February 22, 2011

Ms. Anne Kelly, Chair
Property and Casualty Risk-Based Capital Working Group
Capital Adequacy (E) Task Force

National Association of Insurance Commissioners (NAIC)
2301 McGee Street
Suite 800
Kansas City, MO 64108

Dear Anne:

As we discussed, I am attaching the Jan. 31 four-part report sent by the American Academy of Actuaries[1] to the Solvency Modernization Initiative (SMI) Risk-Based Capital (RBC) Subgroup of the NAIC's Capital Adequacy (E) Task Force. I would like to draw to your attention the following two sections of the report:

1. Safety Levels in NAIC Property/Casualty Risk-Based Capital (pages 5-12 of the attachment)

2. Missing Risks and Measurement Shortfalls in the Current NAIC Property/Casualty Risk-Based Capital Formula (pages 13-44 of the attachment)

These sections of the report have been prepared by two subcommittees of the Property and Casualty Risk-Based Capital Committee of the American Academy of Actuaries. They have been prepared in part to respond to specific questions asked of the Academy by Alan Seeley, the chair of the SMI RBC Subgroup.

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[1] The American Academy of Actuaries is a 17,000-member professional association whose mission is to serve the public on behalf of the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

1. The first section contains a brief analysis of whether and how the current NAIC Property and Casualty Risk-Based Capital formula in the aggregate, or in any of its components, is structured and calibrated to correspond to a specific safety level.[2] The report concludes that the current formula does not contain an explicit safety level for aggregate RBC. It is important to note that the formula was not designed to produce aggregate RBC at an explicit calibration level representing a certain statistical outcome. While calibration of some individual risk charges was attempted at the time the formula was developed, its development did not include statistical calibration of the aggregate capital levels produced by the formula for an individual insurance company to correspond to a specific level of any chosen risk measure(s).

   The discussion of the issue is presented in this section of our report in general terms and includes some of the general considerations involved in structuring and calibrating a standard risk-based capital formula for property and casualty insurance companies.[3]

2. The second section contains a discussion of how and to what degree the risks faced by property and casualty insurance companies are reflected in the current NAIC Property and Casualty Risk-Based Capital formula. A detailed explanation of how capital charges for specific risks are calculated is not part of the report. The report provides a description of the capital charges that is based on the report's internal logic of explaining risk treatment in the RBC formula rather than on directly following the prescribed steps of the calculation.[4] Our goal in providing this

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[2] Safety level is the term used in the original request by the SMI RBC Subgroup. This term is explained in the report.

[3] Standard formula is mentioned here in contrast to the internal modeling approaches to solvency capital regulation that have been implemented or proposed in some jurisdictions as an alternative to the standard risk-based capital formula.

[4] The document assumes the reader is generally familiar with the NAIC property and casualty RBC formula. It is not intended to provide instructions for calculating RBC. Detailed directions for the calculation of RBC are contained in the most recent *NAIC Property and Casualty Risk-Based Capital Report Including Overview and Instructions for Companies*. The second report in the attached document does not always follow the steps outlined in the Instructions. For example, the affiliate risk is discussed primarily under the R_0 heading (as R_0 is a natural starting point of considering affiliate investments), even though some elements of the affiliate risk, such as non-insurance investment affiliates, are designated as part of the R_1 and/or R_2 components. (The second report does point out that, in the actual calculation of RBC, such elements as non-insurance investment affiliates are treated as part of the R_1 and/or R_2 components, which follows the RBC calculation specified in the NAIC Instructions.) Numerous specific rules described in the NAIC Instructions are not mentioned at all as they were seen as not being directly relevant to the primary purpose of the report.

The treatment discussed above is consistent with the overall goal of the attached reports. Except where additional detail was needed to address the specific goals of a document, the discussion provides high-level

description is to identify potential shortfalls in the way various risks are treated in the current RBC formula. The shortfalls considered include risks not reflected in the current formula and risks that are included but not fully captured by the formula.

The report indicates the shortfalls that should be handled on a priority basis in any enhancement or redesign of the formula. Five such general areas are identified, including, not in priority order, the treatment in the formula of catastrophe risk, reinsurance credit risk, underwriting risk, asset-related risk, and precision in specifying risk levels.

We hope the attached document is instructive and would be happy to discuss with your group any questions you may have. We hope that our work can assist the NAIC's continued efforts to improve the U.S. insurance solvency framework, of which the RBC system is a critical element. If you have any questions about our work, please feel free to contact Lauren Pachman, the Academy's casualty policy analyst, at pachman@actuary.org.

Sincerely,

Alex Krutov
Chairperson
P&C Risk-Based Capital Committee
American Academy of Actuaries

cc: Alan Seeley, Chair, SMI RBC Subgroup of the Capital Adequacy (E) Task Force
        Kris DeFrain, Director, Actuarial and Statistical, NAIC
        Thomas Herzog, Distinguished Scholar, NAIC

Attachment

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summary descriptions that, by necessity, exclude many important elements. For example, the summary description of the Regulatory Action Level, after specifying that it corresponds to RBC at 100 percent or greater of the authorized control capital, but lower than the 150 percent level, is limited to the statement that, under these conditions, the insurance commissioner is allowed to order corrective action. This description is intended to contrast this level with the Company Action Level, the Authorized Control Level, and the Mandatory Control Level, but it is not intended to include all the other consequences and actions that may or should be taken by the regulator for such a company as enumerated in the *NAIC Risk-Based Capital Model Law*. We encourage readers to refer to the *NAIC Property and Casualty Risk-Based Capital Report Including Overview and Instructions for Companies*, the *NAIC Risk-Based Capital Model Law*, and other source documents for a detailed description of all elements of the NAIC RBC system.

AMERICAN ACADEMY *of* ACTUARIES

January 31, 2011

Mr. Alan Seeley
Chair, SMI RBC Subgroup
Capital Adequacy (E) Task Force
National Association of Insurance Commissioners

Dear Alan,

On behalf of the American Academy of Actuaries,[1] I am pleased to provide you the attached report in response to your request for assistance with the Solvency Modernization (SMI) project focusing on the NAIC's Risk-based Capital (RBC) formula.

Attached to this letter are separate sections prepared by the Academy's Health, Life, and Property/Casualty RBC committees with information on the following:

1. Any intended or expected safety levels for RBC in aggregate for the original Life, Health and P&C RBC formulas as well as any safety level calibrations underlying individual risk factors within the current formulas.

2. An identification of risks that are missing from RBC and a consideration of which of those risks may be reasonably quantifiable or otherwise merit inclusion in RBC. For those missing risks that may be quantifiable, advice on potential approaches to such quantification. This analysis should also consider potential enhancements, if any, to the inclusion of risk mitigation practices in RBC.

While there are three separate RBC formulas, there is at least one thing that they all have in common: None of the formulas contain an explicit safety level for aggregate RBC. The RBC formulas were not designed by establishing aggregate RBC at an explicit calibration level where this calibration level coincides with a statistical outcome. As explained in the attached, some of

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[1] The American Academy of Actuaries is a 17,000-member professional association whose mission is to serve the public on behalf of the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

the capital charges for individual risks are defined by an explicit calibration point, but aggregate RBC in the US RBC formulas is based on the sum of the capital charges for each of the individual risks with an offset for assumed risk correlation. In addition, we have identified some risks that are not covered by the current formulas. We look forward to discussing our responses with the SMI RBC Subgroup in more detail. Please contact Craig Hanna at 202.223.8196 for scheduling.

Sincerely,

Mary Frances Miller
President, American Academy of Actuaries

cc: Kris DeFrain, Dan Swanson, Alex Krutov, Tim Wisecarver, Donna Novak, Tom Wildsmith, Nancy Bennett, Art Panighetti, Henry Siegel, Craig Hanna

Contents:

<u>Section I:</u>

Reports of Property/Casualty Risk-Based Capital Committee:

- **Subcommittee on Safety Levels in Property/Casualty Risk-Based Capital**
- **Subcommittee on Missing Risks and Measurement Shortfalls**

Report of the American Academy of Actuaries' Subcommittee on Safety Levels in Property/Casualty Risk-Based Capital

Safety Levels in NAIC Property/Casualty Risk-Based Capital

Presented to the National Association of Insurance Commissioners' (NAIC) Solvency Modernization Initiative Subgroup of the Capital Adequacy Task Force

January 2011

The American Academy of Actuaries' mission is to serve the public on behalf of the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

Subcommittee on Safety Levels in P/C RBC of the American Academy of Actuaries
Alex Krutov, FCAS, MAAA, ASA, CERA, Chair

Robert Butsic, ASA
Allan Kaufman, FCAS, MAAA

Safety Levels In NAIC Property/Casualty Risk-Based Capital

This document provides a brief summary of considerations regarding the safety levels and calibration of the Property/Casualty Risk-Based Capital (RBC)[2] formula currently used by the National Association of Insurance Commissioners (NAIC).

Risk-Based Capital

The NAIC RBC system was created to protect the interests of policyholders and society by providing a capital adequacy standard related to risk and giving regulators the authority to enforce compliance.

The RBC calculation uses a standardized formula to determine a minimum amount of capital below which company or regulatory action is required. The degree of action depends upon the relation between the actual capital and the RBC result, as well as the existence of any mitigating or compounding issues.

The RBC system currently has four action and control levels:

Company Action Level	(200 percent of Authorized Control Level [ACL])
Regulatory Action Level	(150 percent of ACL)
Authorized Control Level	(100 percent of ACL)
Mandatory Control Level	(70 percent of ACL)

At the Company Action Level, the company must submit a plan to improve its capital position. At the Regulatory Action Level, the insurance commissioner is allowed to order corrective actions. At the Authorized Control Level, the insurance commissioner is authorized to take control of the company. At the Mandatory Control Level, the company must be taken into supervision.

Terminology

The term "safety level" used by the NAIC usually means the degree of certainty that an insurance company will be able to meet its financial obligations or that the financial losses from insurance company insolvencies will stay below a certain level.

In other words, "safety level" could refer to the probability of an insurance company being unable to fulfill its obligations to policyholders or others, the expected loss from such insolvencies, or any predetermined levels of risk measure(s) chosen to quantify insolvency risk. Examples of such statistical measures include probability of ruin (or, closely-related, Value-at-

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2 Overview and Instructions for Companies, NAIC Property and Casualty Risk-Based Capital Report, National Association of Insurance Commissioners, 2010

Risk [VaR]) and expected policyholder deficit (or, closely-related, Tail Value-at-Risk [TVaR][3]), calculated over a certain time horizon.

