting Policies and Procedures Task Force to "codify" statutory accounting policies. The Manual is embodied in a series of Statements of Statutory Accounting Principles ("SSAP's"), which introduced some significant changes in the statutory accounting practices for many property/casualty insurance companies. The NAIC codification principles also discuss the concept of range with respect to carried loss and loss adjustment expense reserves. SSAP 55 states that the Company should accrue "Management's Best Estimate" of its liabilities for unpaid claims, unpaid losses and loss/claim adjustment expenses for each line of business and for all lines of business in the aggregate. Management may consider a range of reserve estimates; the range shall not include the set of all possible outcomes but only those outcomes that are considered reasonable. When no estimate within the range is better than any other, the midpoint of the range (as opposed to the minimum from the FASB Interpretation No. 14 of FASB 5) is to be accrued. [1]

Current actuarial literature is rich with examples regarding methods to determine ranges of loss reserves. In the spring of 1994, an entire Casualty Actuarial Society Discussion Call Paper Program ("Variability in Reserves") was devoted to various methodologies to determine ranges of reasonable reserves. The Thomas Mack paper titled "Measuring the Variability of Chain Ladder Reserve Estimates", and the Daniel Murphy paper entitled "Unbiased Loss Development Factors" in PCAS 1994 are two such papers. A more recent paper written by Chandu Patel and Alfred Raws titled "Statistical Modeling Techniques for Reserve Ranges: A Simulation Approach" in the 1998 Fall Forum Reserving Call Papers compares various approaches for establishing reasonable

[1] If management's best estimate is different from the estimate of the Company's appointed actuary, some accountants believe that management should offer reasons as to why the difference has occurred, i.e., the factors that the actuary's estimates have not considered which are captured in Management's determination of the loss and loss adjustment expense reserve amount which is carried.

ranges of reserves, and connects those reasonable range of reserves with testing of confidence level factors.

Disclosure of the Reasonable Range of Reserve Estimates

ASOP36 does not require the range of reasonable reserve estimates to be disclosed in the opinion. Commentary in Appendix 2, "Comments on the 1999 Third Exposure Draft and Subcommittee Responses" provides reasoning as follows: "The subcommittee believes that the actuary may be able to consider a range of reasonable estimates for purposes of the opinion without having to specify the end points of the range. This is acceptable because the actuary could be basing the opinion on various methods and estimates that produce results not much different from the stated reserve amount. Consequently, disclosure of a specific range is unnecessary."

However, the Documentation section (Section 4.2) states that the actuary should be guided by the provisions of ASOP No. 9 ("ASOP9"), *Documentation and Disclosure in Property and Casualty Insurance Ratemaking, Loss Reserving, and Valuations.* The explicit ASOP36 requirement from 3.3.2.a. that "When the stated amount is within the actuary's range of reasonable reserve estimates (see Section 3.6.4), the actuary should issue a statement of actuarial opinion that the stated amount makes a reasonable provision..." appears to imply that the actuary must per se already have developed a reasonable range of reserves in order to issue a "reasonable" actuarial opinion. Consequently, ASOP9 would imply that the specific amount of the reasonable range of reserves should be at the very least in the actuarial workpapers. Prior to the issuance of ASOP36, an actuary could issue a reasonable opinion if the indicated reserves were "close", (for example, within 5%, of the carried reserves); ASOP36 appears to necessitate an explicit range calculation notwithstanding the distance of the indicated reserves from the carried reserves.

In the case of the NAIC required actuarial report supporting the actuarial opinion, disclosing the specific range of reasonable reserves would appear to be a logical conclusion resulting from the Documentation section of ASOP36. For example, if the stated reserve amount was within an actuary's reasonable range of reserves but close to either end of the actuary's reasonable range of reserves, disclosure of a specific range in the actuarial report could be especially useful for the regulator. The disclosure of risk of material adverse deviation (discussed in this paper's Section II.C. below) effectively exposes the high end of the range of reserves and its relation to the carried reserves, in those cases where risk of material adverse deviation is thought to exist.