The use of the term "safety level" usually implies that such a risk measure has been chosen and consistently applied to assess solvency of insurance companies.

Considerations and Observations
Given this definition of the term "safety level," the following observations can be made:

Choice of Minimum Required Capital Level
Proper choice of RBC level is an important factor in insurance solvency regulation. It should be guided by the goals of optimizing policyholder interests and facilitating the efficient function of the insurance industry.

- Setting required capital levels too low is undesirable, as it would lead to unacceptably high insolvency risk detrimental to policyholders and other parties.
- Overly stringent capital requirements also could damage policyholder interests in the long run by impeding competition and potentially creating affordability and accessibility problems.

Function and Importance of the NAIC Property/Casualty (P/C) RBC Formula
Introduction of the NAIC Risk-Based Capital framework in the 1990s was a major advance in insurance solvency regulation in the US.

- The NAIC RBC formulas calculate capital level requirements intended to be commensurate with the risk of insolvency faced by insurance companies.[4] Combined with RBC laws adopted in all relevant U.S. jurisdictions, and when used in conjunction with other solvency monitoring tools, it establishes risk-based company action warning levels and allows regulators to take control of an insurance company if its capital falls below defined minimum levels.
- The NAIC RBC formula, in conjunction with the rest of the solvency regulatory structure, has likely served an important role in limiting the number and financial costs of insolvencies in the insurance industry.

Effectiveness of RBC in Capturing Insolvency Risk
Analysis of the safety levels underlying the RBC formula includes examining how well capital charges in the RBC formula correspond to the true insolvency risk levels. RBC solvency targets

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[3] TVaR is also referred to as Conditional VaR (CVaR) or Conditional Tail Expectation (CTE), though CTE sometimes has a slightly different meaning.

[4] Vincent Laurenzano, "Risk Based Capital Requirements for Property and Casualty Insurers: Rules and Prospects," in *The Financial Dynamics of the Insurance Industry*, E.I. Altman and I.T. Vanderhoof (Eds.), New York University, 1995.

are more useful to regulators if they more accurately capture the actual risks faced by insurance companies.

 – While the present NAIC RBC formula is an important and useful tool, it does not fully capture, nor does it fully distinguish among, risks faced by insurance companies. One assessment of these risk measurement shortfalls is presented in the Report on Missing Risks and Measurement Shortfalls in the Current NAIC Property/Casualty Risk-Based Capital prepared by the P/C RBC Committee of the Academy.[5]

 – As that report notes, certain risk elements are not directly reflected in the current NAIC RBC formula even though their magnitude can be significant. An example is the risk of wide-scale insurance losses from a hurricane or an earthquake; this and other examples are discussed in the aforementioned report.

 – No standard risk-based capital formula can or should attempt to capture all company-specific risks. Certain risk elements are not material, while others cannot be accurately measured, and making company-specific risk provisions for them may be inappropriate. There are risk elements that may be best monitored outside of the standard RBC formula. The use of customized (internal) models, rather than one standard formula, if done properly, can lead to improved accuracy in the calculation of required capital. The current NAIC RBC framework does not include the option of using customized models. Rather, it requires that one standard formula be used for calculating regulatory capital. The use of a standard formula by every insurance company has both advantages and disadvantages.

Lack of True Statistical Calibration of Aggregate RBC

No statistical risk measure for the aggregate required capital was explicitly used in the design of and parameter selection for the current NAIC P/C RBC formula.

 – The regulatory capital levels based on the formula cannot be viewed as corresponding to specific levels of a statistical risk measure because no such measure was explicitly chosen. This can be viewed as a weakness and an area of potential improvement in the current approach.

 – While the reasoning behind the selection of some of the elements of the formula is not known, the process included both detailed financial analysis of many individual companies (to limit the number of "false positives" produced by the formula) and a review of insolvencies (to test for "false negatives.") That and other testing of the formula served as input into the final calibration of the formula and the choice of many specific factors.

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[5] *Report on Missing Risks and Measurement Shortfalls in the Current NAIC Property/Casualty Risk-Based Capital*, Subcommittee on Missing Risks and Measurement Shortfalls of the Property/Casualty Risk-Based Capital Committee, American Academy of Actuaries, January 2011.

Mixture of Statistical and Judgment-Based Calibration in RBC

A significant degree of judgment was utilized in designing the current NAIC P/C RBC formula, choosing parameters used to calculate capital charges for individual risks, and specifying risk dependency.

– Some statistical testing was performed. For example, the asset risk charge for unaffiliated common stock can probably be seen as calibrated to the 95th percentile, or what was determined to be approximately equal to the 1 percent expected policyholder deficit ratio.[6,7]

– Expert judgment was the main determinant of risk factor choice. The factors used in the calculation of capital charges for most risks have not been statistically calibrated. For example, the choice of a 10 percent credit risk charge for reinsurance recoverables[8] appears not to be based on statistical analysis. Another example is the choice of capital risk factors for the underwriting risk charge, which does not seem to be based on a defined level of any statistical risk measure.

– Some factors and approaches were intended to provide incentives for certain behavior or for public policy reasons.[9]

– The approach used for calculating risk-based capital assumes that some risks are perfectly correlated, while others are not correlated at all ("covariance adjustment"). The way that risk dependency is reflected in the RBC formula is as important as the way individual risks are treated.

Challenge of Calibrating RBC

The difficulty of precise calibration of the risk-based capital formula faced by the NAIC is highlighted by the fact that non-U.S. jurisdictions seem to have been similarly challenged. This difficulty is also evident in the very selection of the level to which a chosen risk measure is calibrated.

- Standard formulas (when internal models are not used) in Solvency II,[10] the Swiss Solvency Test, and the Bermuda Monetary Authority approach all appear to use

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[6] Sholom Feldblum, *NAIC Property/Casualty Insurance Company Risk-Based Capital Requirements*, Proceedings of the Casualty Actuarial Society, 1996, LXXXIII, pp. 297-435, available at www.casact.org/pubs/proceed/proceed96/96297.pdf.

[7] The specific factors were based on the recalibrated original common stock charge in the life insurance RBC formula. There are concerns about the consistency and accuracy of these calculations, and the data used may not reflect the current risks associated with this type of asset. The expected policyholder deficit level as calculated does not necessarily apply to an individual company. The question of the time horizon used in the calculation of the 95th percentile was never fully resolved.

[8] In addition, the factor is applied uniformly and does not reflect differences in the quality of reinsurance protection (reinsurer-specific credit risk) or reinsurer concentration level.

[9] Examples include not reflecting collateral in determining reinsurance credit risk and not treating small and large companies differently for the company-experience adjustment.

[10] This pertains to Solvency II in its current form. Future adjustments are expected.

significant judgment in risk factor and dependence ("correlation") calculations. It is not always possible to determine whether the target levels are achieved.

- In jurisdictions in which a concrete solvency risk measure is used or proposed, the choice of its particular level usually involves judgment. For example, Solvency II chooses the threshold of the 99.5 percent Value-at-Risk level, which generally implies a failure once in 200 years on average. To a significant degree, the chosen level appears to be based on judgment. Although it may be theoretically possible to determine the economically optimal solvency threshold, in practice, such a determination would still involve making a carefully-considered judgment call.

Individual Company Risk and Potential Industry Losses

The decision of what risk measure(s) to use and what levels of the risk measure(s) constitute appropriate "safety levels" also depend on whether the focus of the assessment is risk to an individual company or also to the whole insurance industry.

– The typical view is that, even though most factors in calculating individual company capital requirements may come from industry experience, the RBC formula is intended to look at the solvency of individual companies. This is a valid view that reflects the main purpose of risk-based capital requirements.

– Another relevant issue is the potential for large interdependent industry losses from insolvencies. The risk here is of systemic shocks to the industry, i.e., events affecting many insurance companies at the same time, leading to multiple related insolvencies. Standard formulas, focused on individual company risk assessment, and neglecting correlation among companies, do not fully mitigate this risk to the overall industry. While possibly small, this risk is seen by some as the most important, because simultaneous insolvencies by many companies can overwhelm the guaranty fund system and lead to widespread disruption in the way insurance markets function. One way to address this risk is to take into account the extreme scenarios incorporating such industry-wide events when calculating RBC for individual companies.

These are just some of the considerations regarding the safety levels and calibration of the Property/Casualty RBC formula currently used by the NAIC. A detailed description of the NAIC P/C RBC formula and the considerations involved in its development can be found in the *NAIC Property/Casualty Insurance Company Risk-Based Capital Requirements* article.[6] An intelligent and informative view on the future of solvency regulation is presented in "Financial Stability and Insurance Regulation: The Future of Prudential Regulation."[11] A useful discussion of the shortfalls and potential areas for improvement to the NAIC P/C RBC formula is contained

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11 Terri Vaughan, "Financial Stability and Insurance Regulation: The Future of Prudential Regulation," *The Geneva Papers on Risk and Insurance*, Vol 29, No 22, April 2004, pp. 258-272.

in the *Missing Risks and Measurement Shortfalls in the Current NAIC Property/Casualty Risk-Based Capital* report, also prepared by this Committee.[5]

Report of the American Academy of Actuaries' Subcommittee on Missing Risks and Measurement Shortfalls

Missing Risks and Measurement Shortfalls in the Current NAIC Property/Casualty Risk-Based Capital Formula

Presented to the National Association of Insurance Commissioners'
Solvency Modernization Initiative Subgroup of the Capital Adequacy Task Force

January 2011

Subcommittee on Missing Risks and Measurement Shortfalls
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Saeeda Behbahany, ACAS, MAAA
Kendra Felisky, FCAS, MAAA
Alex Krutov, FCAS, MAAA, ASA, CERA
Thomas Le, FCAS, MAAA
Harvey Sherman, FCAS, MAAA
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Mark Verheyen, FCAS, MAAA, CERA, ASA

Property/Casualty Risk-Based Capital Committee
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Navid Zarinejad, FCAS, MAAA

Contents

1. Subcommittee Charge

Charge

The charge of the Subcommittee on Missing Risks and Measurement Shortfalls of the Property/Casualty Risk-Based Capital (RBC) Committee is to prepare a document identifying apparent shortfalls in the National Association of Insurance Commissioners (NAIC) Property & Casualty (P/C) RBC formula and selecting the shortfalls that should be handled on a priority basis. The shortfalls considered include risks not reflected in the current formula and risks that are included but not fully captured by the formula.

Scope

From the perspective of this Subcommittee, a shortfall is identified as a case in which the measure either understates or overstates the risk.

The scope of work of this Subcommittee does not include providing specific recommendations on how to address those apparent shortfalls.

The Academy's Property/Casualty RBC Committee is working on a number of related issues. It has requested research assistance from the Casualty Actuarial Society (CAS) to complete some of its work.

This paper assumes the reader is generally familiar with the property/casualty RBC formula.[12]

Note

In this paper, references to "we," "our," or "the Subcommittee" allude to the Academy's Subcommittee on Missing Risks and Measurement Shortfalls of the Property/Casualty Risk-Based Capital Committee.

We use the term "Missing Risks" to include both missing risks and measurement shortfalls.

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[12] For a comprehensive description of the formula and its initial basis, see Feldblum, Sholom, NAIC Property/Casualty Insurance Company Risk-Based Capital Requirements, *Proceedings of the Casualty Actuarial Society,* 1996.

2. Nature of Risks/Gaps in the RBC Formula ("Missing Risks")

RBC

The NAIC RBC system was created to provide a capital adequacy standard that is related to risk, raises a safety net for insurers, provides uniformity among the states, and supplies regulatory authority for timely action.[13]

The RBC calculation uses a standardized formula to determine a minimum amount of capital below which company or regulatory action is required. The degree of action depends on the relationship between the actual capital and the RBC result, as well as the existence of any mitigating or compounding issues.

The RBC currently has four action and control levels:

Company Action Level	(200 percent of Authorized Control Level [ACL])
Regulatory Action Level	(150 percent of ACL)
Authorized Control Level	(100 percent of ACL)
Mandatory Control Level (MCL)	(70 percent of ACL)

At the Company Action Level, the company must submit a plan to improve its capital position. At the Regulatory Action Level, the insurance commissioner is allowed to order corrective actions. At the Authorized Control Level, the insurance commissioner is authorized to take control of the company. At the Mandatory Control Level, the company must be taken into supervision.

Origin of Gaps

Gaps in the RBC formula can arise for a variety of reasons, including the following types:

1. A risk that is excluded intentionally.

2. A risk that is not recognized but should be.

3. A risk that is considered, but the impact of the risk is not sufficiently reflected in RBC parameter selection, e.g., because the events related to the risk are not fully reflected in the data from which the risk impact is measured.

4. Risks that are reflected, but the parameters do not sufficiently reflect variations in risk between companies.

A missing risk of type 1 may be intentionally excluded for a number of reasons. It may be excluded because the risk is not material or because the risk is outside the "window" considered by the capital system, e.g., outside the 1 in 200 year event horizon of Solvency II. It may be

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[13] NAIC Risk-Based Capital, General Overview, July 2009, available at
http://www.naic.org/documents/committees_e_capad_RBCoverview.pdf.

excluded because it is a risk that is not pre-funded by capital, e.g., liquidity, which is handled by liquidity strategies rather than capital.

Missing risks of types 2 or 3 will tend to understate the total industry RBC.

A missing risk of type 4 would tend to result in RBC that does not sufficiently reflect differences in capital requirements by company. A change in RBC formula for such risks would produce increases in RBC for some companies and decreases for other companies. With regard to type 4 missing risks, however, any capital formula that is not an individual company model will not reflect all company-to-company differences.

Practicality

A gap in the formula may also be identified from the perspective of practicality, and, from that perspective, risks may be classified as to whether:

1. We know how to measure them.
2. We are unsure of how to measure them, and analysis is required to determine whether a solution can be developed.
3. We currently do not know how to properly measure them.

This Subcommittee has considered the issue of practicality in selecting its priorities.

Historical Considerations

The P/C RBC formula was adopted in December 1993 to be effective in December 1994 Annual Statements. The analysis and decisions underlying the formula date from 1990-1993.[14] The formula reflects the following considerations during that time frame:

1. It provided for regulatory action when company capital fell below the RBC level, without requiring a lengthy court proceeding.
2. RBC was a very new regulatory arrangement, and the effect of its implementation was uncertain.
3. All data was to come from the Annual Statement.
4. Ease of calculation was important.
5. The basis and the results needed to be understandable and transparent to insurance executives and regulators.
6. It had to incent the right behavior and not incent the wrong behavior.
7. There was a lower level of familiarity with modeling by users (in-company, out-of-company, and within the regulatory community).

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[14] The Subcommittee recognizes, and its conclusions reflect, the extent to which some of the factors have been changed since their initial implementation.

A number of the Subcommittee's overarching recommendations result from reconsidering the extent to which these considerations currently apply.

3. Approach

We first considered the major risk areas reflected in the current P/C RBC formula:

Table 1
RBC Risk Areas

R_0	Asset Risk – Subsidiary Insurance Cos
R_1	Asset Risk – Fixed Income
R_2	Asset Risk – Equity
R_3	Credit
R_4	Underwriting – Reserves
R_5	Underwriting – Premium
Other	Issues addressed in the overall formula

Then, within each of those risk areas, we considered the following:

- The experience of the Subcommittee members and others with whom the Subcommittee consulted.

- How RBC operates for the risks that are particular to specialized companies, such as reinsurers, mono-line companies (medical professional liability, auto, workers' compensation, and others), small regional carriers, etc.

- Risks considered in research related to Solvency II and other capital measures.

Next, we compiled a list of the risks or issues related to the RBC formula. Those lists, organized by risk area, are shown in Section 11.A to F. Section 11.G covers the risks and issues that do not readily fit within the individual risk categories, generally because they affect more than one risk area. In Section 10, we identify potential issues; we do not discuss or evaluate the issues. That would be a larger project than intended by this document.

Finally, we used these lists to select a small number of priority items. These priorities are listed in the summary Section 0 and discussed individually in Sections 5 to 9.

4. Priority Risks

The Subcommittee believes that the risks and calibrations that deserve the most attention in the short term are the following:

1. R5, R3 – Catastrophe risk
2. R3 – Credit for Reinsurance
3. R4 and R5 – Underwriting and Reserve Risk – – Investment Income Offset
4. R0, R1, R2 – Relationship between Life and P&C risk factors for assets and treatment of foreign affiliates
5. All – Specification of Risk Levels (i.e., the risk metric used, such as Value at Risk (VaR), Tail Value at Risk (TVaR), etc., and the value chosen for the risk metric and time horizon in determining various RBC levels.

The Property/Casualty Risk-Based Capital Committee of the Academy is reviewing the way some of these risks are reflected in the RBC formula, and the CAS is providing research assistance in the analysis of the underwriting risk factors in R4 and R5, risk dependency, and the overall structure of the RBC formula. Those broader reviews are important, but we have identified a set of more narrowly-focused issues corresponding to the Subcommittee charge.

5. Priority 1 – Natural and Man-Made Catastrophes (R5, R3)

Current Treatment

These risks are largely reflected in R5, underwriting – premium risk. The catastrophe risk is an implicit part of the factor applied to net earned premium.[15]

Shortfalls in the Current Treatment

Catastrophe risks are considered in the current RBC formula only to the extent that such catastrophes are part of the variation in loss ratios net of reinsurance that is used to calibrate the risk factors. This is problematic as the occurrence or non-occurrence of catastrophes is sufficiently random that any data set of observed data for a 10-year period is only a rough approximation of the actual risk.

Moreover, subject to the effect of the own-company adjustment, the RBC factors assume that, for relevant lines of business, each company's reinsurance program produces the same required risk-based capital, net of reinsurance, as the average company. That assumption is problematic in that individual companies' risk profiles vary significantly. Also, use of the industry factors assumes that the relative exposure of different companies to the risk is adequately represented by written premium reported in the Schedule P line.

The own-company adjustment is not specifically designed to, and is unlikely to, correct for these shortfalls in the catastrophe treatment. Therefore, these issues remain.

Catastrophes may also create credit risk associated with the reinsurance recoveries from such events. Even companies with the same catastrophe risk net of reinsurance may have different ceded reinsurance credit risks that are not reflected in the formula.

The R3 reinsurance credit risk factor is 10 percent applied to existing (i.e., balance sheet) ceded loss reserves and does not consider the potential reinsurance credit risk for future significant events such as catastrophes. Also, R3 does not adequately distinguish the ceded reinsurance credit risk between companies that may have the same level of catastrophe risk net of reinsurance but different levels of risk gross of reinsurance.

Historical Observations

The current treatment of catastrophes in the P/C RBC formula reflects the historical considerations described in Section 2, in particular:

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[15] If there are unpaid claim reserves related to a catastrophe event, then R3 includes a reinsurance credit risk component equal to 10 percent of the ceded loss reserve.

1. At the time the RBC formula was developed, input data was to be publicly available, coming from an Annual Statement that would be audited.

   Currently, while most data used in the RBC formula is from the Annual Statement, there are some exceptions.

The current treatment of catastrophes in the RBC formula reflects the limitations in technology that was used at the time the RBC formula was designed:

2. At the time the RBC formula was developed, catastrophe models were seen as less reliable, and the routine use of such models was less extensive than it is today.

   Catastrophe modeling is now routinely used in primary and reinsurance pricing and is typically part of insurance company reporting to rating agencies.

The Catastrophe Risk Subgroup of the Property/Casualty Risk-Based Capital Working Group of the Capital Adequacy Task Force is studying the incorporation of a property catastrophe risk into the RBC formula. The Property/Casualty Risk-Based Capital Committee of the Academy intends to provide comments to assist in the development of the catastrophe charge in the NAIC RBC formula.

Desirable Changes

The optimum change would include the following:

1. Assessment of gross and net risk related to all types of catastrophes based on appropriate modeling of individual company exposures

2. "Catastrophes" would include hurricanes, earthquakes, regional storms (e.g., tornadoes),[16] terrorism,[17] and any other property-related catastrophe risks specific to the company.

3. An assessment of the risk based on a specified metric, e.g., does RBC provide for a 1 in 100, 1 in 200, 1 in 250, or 1 in 500 year event?

4. The availability and cost of reinstatement premiums for second and subsequent events

5. The cost of associated assessments, such as those from windstorm pools and other residual market mechanisms

6. The cost for both property lines and the workers' compensation line (especially with regard to earthquakes).

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[16] Regional tornadoes, hail, etc. may not be significant for larger insurers with geographic diversification and catastrophe protection limits required by hurricane and earthquake risk. However, regional tornadoes, hail, etc. may be significant for some companies.