C. Materiality (3.4), Significant Risks and Uncertainties (Explanatory Paragraph) [3.3.3], and Adverse Deviation (3.6.5)

The AICPA Professional Standards section entitled "U.S. Auditing Standards" defines methodology to evaluate materiality in a manner similar to the guidance provided by ASOP36. The AICPA section goes one step further: it defines Materiality. That definition is useful for our guidance in evaluating materiality standards. Section 312.10 of the AICPA code states the following:

> "The auditor's consideration of materiality is a matter of professional judgment and is influenced by his or her perception of the needs of a reasonable person who will rely on the financial statements. The perceived needs of a reasonable person are recognized in the discussion of materiality in Financial Accounting Standards Board Statement of Financial Accounting Concepts No. 2, Qualitative Characteristics of Accounting Information, which defines materiality as 'the magnitude of an omission or misstatement of accounting information that, in the light of surrounding circumstances, makes it probable that the

judgment of a reasonable person relying on the information would have been changed or influenced by the omission or misstatement.' That discussion recognizes that materiality judgments are made in light of surrounding circumstances and necessarily involve both quantitative and qualitative considerations."

In Section 3.4 of ASOP36, it is stated that the actuary should consider the purposes and intended uses for the SAO in evaluating materiality. The ASOP36 states that the actuary should evaluate materiality based upon:

1. Professional judgment,
2. Materiality guidelines or standards applicable to the SAO, and
3. The actuary's intended purpose for the SAO. The actuary should understand which financial values are usually important to the intended users of the statement of actuarial opinion and how those financial values are likely to be affected by changes in the reserves and future payments for losses and loss adjustment expense reserves.

ASOP36 provides three examples of materiality which actuaries could reference in Statements of Actuarial Opinion:

1. "Specified reserve amount for which an opinion is given"; i.e. as a percentage of net loss and loss adjustment expense reserves.

2. "The Company's reported surplus"; this materiality standard would be appropriate for a SAO for an insurance company to be used for financial reporting to insurance regulators.

3. "The Company's net worth and annual net income" could be the bases used in an actuarial appraisal.

Section 3.3.3, Significant Risks and Uncertainties (Explanatory Paragraph) states that the actuary should include an explanatory paragraph when the actuary reasonably believes that there are significant risks and uncertainties that could result in material adverse deviation. The explanatory paragraph should contain a) "the amount of adverse deviation that the actuary judges to be material with respect to the statement of actuarial opinion"; and b) "a description of the major factors or particular conditions underlying risks and uncertainties that the actuary believes could result in material adverse deviation".

Section 3.6.5 discusses and defines Adverse Deviation. "An adverse deviation occurs when such a variation results in paid amounts higher than provided for in the reserves. The actuary should consider whether the future paid amounts are subject to significant risks and uncertainties that could result in a **material** adverse deviation" (emphasis added).

Quantitative Percentages to Assess Materiality

From the above discussion, ASOP36 provides three bases against which to assess materiality: loss reserves, surplus and net income. However, ASOP36 does not provide numerical percentages relating to materiality measures. The following are some broad quantitative measures, not meant to be all-encompassing, which can provide the actuary with some guidance on selecting those bases.

- Loss and loss adjustment expense reserves. The author of this paper has seen 5% and 10% of loss and loss adjustment expense reserves as materiality percentage amounts. The range of reasonable reserve estimates has important implications regarding the amounts of material adverse deviation and tests of materiality. The range also provides some guidance in selecting materiality standards. The interrelationship between the reasonable range of reserves and materiality is discussed below in Section IV.

- Reported Surplus. Richard Roth demonstrated in his paper "Analysis of Surplus and Rate of Return without Using Leverage Ratios" that the reserves to surplus ratio has remained relatively constant at 2:1 from 1975 through 1990. For companies writing at that ratio, this suggests materiality percentages of 10% and 20% of surplus would be equal to the 5% and 10% reserve percentages from the above paragraph.

- Net Income. In August, 1999, the Securities Exchange Commission ("SEC") released Staff Accounting Bulletin ("SAB") No. 99. In the SAB, the views of the staff were expressed that relying on certain quantitative benchmarks to assess materiality in preparing financial statements were inappropriate; further, misstatements are not immaterial simply because they fall beneath a numerical threshold. However, the Financial Accounting Standards Board ("FASB") did note that in certain limited circumstances the SEC and other bodies had issued quantitative materiality guidance (discussed in SAB 99's Section 7213, Materiality). The SEC quoted "contradictory studies", one study which suggested widespread use of a "rule of thumb" of 5% to 10% of net income. Although the FASB rejected the formulaic approach, this example is another place to start in assessing materiality in percentage form, after evaluating the quantitative and qualitative considerations discussed below.