[17] Including property, workers' compensation, accident and health liability, and other claims arising from terrorist events.

7. Credit risk on reinsurance recoveries (R3), including likely increases in credit risk for many reinsurance programs in the event of multiple major catastrophes, both in terms of a higher company reinsurance recoverable post-event, as well as the risk of increased reinsurer default after a significant industry event.

Considerations Related to the Desirable Changes

1. The desired change is more easily handled for hurricane and earthquake exposure, less easily handled for terrorism and regional exposures, and, to some extent, less easily handled for exposures outside the U.S. (although expansion of regulatory attention to catastrophe assessment outside the U.S. helps in that regard).

2. While terrorism risk assessment may be more difficult, it is potentially a larger addition to the RBC requirement for some companies.

3. The impact of the Terrorism Risk Insurance Act of 2002 (TRIA) and its progeny in mitigating terrorism risk should be considered, to the extent that a charge for terrorism risk is included.

4. All else equal, the remaining net premium RBC factors (R5) may need to be reduced in light of any separate provision for catastrophe risk, although likely not by the full amount of the capital requirements indicated by catastrophes alone.

5. After the first event, reinsurance credit risk for second event coverage may be greater than credit risk for the first event, as the reinsurance industry security post-catastrophe would be lower than pre-catastrophe.

6. The use of "realistic disaster scenarios,"[18] in part standardized across companies, may help address more complex risks that do not fit standard models.

7. As it may not be possible to model some types of catastrophe risks, a provision for the remaining risk may be necessary

8. The change discussed above relates to property catastrophes,[19] although liability catastrophes, commonly known as mass torts, also deserve RBC attention.

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[18] Perhaps, in part, "realistic disaster scenarios" could be standardized across the industry, by regulatory action, by accepted business practice, or otherwise.

[19] This change relates to property catastrophes including workers' compensation, accident and health liability, and other claims arising from initially property-related events.

6. Priority 2 – Credit for Reinsurance (R3)

Current Treatment

Reinsurance credit risk factor is 10 percent applied to ceded loss reserves.

Various factors are applied to other receivables.

Shortfalls in the Current Treatment

The factor is based on judgments applied to a number of interrelated issues and is not based on statistical analysis.

The current factor is not calibrated to a particular risk level.

The factor does not reflect variation in credit risk by reinsurer.

The R3 reinsurance credit risk factor does not consider the potential reinsurance credit risk for future significant events like catastrophes.

Historical Observations

The 10 percent charge is intended to reflect four elements:

- pure reinsurer credit risk,
- the extent to which the ceded reinsurance liability may be underestimated,
- the extent to which risk transfer to the reinsurer may be limited,[20]
- the possibility of disputes regarding coverage.

At the time of development, there was significant concern about the quality of reinsurance.

The uniform 10 percent factor, regardless of whether the reinsurer was large or small, U.S. or alien, or subject to collateral or not, resulted in part from an effort to avoid creating unnecessary bias for or against the purchase of reinsurance generally or purchases from different types of insurers.

Conditions have changed in that:

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[20] Many reinsurance contracts do not contain full risk transfer. For example, there may be loss ratio or other limits on the aggregate amounts recoverable from the reinsurer or additional premiums payable to the reinsurer based on the ceded claims amount. Since the effect of loss limits and additional premiums are not reflected, the reinsurance credit risk charge was set at a higher level than would otherwise be the case.

- There is increased financial and regulatory scrutiny of insurers and reinsurers in the U.S. and in other jurisdictions.

- There is increased attention to gross and ceded reserves in addition to net reserves.

- Risk transfer aspects of reinsurance are monitored much more closely to limit the financial reporting benefit from reinsurance transactions that do not have sufficient risk transfer, including extensive disclosures in the Annual Statement and an attestation of the CEO and CFO as to the treatment of reinsurance.

- In part because of the increased attention on risk transfer, it is currently common to use modeling to measure the extent of risk transfer.

Desirable Changes

The optimum change would include the following:

1. Consideration of each risk component.

2. Modeled charges for limits on risk transfer, as part of point 1 above.

3. Realistic charges for credit risk, possibly including recognition of concentration risk in counterparties or, alternatively, diversification benefits when multiple counterparties are utilized, as well as the reinsurer-specific credit risk.

4. Modeled charges for limits on risk transfer.

5. Charge for risk of reinsurance disputes based on modeling or judgment.

Considerations Related to the Desirable Changes

Changes in the credit risk charges could have an important effect on company behavior in purchasing reinsurance; therefore, RBC changes must be well-considered.

7. Priority 3 – Underwriting Risk Factors – Investment Income Offset (R4, R5)

Current Treatment

The premium and loss reserve factors in R4 and R5 are based first on risk factors gross of future investment, and then those factors are reduced using a 5 percent interest rate over the expected payment period.

Shortfalls in the Current Treatment

The interest rate has remained at 5 percent even though the available yields have decreased over time and are currently at all-time lows.

Historical Observations

The 5 percent interest rate was selected when interest rates on new funds were 7 percent or more.

Desirable Changes

Update factors based on current yields, resulting in a more realistic reflection of investment income.

Considerations Related to the Desirable Changes

The margin over risk-free rates must be selected, if the factors are to be related to, but higher than, risk free rates.

In theory, the interest rate used to adjust the premium factors should vary annually and be current each year. The interest discount used to adjust the reserve factors should vary with changes in the embedded yields. Embedded yield depends on the extent to which assets are valued at amortized cost or market value.

Year-to-year movement in RBC factors may be viewed as undesirable, particularly as the movement may be both up and down over time. Therefore, factors may be adjusted on a moving-average basis, or factors may be changed periodically, e.g., every two or three years.

To the extent that other changes in underwriting factors are expected, the change in interest rate may be made at the same time. However, the change in interest rate can be done without an overhaul of the underwriting factors, because this change in interest rate is a separable issue and may be more straightforward than changes in underwriting factors, generally.

8. Priority 4 – Asset Factors (R0, R1, R2)

Current Treatment

Factors are applied to various types of assets. The Subcommittee notes the following:

1. With respect to insurance affiliates for which RBC is not available, the RBC factor for alien affiliates is 0.50 of book value, and the RBC factor for other affiliated insurers is 0.225.

2. Except in specific situations, RBC asset factors are the same for life, health, and P&C companies.

Shortfalls in the Current Treatment

There were a number of judgments, but no statistical basis, for the treatment of alien insurance affiliates and other affiliated insurers not subject to RBC.

The asset treatment does not recognize the differences in the relationship of assets and liabilities for life and P&C companies.

The treatment includes ad hoc adjustments but no statistical analysis to recognize the differences in accounting treatments for life and P&C companies for certain assets, e.g., fixed income assets in NAIC categories 3, 4, and 5.

Historical Observations

There was no RBC equivalent for alien insurers, and there were concerns about financial reporting and regulation in some non-U.S. jurisdictions. Currently, however, for insurers and reinsurers in other jurisdictions, there is increased use of capital standards, increased level of financial and regulatory scrutiny, increased transparency, increased convergence in financial reporting rules, and more routine communication among regulators.

At the time that RBC was developed, there was far less analysis of asset and liability issues for P&C companies than for life companies, and there was a view that assets should be treated alike for the two kinds of companies.

Desirable Changes

The optimum change would include the following:

1. Alien reinsurers – re-evaluate the RBC charge for alien insurance affiliates.

2. Clarify the basis for P&C factors relative to life factors, considering differences in annual statement valuation and differences in cash flow obligations between the two types of insurance businesses.

Considerations Related to the Desirable Changes

The present treatment was designed thoughtfully, and there may be no practical alternatives.

Converting alien insurer capital requirements to RBC levels of security may be problematic and not necessarily better than the current treatment.

9. Priority 5 – Increased Precision in Specifying Risk Levels (All)

Current Treatment

Individual risks are calibrated to standards of varying degrees of transparency.

The combined P/C RBC is the result of the covariance formula:

$$RBC = R0´ + \text{square root } [(R1´)^2 + (R2´)^2 + (R3´)^2 + (R4´)^2 + (R5´)^2)]$$

where

R0´=R0 less the portions of R0 that are included in R1´ and R2´

R1´= R1 + R0 for fixed income investments of non-insurance affiliates

R2´=R2 + R0 for equity investments of non-insurance affiliates

R3´= (R3)/2

R4´=R4+ (R3)/2

R5´=R5

The risk measures as well as the target risk level tolerance are not specified, but the purpose is to specify four levels of regulatory action depending on the relationship between the "adjusted surplus" held by the company and the "risk-based capital" surplus: (1) the Company Action Level, at which a company must submit a plan to improve its capital position; (2) the Regulatory Action Level, at which the insurance commissioner is allowed to order corrective actions; (3) the ACL, at which the insurance commissioner is authorized to take control of the company; and (4) the MCL at which point the company must be taken into supervision.

Shortfalls in the Current Treatment

Individual risk charges and the combined RBC are not universally calibrated to a transparent risk tolerance against a specified risk metric (VaR, TVaR, confidence level, etc.) and time horizon.

With respect to individual charges, the lack of transparency makes it difficult to express a view on whether a particular charge is too high or too low.

With respect to the combined charge, the lack of transparency makes it difficult to express a view on whether the method of combining individual risks within the formula achieves the objective of the formula. Moreover, it makes it difficult for regulators to compare results across jurisdictions internationally.

Desirable Changes

The optimum change would include the following:

1. To the extent practical, specify the existing risk tolerances, including risk measures and time horizons, by risk and in total, explicit or implicit.

2. To the extent those risk tolerances are based on outdated studies, reevaluate the implication of the parameters against current data.

3. Recognizing that there are limits in the extent to which the risk levels in all the details can be determined, design a roadmap to improving their specificity over time.

4. Consider the risk levels implied by the Company Action, Regulatory Action, Authorized Control, and Mandatory Control Levels.

5. If the regulators were to choose a target, assess the degree to which the formula meets that target.

Considerations Related to the Desirable Changes

Information (distributions) for some significant factors is not available. Thus, the level of risk is not fully known, and any assessment will be, in part, a subjective expert judgment.

Is specifying a level of risk useful, given the purpose of the RBC formula?

There are a number of issues to consider in specifying the risk measure and tolerance:

(a) risk measures such as VaR, TVaR, etc.,

(b) risk tolerance such as 1 in 200, or 1 in 50, 1 percent expected policyholder deficit, etc.,

(c) time horizon such as runoff, one year, or multiple year.

An analysis of all risks may not be practical. In such instances, the analysis might be limited to a subset of risks. For that subset of risks, in aggregate, the analysis should aim to determine a ruin probability, or another risk measure, due to a combination of stochastic and parameter risks, over a specified time period.

10. Analysis

In the following subsections A to F, we consider each of the six risk areas. In each area, we outline the current RBC method and list issues that may be considered in an assessment of gaps in the RBC formula. In subsection G, we list issues that do not readily fit within the six risk categories, generally because they affect more than one risk area. It is beyond the scope of this work to discuss and analyze each of the issues identified in these subsections.

We used the lists to select the "priority" items discussed in Sections 6-10 above.

A. R_0– Asset Risk – Subsidiaries (Affiliate Risk)

Current RBC Method – Key Points

The R0 risk relates to investments in insurance affiliates, non-controlled assets, guarantees for affiliates, and contingent liabilities. The RBC calculations can be complex because the structure of insurance groups can be complex. In simplified terms, the RBC calculation is outlined below.

For directly- and indirectly-owned insurance affiliates, the risk charge is the RBC charge of the affiliate.

Some insurance affiliates are not subject to RBC. These affiliates include owned alien affiliates, title insurers, mono-line financial insurers, and mortgage guarantee insurers. For these insurance affiliates, the RBC charge equals a factor applied to the statement value. The factors are 0.50 for alien affiliates and 0.225 for other affiliates, and these factors are intended to represent the RBC requirements for those insurers.

For non-insurance investment affiliates, factors are applied based on the underlying assets or liabilities of the affiliate. This category includes both managed care organization affiliates and investment affiliates.[21]

In addition there is a .01 charge for off-balance sheet items including non-controlled assets, guarantees for affiliates, and contingent liabilities. A lower factor, 0.002, is applied for security lending programs that meet specified criteria.

Issues to Consider

1. There were a number of judgments, but no statistical basis, for the treatment of alien affiliates. (Priority item 2)

2. The risk charges for affiliates are not calibrated to a transparent risk level. (Priority item 5)

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[21] For purposes of the covariance formula, this portion of the R0 is transferred to R1 or R2 for fixed income or equity assets, respectively.

3. There is no charge for risks that parent companies or other group companies (insurers or non-insurers) create for the subject insurer ("group risk").

4. The definition of "off-balance sheet risk" may not be broad enough, even though off-balance sheet items were reviewed by the NAIC in 2008.

5. Non-insurance affiliates can create risks unrelated to the specifics of the assets or liabilities of the affiliate.

6. The charge for alien affiliates does not consider the extent to which alien insurers are now subject to capital requirements.

B. R₁– Asset Risk – Fixed Income (Fixed Income Risk)

Current RBC Method – Key Points

Assets in this category include cash, bonds, collateral loans, mortgage loans, short-term investments, cash, and other long-term invested assets.

The risk charge is determined by factors that are applied to the statement value of fixed income assets.

Property Casualty Annual Statement values for fixed income assets are amortized cost for NAIC categories 1 and 2 and market value for NAIC categories 3-6.[22]

There is a concentration adjustment for assets (fixed or equity) from a single issuer. R1 includes the fixed income component of that adjustment.

There is a bond size factor to reflect diversification in the bond portfolio.

Issues to Consider

1. There were a number of judgments, but no statistical basis, for the treatment of alien insurance affiliates and other affiliated insurers not subject to RBC. (Priority item 4)

2. The treatment of assets does not recognize the differences in the relationship of assets and liabilities for life and P&C companies. The treatment includes adjustments, but no statistical analysis, to recognize the differences in accounting treatments for Life and P&C companies (fixed income NAIC categories 3, 4, and 5). (Priority item 4)

3. While most risk charges were calibrated to a 95 percent one-year confidence level, some were not calibrated to any specified risk metric, e.g., VaR, TVaR, confidence level, etc., or risk level and time horizon. (Priority item 5)

4. Are the NAIC fixed income categories too broad? For example, should risk factors distinguish between municipal vs. corporate vs. other, beyond those reflected in the NAIC categories?

5. Should there be differences among the types of mortgages and mortgage-linked securities and their inherent risks, beyond those reflected in the NAIC categories?

6. Should liquidity (ability to convert to cash) be considered for all asset classes?

7. For state and municipal assets, should there be a state concentration factor, which would be similar to the single issuer concentration factor?

8. Structured investment products may appear to be fixed income assets, but the risks may be greater than for normal fixed income products.

9. Should the bond size factor be simplified or eliminated?

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[22] Life Annual Statement values are amortized values for categories 1-5.

10. Should investments in sectors or asset classes highly correlated with insurance risk be subject to a higher risk charge or, alternatively, receive less diversification benefit? Examples include direct investment in insurance holding company debt, risk-linked securities such as catastrophe bonds, or structured products consisting of securitized pools of surplus notes.

C. R₂ – Asset Risk – Equity (Equity Risk)

Current RBC Method – Key Points

Assets in this category include unaffiliated common and preferred stock, owned real estate, and other invested assets.

The risk charge is determined by factors that are applied to the statement value of equity assets.

Statement value of equity assets are market values.

There is a concentration adjustment for assets (fixed or equity) from a single issuer. R2 includes the equity component of that adjustment.

Issues to Consider

1. Some risk charges were calibrated, for example, to a 95 percent one-year confidence level or expected policyholder deficit,[23] but some are not calibrated to a specified risk metric, e.g., VaR, TVaR, confidence level, etc., or risk level and time horizon. (Priority item 5)

2. Are risks related to owned real estate properly handled?

3. There is no adjustment for the stock portfolio "beta" or for the risk associated with equity investments that are concentrated in certain industries.

4. Should the risk factor be adjusted if the company has specific risk mitigation plans in place if asset values fall below a certain threshold?

5. The Life and P&C equity charge for unaffiliated common stocks are different.[24]

6. Does the deferred tax credit treatment need further review?

7. Should investments highly correlated with the insurance cycle be subject to a risk surcharge or allowed a reduced diversification benefit?

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[23] Feldblum page 308-9

[24] For health companies, the equity risk charge is the same as for P&C companies.

D. R_3 – Credit Risk

Current RBC Method – Key Points

The credit risk charge equals RBC factors times various balance sheet assets for which there are apparent credit risks. The main asset in this category is often credit for reinsurance recoverables.

The reinsurance credit risk factor is 10 percent applied to existing (i.e., balance sheet) ceded loss reserves.

Issues to Consider

1. Does the formula adequately address the credit risk arising from reinsurance related to catastrophes that might affect policies written but not yet earned? (Priority item 1)

2. The reinsurance credit risk charge is based on the considerations discussed in Section 6 rather than empirical observations of risk impact. (Priority item 2)

3. The current factor is not calibrated to a particular risk level. (Priority items 1 and 5)

4. Differences in reinsurer credit risk level are not considered.

5. Reinsurer concentration risk is not reflected.

6. Should there be different credit risk treatment if a company has credit risk exposure that differs from the norm, e.g., higher than average exposure to agents' balances (including exposure to fast-growing agents' balances), miscellaneous receivables, etc.?

7. Liability reinsurance credit risk extends over longer payment periods than property reinsurance credit risk, but that additional risk is not reflected in the current credit risk charge.

8. Treatment of reinsurance collateral and any interrelationship to the RBC charge.

9. The structure of reinsurance credit charges could have an important effect on company behavior in purchasing reinsurance, and, therefore, RBC changes may have unintended and possibly undesirable consequences.

10. Reinsurance credit risk might vary with the underwriting cycle, but this is not reflected in the current formula.

11. A company's current and historical position with respect to reinsurance disputes may be relevant to the risk assessment.

Current RBC Method – Key Points

This risk charge equals net reserves by Schedule P reserve line of business multiplied by risk factors for each line of business.

The result is adjusted by individual company adverse development experience compared to industry experience using a 50/50 rule.

There is a credit for investment income earned as claims are paid.

There is a credit for loss sensitive contracts.

Risks by line of business are combined with a diversification formula ("70 percent rule").

The initial risk factors are developed from industry adverse loss development ratios by company/Schedule P line of business – individual company ratios are averaged (greatest average value over 9 years used to avoid giving undue influence to larger carriers) to determine the reserve charge. That result is adjusted before it is used.

Issues to Consider

1. The interest rate for the investment income credit has remained at 5 percent, even though the available yields have decreased over time and are currently at all-time lows. (Priority item 3)
2. The risk charges are not calibrated to a transparent risk level. (Priority item 5).
3. The method of calibrating the factors is not completely transparent.
4. Is dependency between lines of business adequately considered?
5. Is the 70 percent rule an appropriate way to measure diversification?
6. The interest rate for investment income credit does not vary based on the duration of the liabilities, even though the yield curve means returns are larger for longer-duration liabilities than shorter-duration liabilities.
7. Should the interest rate be based on a stochastic model?
8. Are the adjustments for loss-sensitive contracts appropriate?
9. Do the charges properly consider risks from unusual causes that are not well-represented in past history, such as:
   a. Risks that are observed but not necessarily considered adequately in calibration for the future – asbestos and pollution claims, construction defect claims, etc.
   b. Risks that are not observed yet (emerging risks) – climate change, nanotechnology, etc.

10. Line of business concentration – do factors apply equally well to companies that are diversified across multiple lines of business as they do to companies with few or even one line of business?

11. Regional concentration – do factors apply equally well to companies that are diversified across regions as they do to companies that are diversified across geography?

12. Risk of reserve inadequacy from mandatory or voluntary pool participation may not be fully recognized by the risk factor calibration method.

13. Does the current treatment of assumed retroactive reinsurance, subject to deposit accounting for Annual Statement purposes, properly reflect the risk involved?

14. Should the reserve factors be adjusted to reflect the position in the underwriting cycle, as reserve adequacy is sometimes seen to vary with rate adequacy?

15. Is the 50/50 treatment of company and industry loss reserve development appropriate?

16. Company size is not reflected, but smaller companies may have greater relative reserve variability (law of large numbers).

17. As the RBC formula relies primarily on NAIC Annual Statement lines of business, risk differences for categories within Annual Statement lines of business may not be sufficiently reflected. For example, the risk factors are the same of Directors' and Officers' (D&O) policies, lawyers' professional liability policies, and liability policies for both small and large retail businesses. Does this obscure significant risk differences?[25]

18. Should the risk factors be higher for new companies and companies with new lines of business or operations in new geographic areas?[26]

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[25] Some portion of the difference would be reflected by the adjustment for individual company experiences.