Professional Guidance regarding Materiality

The CAS Valuation, Finance and Investments Committee ("VFIC") has published "Materiality and ASOP No. 36: Considerations for the Practicing Actuary. (The VFIC was included as Appendix 7 in the December 31, 2001 Property and Casualty Practice Note developed by COPLFR). Materiality in accounting contexts is also discussed, with references to the NAIC Accounting Practices and Procedures Manual. The VFIC paper is a good resource, summarizing the qualitative and quantitative measures that the actuary should consider. Quantitative measures in addition to the percentages of loss reserves, surplus, net income and worth presented above are: absolute magnitude of item that represents a correction or different result, absolute magnitude of item for which data is not available, and the impact of an item on IRIS ratios and Risk-based Capital results.

SAB 99, introduced above, stated that numerical quantitative values for rules of thumb have no basis in law or accounting literature.[2] However, quantitative rules are simpler to understand, and are stated above to reflect some common rules of thumb in regards to materiality.

In summary, the above sources provide guidance in terms of either qualitative or quantitative measures important in assessing materiality:

- VFIC: "Requiring the use of professional judgment and placing importance on intended purpose both emphasize the role of qualitative considerations in evaluating materiality."

[2] Note that the SEC only has regulatory authority regarding publicly traded companies. The Supplementary Information for each SAB states that "the statements in the staff accounting bulletins are not rules or interpretations of the Commission, nor are they published as bearing the Commission's official approval.

- SAB 99: "But quantifying, in percentage terms, the magnitude of a misstatement is only the beginning of an analysis of materiality; it cannot appropriately be used as a substitute for a full analysis of all relevant considerations".

Significant Risks and Uncertainties

The explanatory paragraph in the opinion discussing significant risks and uncertainties is not required if material adverse deviation is deemed not to exist. However, the "maximum" amount of material adverse deviation is not required to be disclosed if material adverse deviation is deemed to exist; only the presence of this "minimum" material hurdle amount is disclosed. Finally, broad statements about risks and uncertainties due to economic changes, judicial decisions, regulatory actions are generally not the types of risks envisioned by the requirement to disclose risk of material adverse deviation, nor is an exhaustive list of all potential sources required to be mentioned.

IV. Specific Examples: The Connection between Material Risk of Adverse Deviation and Reasonable Range of Reserves

A. Definition of Material Adverse Deviation in Relation to Range

In Appendix 2 of ASOP36, it was noted that comment letters included a request that the ASOP provide more guidance by giving examples in the various sections of the ASOP. From the discussion above, the role of judgment in assessing materiality is listed as primary. The central purposes of this paper are to connect the concepts of reasonable range of reserves and materiality, and to demonstrate that the actuary's inherent ideas of what constitutes the width of an "average"

They represent interpretations and practices followed by the Division of Corporation Finance and the Office of the Chief Accountant in administering the disclosure requirements of the Federal securities laws."

reasonable range of reserves can influence the materiality level that is chosen by the actuary. For example, if two actuaries believed that materiality standards are 10% and 20% of losses, respectively, then the amount of times that the "10% actuary" expresses material adverse deviation exists would be above that of the "20% actuary". This point is demonstrated below using industry development.

First, the concept of the connection between reasonable range and materiality is presented below. Simple general examples are then presented to demonstrate the concepts. Then, specific examples are constructed below using a confidence level approach outlined in the paper Unbiased Loss Development Factors by Daniel Murphy in PCAS 1994. It has already been discussed, but is worth reiterating here, that qualitative measures regarding the risk of adverse material deviation should be considered in addition to the quantitative section below.

Section II.C. showed the considerable latitude that ASOP36 provides the actuary in determining materiality. There is however, a connection between the risk of material adverse deviation, the amount of materiality, and the maximum end of the range of reasonable reserves. The following illustrates that the risk of material adverse deviation exists if:

a. The difference between the High end of the Range and Carried Reserves is greater than:

b. The Materiality Amount

The following uses terminology as presented by Robert Butsic in his paper "Solvency Measurement for Property-Liability Risk Based Capital Applications to clarify the discussion.

Given:

Assets	A	cash (realizable value is certain)
Loss Reserve	L	unpaid loss (realizable value is a random variable)
Capital	C	assets – loss reserve (realizable value is a random variable)

For a discrete loss size probability distribution, when assets are certain, the Expected Policyholder Deficit ("EPD") is

$$D_L = \sum_{x>A} p(x)\,(x-A), \qquad (1)$$

where p(•) is the probability density for losses ($0 \leq x < \infty$). The EPD ratio is $d_L = D_L / L$

In words, Butsic defines the term D_L / L as:

- the ratio of capital to the expected valued of the risk element ("L"), and
- the coefficient of variation, the ratio of the standard deviation of the risk element to its mean