[26] Some portion of the difference might be reflected in the growth charge.

F. R$_5$ – Underwriting Risk – Premiums

Current RBC Method – Key Points

This risk charge equals net premium by Schedule P lines of business multiplied by risk factors for each line of business.

The result is adjusted by individual company adverse development experience compared to industry experience using a 50/50 rule.

An additional charge is applied for "excess growth."

There is a credit for investment income earned as claims are paid.

There is a credit for loss-sensitive contracts.

Risks by line of business are combined with a diversification formula ("70 percent rule").

The initial risk factors are developed from industry loss ratios by company/Schedule P line of business; individual company loss ratios are averaged (greatest average value over 9 years used to avoid giving undue influence to larger carriers) to determine the premium charge. That result is adjusted before it is used.

Issues to Consider

1. Natural and man-made catastrophes (Priority item 1)

2. The interest rate for the investment income credit has remained at 5 percent even though the available yields have decreased over time and are currently at all-time lows. (Priority item 3)

3. The risk charges are not calibrated to a transparent risk level. (Priority item 5).

4. Is the treatment of risk related to unearned premium appropriate?

5. The method of calibrating the factors is not completely transparent.

6. Is dependency between lines of business adequately considered?

7. Is the 70 percent rule an appropriate way to measure diversification?

8. The interest rate for investment income credit does not vary based on the duration of the claim payments, even though the yield curve means returns are larger for longer-duration liabilities than for shorter-duration liabilities.

9. Should the interest rate be based on a stochastic model?

10. Are the adjustments for loss-sensitive contracts appropriate?

11. Do the charges properly consider risks from unusual causes that are not well-represented in past history, such as:

    a. Risks that are observed but not necessarily considered adequately in calibration for the future – asbestos and pollution claims, construction defect claims, etc.

      b. Risks that are not observed yet (emerging risks) – climate change, nanotechnology, etc.

12. Related to the above – is the risk of liability "catastrophes" sufficiently considered?

13. Related to the above – to what extent should the RBC formula consider the risk of new types of claims not reflected in past data?

14. Line of business concentration – do factors apply equally well to companies that are diversified across multiple lines of business as they do to companies with few or even one line of business?

15. Regional concentration – do factors apply equally well to companies that are diversified across regions as they do to companies that are diversified across geography?

16. Risk of unexpected underwriting losses from mandatory or voluntary pool participation – residual market arrangements, property catastrophe arrangements, nuclear pools, guarantee funds, etc.

17. Should the premium factors be adjusted to reflect the position in the underwriting cycle?

18. Is the 50/50 treatment of company and industry loss ratios appropriate?

19. Risk that regulatory constraints would restrict rate changes or underwriting criteria modifications

20. Company size is not reflected, but smaller companies may have greater relative loss ratio variability (law of large numbers).

21. As the RBC formula relies primarily on NAIC Annual Statement lines of business, risk differences for categories within Annual Statement lines of business may not be sufficiently reflected. For example, the risk factors are the same for D&O policies, lawyers' professional liability policies, and liability policies for both small and large retail businesses. Does this obscure significant risk differences?[27]

22. Should the risk factors be higher for new companies and companies with new lines of business or operations in new geographic areas?[28]

23. Rate adequacy is a major risk factor, but it is reflected based on historical variability rather than more directly for the historical or current company position. Is there a better way to reflect this risk?

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[27] Some portion of the difference would be reflected by the adjustment for individual company experiences.

[28] Some portion of the difference might be reflected in the growth charge.

G. Other Issues

This section identifies issues that do not readily fit within any of the individual risk categories.

i. Dependency and Other Structural Issues

The combined P/C RBC is the result of the covariance formula

$$RBC = R0´ + \text{square root } [(R1´)^2 + (R2´)^2 + (R3´)^2 + (R4´)^2 + (R5´)^2)]$$

Where:

R0´=R0 less the portions of R0 that are included in R1´ and R2´

R1´= R1 + R0 for fixed income investments of non-insurance affiliates

R2´=R2 + R0 for equity investments of non-insurance affiliates

R3´= (R3)/2

R4´=R4+ (R3)/2

R5´=R5

The issues with respect to this formula and dependency generally include the following:

a. Does this properly express the dependency among the risk elements?
b. Is dependency within each risk element properly handled?
c. The risk level and time horizons should be consistent across the different risk elements.
d. The risk level and related risk factors might be derived from scenarios that could better describe the relationship among the risks and therefore better describe the dependency structure.

ii. Other Possible Risk Areas

e. Operational risk[29]
f. Interest rate risk not otherwise considered
g. Liquidity risk
h. Currency risk
i. Hyper-inflation/deflation and their effect on both assets and liabilities
j. Extreme events or other risks not otherwise considered

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[29] **Operational risk** in this context might be defined as the risk of loss not otherwise considered resulting from inadequate or failed internal processes, people and systems, or from external events.

iii.   When the Company is not Average

The RBC calibration, by its nature, largely selects factors appropriate for an average company.

k. Should there be additional risk charges, with adjustments for possible double counting with factors already considered in the RBC formula (points up or down for a basket of possible variations from "average"), for factors like those identified in the NAIC Financial Analysis Solvency Tools system:

- Changes within a company: growth in combined ratio, reduced liquidity, growth in agents' balances, growth in expenses, growth in ratio of affiliate investment to surplus;

- Higher than average ratios: affiliate receivables to surplus, miscellaneous receivables to surplus, non-investment grade assets to surplus, other assets to surplus, cash outflow, high expense ratio, concentration in sources of business.

l. Should the risk factor be adjusted if the company has specific risk mitigation plans in place if assets fall below a certain threshold?

m. Should individual company stress and scenario tests be used to evaluate the adequacy of RBC factors and/or allow the use of alternative factors?

iv.   Capital

n. Is the nature of the capital structure considered adequately?

o. Should a differential in capital-raising ability between stock and mutual companies be considered?

Section II:

Report of the Health Solvency Work Group

American Academy of Actuaries

Report of the American Academy of Actuaries' Health Solvency Work Group

Presented to the National Association of Insurance Commissioners'

Solvency Modernization Initiative Subgroup of the Capital Adequacy Task Force

January 2011

The mission of the American Academy of Actuaries is to serve the public on behalf of the U.S. actuarial profession. The Academy assists state and federal policymakers by providing objective actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

Health Solvency Work Group

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The American Academy of Actuaries Health Solvency Work Group ("Work Group") was charged with preparing a document identifying opportunities for improvement in the National Association of Insurance Commissioners (NAIC) Health RBC formula and selecting the shortfalls that should be handled on a priority basis. The Work Group has provided analysis/information for each of the following two items: 1) Any intended or expected safety levels for RBC in aggregate for the original Life, Health and P&C RBC formulas as well as any safety level calibrations underlying individual risk factors within the current formulas; and 2) An identification of risks that are missing from RBC and a consideration of which of those risks may be reasonably quantifiable or otherwise merit inclusion in RBC. For those missing risks that may be quantifiable, provide advice or potential approaches to such quantification. This analysis should also consider potential enhancements, if any, to the inclusion of risk mitigation practices in RBC.

1.   Any intended or expected safety levels for RBC in aggregate for the original Life, Health and P&C RBC formulas as well as any safety level calibrations underlying individual risk factors within the current formulas.

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The Work Group's research has not discovered any intended or expected safety
levels for RBC in aggregate for the original Health RBC formula or any safety
level calibrations underlying individual risk factors within the current
formulas.
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The Work Group thought a brief history of the development of the Health RBC formula would be useful and have thus included our understanding of that history.

The Health Risk-Based Capital (HRBC) formula quantifies five separate risks:

- H0-Asset Risk for Affiliates with RBC
- H1-Asset Risk for Other
- H2-Underwriting Risk
- H3-Credit Risk
- H4-Business Risk

Asset Risk – Affiliates with RBC (H0) and Asset Risk Other (H1)

- The asset risk factors for the HRBC formula were primarily based on the Life asset risk factors. Exceptions to this general rule were made in situations where either because of valuation bases or the types of asset involved (e.g., buildings), there was no direct parallel with the life blank. In those cases, Property & Casualty (P&C) and other factors were used. For example, some of the bonds below bond level 2 have different statement valuation bases in the life blank than in the P&C blank; consequently the P&C factors were used for the Health RBC formula.

- The P&C formula was used for common stock, because the assets and asset management of health companies is more similar to P&C companies than that of Life companies.

- Risks unique to Health required new factors such as the asset risk for health pre-payment amounts and health care receivables.

Underwriting Risk (H2)

- When the original modeling for the medical products underwriting risk was done, a 95 percent confidence level was used so that a company would remain solvent over a 5 year timeframe.[30]

- A ruin theory model for 7 years was used. The first two years were ignored because they were distorted by the start-up effects caused by the model. The years 3-7 (5 year period) and a 95 percent likelihood of not failing over the five years to get consistent numbers were used. Two adjustments were made: 1) the managed care credit, and 2) the rate review adjustment (in the life formula, this became the increased factor for individual health insurance). The rate review adjustment was eliminated by the NAIC's Health RBC Working Group in the health formula.

- Modifications were made for managed care by estimating a percentage of claims that would be adjusted. The NAIC modified that adjustment (bifurcated it) increasing the amount of managed care credits, and adding a credit risk into the H3 factor. This had the effect of lowering the total RBC after the covariance formula was applied.

- Tail risks[31] were not specifically identified and included as a separate risk.

- The Academy's Health Organizations Risk Based Capital Task Force produced a report that was delivered to the NAIC in December of 1994. In this report,[32] recommendations were made for all forms of health coverage, including disability. However, because medical insurance RBC requirements did not exist at that time for some forms of health organizations, the NAIC primarily focused efforts on these forms of coverage. As a result, adoption of the standards for disability insurance was postponed until after the medical standards were put in place.

- The Disability Income (DI) claim reserve factor was left unchanged at 5 percent.

- In 1998, the Academy formed the Joint Disability Income (DI), Long-Term Care (LTC), Stop-Loss (SL), and Limited Benefit (LB) Task Forces to respond to the NAIC request for assistance to develop more appropriate factors for these lines of business. Members of these task forces were drawn from members of the Academy's Life Risk-Based Capital Committee (LRBC) and its Task Force on Health RBC.

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[30] American Academy of Actuaries *Report to the National Association of Insurance Commissioners Health Organizations Risk Based Capital Working Group (Dec. 1994):* http://www.actuary.org/pdf/health/HORBC_1994.pdf.

[31] Tail risk is defined as the risk of an extreme event with a low probability of occurrence.

[32] See footnote one.

- In 1996 an analysis was performed by the Academy's Health Organizations RBC Simplification Task Force (HORBC) and recommendations were made for accident only disability business.[33] Subsequently, the factors applied to this business were reduced, and the reporting on this segment was moved to an "other category."

- While no specific guidelines exist, the Academy DI Work Group that reviewed the Health RBC DI factors[34] believed that the typical approach to prior analysis was to find the surplus required to reduce the probability of ruin for a stationary population over a 5 year period to 5 percent while giving full recognition to taxes.

- The DI Work Group focused the majority of its effort on determining the aggregate risk-based capital requirement for active and disabled lives. This was done using an "aggregate model." A much less intense effort was made on the risk-based capital requirements for disabled lives, the claim reserve component of risk-based capital. A simple claim reserve model was used to determine that the 5 percent claim reserve factor recommended in 1991 and again in 1994 was reasonable. The premium requirement for risk-based capital was then found by subtracting the claim reserve requirement from the aggregate requirement.

- Revised LTC factors for C2 (H2) were based on LTC data. A subgroup of the Academy's HORBC Task Force reviewed data of incurred loss ratios (no increases in policy reserves). These loss ratios were for a variety of large and small writers, observed by company, over a period of time. A model was employed to analyze the statistical and volatility patterns of these loss ratios.

- Stop Loss (SL) coverage and Limited Benefit (LB) coverage (cancer, accidental death, short term disability, etc., lumped together as LB) did not have a sufficient amount of credible data. Therefore, factors were keyed off the DI analysis.

- Medicare Part D, as stand alone coverage, was added in 2006 as a separate risk. There were federal reinsurance and risk corridor rules that caused wide variations in underlying risks of pricing fluctuation. Factors were based on judgment from surveys of participating actuaries.

Credit Risk (H3)

The credit risk was developed by the NAIC with industry input and includes factors for reinsurance, intermediary risk and other receivable risk. The intermediary risk is the risk that a capitated provider is

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[33] American Academy of Actuaries *Final Report to the National Association of Insurance Commissioners Health Organizations Risk-Based Capital Working Group (June 1996):* http://www.actuary.org/pdf/health/HORBC_1996.pdf.

[34] American Academy of Actuaries *Report of the Disability Income Risk-Based Capital Work Group (March 2001):* http://www.actuary.org/pdf/health/naic/docs_RBCdisability_032601.pdf.

unable to perform service according to their contract. It was moved from the underwriting risk (H2) to the credit risk (H3).

Business Risk (H4)

The business risk was developed by the NAIC with industry input and includes factors for administrative expense, non-underwritten and limited risk business, premiums subject to guaranty fund assessments and excessive growth risk.

Covariance

In part the health formula moved from employing the factors for each individual risk to an overall company RBC through use of a covariance formula similar to the ones that were in the Life and P&C formulas already (that used covariance factors that were 1 or 0).

The covariance is calculated as H0 + Square Root ($H1^2 + H2^2 + H3^2 + H4^2$). The effect of using the covariance for the H1 through H4 risks is that the RBC is less than it would be otherwise if the risks were all added together and is driven by the underwriting risk (H2), since it is much larger than the other risks. The covariance formula is based on the assumption that the risks under the square root are independent of one another.

After those results were developed for HRBC, the primary issue considered in the development of the formula appears to have been the percent of companies that the regulators anticipated would fall within monitoring levels based on alternative factors or calibration levels. This drove much of how the final formula was developed and the final factors and covariance selected.

2. *An identification of risks that are missing from RBC and a consideration of which of those risks may be reasonably quantifiable or otherwise merit inclusion in RBC. For those missing risks that may be quantifiable, advice on potential approaches to such quantification. This analysis should also consider potential enhancements, if any, to the inclusion of risk mitigation practices in RBC.*

Since the implementation of HRBC, there have been a number of risks that either did not exist at the time that HRBC was finalized or have increased (or our awareness of which has increased) since that time, including:

- **Pandemic:** With new bacterial and viral strains appearing that are immune to current vaccines and anti-biotics, there has been increased awareness and concern over a potential pandemic. Even the concerns of a pandemic sends people to the doctor's office for vaccination. Once

there, the doctor often finds other conditions that need treatment or the need for overdue preventative services. The resulting unpredicted medical health care cost increase can be significant.

- **Biological Terrorism:** Since the implementation of HRBC there have been actual biological weapons sent through the mail. The threat of future biological attacks has increased, which would most likely result in cost of treatment and of security to protect our medical health care institutions from danger.

- **Increased cost of compliance**: There is more regulation both at the state and federal level that results in the need for capital investments in computer systems and staff. These additional costs are coming at a time when there is also increased medical rate regulation and increased scrutiny regarding rate increases.

- **Privacy breaches**: Privacy rules and regulations have changed significantly since the implementation of HRBC. In addition, the potential for data to be stolen via a laptop or other portable devices has increased. While insurers go to great lengths to protect the privacy of their customers, breaches can occur and may result in monetary and reputational damage.

- **Risk of Reserve Inadequacy for Long Duration Products:** These are health products with RBC issues, however, they would impact any company selling long duration products.

Long Term Care (LTC) insurance reserve adequacy risk - LTC insurance is a relatively new product line, having only been sold since the late 1980s. It is priced on a level-premium basis, generally from issue age. The expected claim cost curve is steep with the bulk of claims expected to be incurred 10 or more years after original policy issue dates.

There are no prescribed morbidity and lapse tables; LTC reserves are based on pricing assumptions. Since subsequent experience has demonstrated that the original pricing assumptions were incorrect for older blocks of LTC business (including assumptions regarding claims cost, persistency and interest), LTC reserve adequacy is questionable. LTC policies are guaranteed renewable. As such, future premium increases can mitigate reserve inadequacy. The challenge lies in the timeliness and the quality of experience and reserve adequacy reviews.

Experience has been rapidly emerging in more recent years. Insurers have been able to refine their pricing. Thus, newer issues may well have fewer reserve difficulties.

Disability Income (DI) reserve adequacy risk - The RBC factors for morbidity risk for DI policies were last updated in 2001. That analysis set morbidity factors based on historical DI experience volatility from 1983 to 1998. The 2001 Work Group noted that the 1983 to 1998 time span "was a particularly stressful time for DI. Companies were experiencing below average profit levels, consolidating and exiting the business."[35]

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[35] Ibid.

More recent experience has been materially better for DI writers. There are a limited number of companies still actively selling new DI policies, compared to those active prior to 1998. DI writers have generally improved their contract provisions, underwriting practices and claim management practices. Based on recent Society of Actuaries (SOA) experience studies and industry surveys, the DI industry has seen improving trends in claim incidence and terminations. In general, these environmental changes would suggest decreased, rather than increased morbidity concerns. This would apply to the claim component as well as the premium component of DI RBC (C2).

In addition, we have the following observations regarding DI insurance risk:

- It does not appear that the recent passage of the Affordable Care Act (ACA) will have a significant impact on DI morbidity.
- DI does not appear to have a significant exposure to catastrophic morbidity events (e.g., pandemics).
- Based on recent industry surveys, the last economic downturn does not seem to have had a major impact on general industry morbidity through 2009.

Impact of Affordable Care Act

We believe that the Affordable Care Act (ACA) poses new risks to health insurers. Uncertainty exists regarding how regulations will be written, interpreted and enforced. There is also uncertainty in how some of the changes will affect insurances exchanges, behavior of consumers and providers, and actuarial methods used to manage risk (risk classification, underwriting, rating, benefit limitations, etc).

Below is a list of potential risks that could be affected by ACA in the near future:

- **Medical loss ratios (MLR)** The MLR results in an asymmetrical risk profile for health insurers. Insurers must pay rebates when their loss ratio falls below the statutory minimum, but their ability to recoup losses when loss ratios are above the minimum is restricted. At the same time that there is an increased cost of compliance with many ACA requirements there is intensified pressure to constrain administrative expenses and premium rates. This could create increased uncertainty, higher probability for financial losses in any year and lower probability of recovery from future profits.

- **More stringent rate review framework**: At the same time that there is an increased cost of compliance with many ACA requirements, there is a new framework for rate reviews, which may constrain health insurers from seeking an increase in premiums to cover this cost for certain lines of health business. This risk is increased for carriers that only offer insurance in one state with heavy focus on the lines subject to greater review of rate increases. Unlike a multi-state company in which not all rate increases are delayed at the same time, a rate increase delay in a single-state company could impact its capital to a greater extent. In addition, there is the possibility of adverse economic conditions that impact one state more than others.

- **Increased trend risk:** because reform changes will create entirely new mixes of morbidity, products, and cost shifting from increasing enrollment in public programs for payers. This could diminish the reliability of historical trends as a basis for rate projections and further increase the odds of unfavorable material trend misses and resultant negative impacts on surplus.

Ultimately, surplus needs (and RBC risk factors) are fundamentally driven by two factors: uncertainty in outcomes and the ability of insurers to react and recover from loss events and unexpected regulatory burdens. Given that ACA has increased systemic risk for health insurers, Health RBC requirements will also likely be higher to maintain the same level of protection.

Some of these risks could be quantified through modeling. An example would be modeling of rate increase delays as well as stochastic modeling of the probability of paying rebates due to random fluctuations. We would be glad to assist with this effort, assuming that we can obtain the necessary data or determine an appropriate actuarial methodology if such data are not available. Having separate factors for individual, small, and large blocks of business will probably be necessary due to the differences in regulatory oversight and potential differences in statistical fluctuation.

Going forward there will be additional risk as other ACA requirements are implemented. Currently there are no data available to model these risks, but these risks should be accommodated by the HRBC formula. In the future, data may or may not be available to quantify them, but the HRBC formula should account for these risks, including:

- **Guaranteed issue** in the individual market could result in gradual adverse selection of the individual pool over time. Guaranteed issue will increase costs if the individual mandate is not sufficient to effectively offset adverse selection. Guaranteed issue will result in more variability in health care cost at the same time there is a lessened ability to increase premiums to cover wide fluctuations in health care costs.