Let us define

Maximum Loss (G) in our range of reasonable reserves	L_G
Materiality measure as a percentage of losses	m
Total materiality amount in dollars	M=m*L

For a discrete loss size probability distribution, when assets are certain, the Expected Material Deviation ("EMD") is:

$$D_{MD} = \sum_{x>L+M} p(x)\,(x-(L+M)), \qquad (2)$$

where p(•) is the probability density for losses ($0 \leq x < \infty$). Risk of material adverse deviation exists when $L_G > L+M$; the amount of material adverse deviation is equal to $L_G - (L+M)$. The EMD ratio is therefore defined as $d_{md} = D_{MD} / L$. In words, the term $d_{md} = D_{MD} / L$ can be defined as the ratio of the expected material deviation to the expected valued of the risk element ("L").

Similar distributions exist for continuous distributions:

$$D_L = \int_A^{\infty} (x-A)\, p(x)dx, \qquad (3)$$

And,

For a reasonable range of reserves,

$$D_{MD} = \int_{L+M}^{\infty} (x-(L+M))\, p(x)dx, \qquad (4)$$

Where p(•) is the probability density for losses ($0 \leq x < \infty$), risk of material adverse deviation exists when $L_G > L+M$.

The above examples show that material adverse deviation can be considered a special subset of the concept of capital when applied to insurance situations. As capital is reserved for deviations in excess of loss reserves, material adverse deviation can be considered when the deviation amount places losses higher than the top end of the range. The amount of capital is available to absorb that amount.

Note that ASOP36 requires the actuary to disclose the materiality threshold ("M") if the actuary believes that the risk of material adverse deviation exists. However, the amount of adverse deviation, defined as $[L_G - (L+M)]$, need not be disclosed; effectively, the actuary is expressing the opinion that $[L_G - (L+M)] > 0$.[3]

[3] If $[L_G - (L+M)] > 0$, then $[L_G - L > M]$; the amount M must be disclosed, but not the amount $L_G - L$

B. General examples of Range of Reasonable Reserve Estimates in Relation to Risk of Material Adverse Deviation

To continue the above example, the following is a range of reasonable reserves for an insurance company, with the materiality threshold expressed in terms of 10% of carried reserves[4]:

Low	Point	High	Carried	Materiality	High End - Carried
90	100	110	105	10.5	5

Since the high end of the reasonable range – carried reserves (5) is less than the materiality standard (10.5), risk of material adverse deviation does not exist. An alternative presentation of the same test is as follows:

Low	Point	High	Carried	Carried + Materiality
90	100	110	105	115.5

Since the high end of our reasonable range of reserves is below the carried reserves plus the materiality standard, then risk of material adverse deviation does not exist. Restated, in this case, the high end of the actuary's *range of reasonable estimates* is 110, an amount that could be produced by appropriate actuarial methods or alternative sets of assumptions that the actuary judges to be reasonable. The risk of material adverse deviation does not exist because the amount

[4] If the standard was expressed as a percentage of statutory surplus, the standard could be converted to reserves using a reserves to capital percentage, and applied as described above.

of the carried reserves plus the material standard (115.5) is greater than the highest amount the actuary deems reasonable (110).

To continue the above example, the following is the same example, with carried reserves of 95:

Low	Point	High	Carried	Materiality	High End - Carried
90	100	110	95	9.5	15

Since the high end of the reasonable range – carried reserves (15) is greater than the materiality standard (9.5), risk of material adverse deviation exists. An alternative presentation of the same test is as follows:

Low	Point	High	Carried	Carried + Materiality
90	100	110	95	104.5

Since the high end of our reasonable range of reserves is above the carried reserves plus the materiality standard, then risk of material adverse deviation exists. Restated, in this case, the high end of the actuary's *range of reasonable estimates* is 110, an amount that could be produced by appropriate actuarial methods or alternative sets of assumptions that the actuary judges to be reasonable. Since the amount of the carried reserves plus the material standard (104.5) is greater than the highest amount the actuary deems reasonable (110), the risk of material adverse deviation does exist, and can be quantified to be 5.5 (110-104.5).

As defined above, the EMD ratio is equal to 5.8% (5.5/95). This ratio, the ratio of the expected material deviation to the expected valued of the risk element ("L"), should be examined within the context of the NAIC IRIS Ratio Tests, Risk Based Capital percentages, or similar impairment of capital measures.

Note that ASOP36 does not mandate that the materiality amount, 9.5 in this example, be disclosed, as well as the risk of material adverse deviation. However, the **amount** of material adverse deviation implied by the high end of the range, equal to 5.5 (110-104.5), need not be disclosed.

C. Specific examples of Range of Reasonable Reserve Estimates

In his 1994 paper, Daniel Murphy presents a paper in which confidence intervals are constructed using regression techniques and ranges of reasonable reserves. Mr. Murphy's paper provides one convenient triangle-based approach to determine confidence intervals. However, it is silent regarding the concept of "reasonable range of reserves". The above paper cited by Mr. Patel and Mr. Raws provided an example where "..the range can be defined as the values encompassed in the 5^{th} and the 95^{th} percentile...". The following are the results of Mr. Murphy's methodology applied to 2000 A.M. Best's data for several lines of business, with the assumption that the 5%

and 95% confidence levels define a reasonable range of reserves.

Line of Business	5%	50%	95%	Carried
Medical Malpractice	7,566	8,808	10,051	8,111
	-14.1%		+14.1%	
Workers Compensation	48,589	52,702	56,814	51,097
	-7.8%		+7.8%	
Private Passenger Auto Liability	52,800	56,587	60,374	63,534
	-6.7%		+6.7%	
General Liability	34,107	37,578	41,049	34,037
	-9.2%		+9.2%	
Commercial Auto Liability	18,813	20,437	22,061	18,894
	-7.9%		+7.9%	
All Lines	286,162	304,677	323,192	297,039
	-6.1%		+6.1%	

If a materiality standard of 10% of carried reserves was applied to the above lines of business, risk of material adverse deviation could be tested as follows:

LOB	10% of Carried Reserves (A)	High End Minus Carried Reserves (B)	Risk (B>A?)
Medical Malpractice	811	1,940	Yes
Workers Comp	5,110	5,717	Yes
PP AL	6,353	(3,160)	No
GL	3,404	7,012	Yes
CAL	1,889	3,167	Yes
Total	29,704	26,153	No

The workers compensation and private passenger automobile situations illustrate that the degree of margin or deficiency can influence the determination of risk of material adverse deviation. Although the workers compensation high end of range of 7.8% was only 1.1% above the private passenger automobile range, the deficiency of the line (relative to the private passenger auto liability redundancy) caused the risk of material adverse deviation to be present.

The amount of material adverse deviation, and the EMD ratios define above, are as follows:

LOB	Material Adverse Deviation (B)-(A)	EMD Ratios
Medical Malpractice	1,129	14% (1,129/8,111)
Workers Comp	607	1%(607/51,097)
GL	3,698	11% (3,698/34,037)
CAL	1,278	7% (1,278/18,894)

The results of the above test confirm several preconceived notions regarding whether risk of material adverse deviation exists by line of business. Given the low frequency, high severity nature of medical malpractice, and the relatively long-tail payout of the line of business, the width of the range of the reasonable reserves produces an opinion regarding the presence of risk of material adverse deviation. The redundancy of private passenger automobile does not allow risk of material adverse deviation to be achieved.

By raising the materiality standard to 20%, the test results change as follows:

LOB	20% of Carried Reserves (A)	High End Minus Carried Reserves (B)	Risk (B>A?)
Medical Malpractice	1,622	1,940	Yes
Workers Comp	10,220	5,717	No
PP AL	12,706	(3,160)	No
GL	6,808	7,012	Yes
CAL	3,778	3,167	No
All	59,408	26,153	No

The above shows that the width of the "average" reasonable range of reserves can influence the materiality standard selected. For example, one actuary might believe that a reasonable materiality standard should be 10%, based upon the idea that a preconceived "average" width of the high end of a reasonable range of reserves is 10%. Consequently, that actuary would express that the risk of material adverse deviation exists more often (4 out of 6 times for the above lines of business) than the actuary with a 20% materiality standard (2 out of 6 times for the above lines of business).

V. Conclusions

This paper has demonstrated the following points:

1. The range of reasonable reserves and the amount of material adverse deviation are related. Reasonable ranges of reserves can be generated to support a reasonable opinion, as well as to test for the risk of material adverse deviation.

2. The amount of material adverse deviation can be quantified, as the high end of the range less the carried reserves plus the materiality standard.
3. The width of what the actuary deems to be an "average" reasonable range of reserves may be an additional factor to be considered when selecting the materiality amount, and the "average" frequency that the risk of material adverse deviation will be cited by the actuary.
4. Although the range of reasonable reserves need not be disclosed in the actuarial opinion, other Actuarial Standards of Practice (such as ASOP9) under certain circumstances could imply the necessity to disclose the range in the actuarial report.
5. The risk of material adverse deviation can be supported by qualitative as well as quantitative tests.

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