- **Restrictions and prohibitions in rating variations** will likely result in additional cross-subsidy of higher cost risks. This will result in unpredictable changes in populations as individuals and groups react to increases in premiums due to increases in subsidization.

- **Risk adjustment and reinsurance:** The risk adjustment mechanism has not been designed at this time. When first implemented it will be difficult for health insurers to predict the accuracy of any risk adjustment mechanism and the potential for having to make payments or for receiving refunds from this mechanism. The risk to solvency is that the risk adjuster results in one carrier subsidizing another when there is not an equivalent inequity in claims costs.

If you have any questions regarding our comments, please contact Tim Mahony, the Academy's state health policy analyst, at 202.223.8196 or Mahony@actuary.org.

Sincerely,

Donna Novak, ASA, MAAA, FCA

Chairperson

Health Solvency Work Group

Section III:

Report of the Life Capital Adequacy Subcommittee

Report of the American Academy of Actuaries' Life Capital Adequacy Subcommittee

**Presented to the National Association of Insurance Commissioners'
Solvency Modernization Initiative Subgroup of the Capital Adequacy Task Force**

January 2011

The American Academy of Actuaries' mission is to serve the public on behalf of the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

Life Capital Adequacy Subcommittee
Nancy Bennett, FSA., MAAA, Chair

Mary Bahna-Nolan, FSA, MAAA	Bob Meilander, FSA, MAAA
David Berger, FSA, MAAA	Jeff Mohrenweiser, FSA, MAAA
Ross Bowen, FSA, MAAA	Craig Morrow, FSA, MAAA
Peter Boyko, FSA, MAAA	Keith Osinski, FSA, MAAA
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Jackie Keating, FSA, MAAA	Ken VandeVrede, FSA, MAAA
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Tina Kennedy, FSA, MAAA	Bill Wilton, FSA, MAAA
	Mark Yu, FSA, MAAA

The following report contains a description of the technical foundation of the Life Risk-Based Capital (LRBC) formula as prescribed by the National Association of Insurance Commissioners (NAIC), including the statistical safety level embedded in the formula. In addition to providing information on the historical development of the RBC system, this report also contains an explanation of the calibration level for most of the individual risk factors contained in the LRBC formula along with a description of the intended calibration level for regulatory capital requirements in aggregate. The report also provides some comments on risks that have been excluded from the LRBC formula along with a corresponding discussion of risk mitigation practices not reflected in the current formula. The Academy's Life Capital Adequacy Subcommittee (LCAS) has undertaken this report in response to the following charges from the Solvency Modernization Initiative Subgroup of the NAIC's Capital Adequacy Task Force:

1. Estimate the safety levels underlying current RBC methodologies.
    a. provide an explanation of the safety level calibration underlying the individual risk factors within the current formulas
    b. provide an explanation of the intended or expected safety level for RBC in aggregate for the original Life, Health and P&C RBC formulas

2. Identify and evaluate risks that are missing from the current RBC formulas (e.g., catastrophe risk, operational risk, various off-balance sheet risks).
    a. Provide discussion of risks missing from current RBC formula and comment on requiring capital for the particular risk
    b. Provide comments on risk mitigation practices not included in RBC formula

It is important for the reader to understand that this paper does not provide the LCAS evaluation of the overall effectiveness of the LRBC formula. We have focused on providing the technical foundation of the current formula, with particular emphasis on the questions asked by the NAIC's SMI RBC Work Group.

The report does not discuss any areas where the RBC formula may not be functioning as intended. For example, there may be areas within the LRBC formula that give false signals to regulators regarding companies that may be weakly capitalized or areas where the formula creates inappropriate risk management incentives for an individual company. Further, the subcommittee has not commented on areas where the LRBC formula can create an inaccurate perception of a particular company or the industry when the formula is used for purposes other than what was intended, (e.g., being used as a tool to rank the safety of insurers).

The following report focuses solely on the LRBC formula and is organized into the following sections:

A. Executive Summary

B. Introduction: A Short History of LRBC Development

C. Technical Foundation of LRBC

D. Calibration Level of Individual LRBC Components

A. Executive Summary

The National Association of Insurance Commissioners' (NAIC) Risk-Based Capital (RBC) system for life insurance was developed in the early 1990's. The objectives, as commonly accepted, for the Life RBC system during its development were as follows:

1. Create a relatively simple formulaic structure that would identify potentially weakly capitalized companies;
2. Design a formula that would be applied to all companies based on publicly available information;
3. Provide a regulatory tool that requires more extensive review of an individual company's risks and capital (including proprietary models and other detailed analysis) for those companies who were likely to be, or are weakly capitalized, in order to determine if corrective action(s) are needed;
4. Establish an objective standard for triggering regulatory action, including the authority to take over a company under certain conditions, such as falling below a certain capital level.

Regarding the technical foundation of the LRBC system and the specific questions posed to the Academy by the Solvency Modernization Initiative Subgroup of the NAIC's Capital Adequacy Task Force, the LCAS conclusions are summarized below:

1. Statistical safety level

    a. Initial LRBC Formula

    - The intent of the original LRBC formula was the identification and measurement of the risks that could affect an insurer's solvency. The original LRBC formula development started with the definition of major risk categories. The categories were C-1 (Asset Risk), C-2 (Insurance Risk), C-3 (Interest Rate Risk), and C-4 (Business Risk).

    - Each major risk category was further split into individual risks. The RBC factors for these individual risks that comprise the major risk categories were based on loss distributions constructed from experience in the late 1980s. The individual risk factors were established at confidence levels between the 92nd and 96th percentile over varying time horizons. As described in the original LRBC recommendation made by the Technical Advisory Committee to the NAIC, there was an intent to calibrate the individual risk factors in this range, as a way for the major risk categories to be approximately set at a 95th percentile confidence level.

    - The time horizon for each individual risk factor was equated with the time period where that risk could cause a rapid deterioration in statutory solvency. The LRBC factors were intended to be appropriate over a multi-year period and to reflect the inherent conservatism in statutory valuation and accounting principles.

    - Specific, but conservative, covariance adjustments were made in combining the RBC requirements for the major risk categories. Essentially, C1 and C3 risks were

assumed to be 100% correlated, with C2 risk being independent of both C1 and C3. These assumptions were considered reasonable at the time of the original recommendations, but shown to be conservative in later research conducted by Academy work groups. Little or no covariance benefit was observed in the Academy analysis between the individual risk factors within the major risk categories, thereby producing additional conservatism in the aggregate RBC.

- In terms of total LRBC requirements, the original LRBC formula was not designed with establishment of aggregate RBC at an *explicit* calibration level where this calibration level results in a stated outcome. In other words, LRBC was not established by equating the numerical results of a process to a pre-defined calibration level.

b. Current LRBC formula

- Since the original LRBC formula was designed, segments of the capital markets have changed significantly and insurers' investment practices have changed accordingly. In addition, the methods for quantifying risk have advanced. There have been significant changes to the risk profiles of company balance sheets, for both assets and liabilities.

- Several modifications have been made to the LRBC requirements since its introduction yet despite these modifications, the LRBC requirements have not kept pace with the developments in either the capital markets or the products offered by life insurers. LRBC changes have been ad hoc for specific risk factors, rather than making changes to LRBC reflective of how companies' risks and/or solvency positions have shifted. With major shifts in the economy, risks can materialize in a different manner than previously observed and/or assumed in the current LRBC formula.

- Some factors have not been updated for recent experience and are based on studies from the late 1980's (e.g., mortality and bond default factors).

- The original formula has been modified such that it is now a combination of different risk metrics – percentile and conditional tail expectation (CTE) metrics. The original formula began with static factors applied universally to each company, and now includes risk charges based on the results of internal modeling. Further, the original formula has been modified to include prescribed scenarios and caps and floors applied to certain elements of the formula.

- It is very likely the calibration level achieved for LRBC results in 2010 is different from what was originally intended due to shifts in experience and formula structure.

While some believe that US life insurers have fared well in the recent economic environment, particularly in comparison to other sectors of the financial services industry, it would be

implausible to attribute the relative success of the US insurance industry to any one of many factors, such as the LRBC formula.

2. Excluded risks and risk mitigation practices

Some risks have been intentionally excluded from the LRBC system. The excluded risks fall into three areas:

- Immaterial over the LRBC time period (i.e., which generally covers risks that could abruptly materialize over a short to medium time frame, such as three to five years)

- Tail Risks, or risks that materialize beyond the tested portion of the risk distribution (i.e., in the outside tails of the distribution beyond the 95th percentile). These risks materialize so infrequently that they only exist beyond the stated calibration level

- Risks that cannot be pre-funded by capital, such as liquidity or specific operational risks

Some of the excluded risks, while potentially significant, would materialize over a long time horizon. As explained below, RBC for life insurance is designed to identify companies that are or could become weakly capitalized in a short to medium time frame. The LRBC framework is defined within the statutory accounting framework and focuses on risks that could have a material impact on an insurer's statutory capital position. The LCAS does not believe that any material risks have been excluded consistent with the original established objectives and design of the LRBC framework.

B. Introduction: A Short History of Life RBC Development

This introduction documents LCAS'S understanding of the history of the development of LRBC. Our intent in providing this information is to provide some context for our description of the original design of the LRBC system and its subsequent modification. We have reviewed historical publications, where available, to support our description and have included those publications in the bibliography of this report. Since the LRBC system was designed more than twenty years ago, we have taken some license, albeit without intentional bias, in describing how LRBC was designed. As a result, this should be regarded as an historical account of the context in which LRBC was formulated, but reflects the perspectives of many parties involved, each with a different outlook..

As described earlier, the NAIC's Risk-Based Capital system for life insurance (LRBC) was designed to accomplish several objectives. As originally implemented, LRBC was entirely formulaic and based on published data so as to provide an auditable and objective calculation applied to all companies. As some of the risk exposures of life insurers' have shifted due to new benefit designs, guarantees and investment practices, some LRBC calculations are now based on internal models and company assumptions, in part.

As contained in the NAIC Instructions to the Life RBC Filing, risks were identified as being part of one of four major risk categories:

C1 – Asset risk:
the risk of assets' default of principal and interest or fluctuation in fair value.
C2 – Pricing Risk:
the risk of underestimating liabilities from business already written or inadequately pricing business to be written in the coming year.
C3 – Interest Rate, Health Credit Risk and Market Risk:
the risk of losses due to changes in interest rate levels and the risk that health benefits prepaid to providers become the obligation of the health insurer once again, and risk of losses due to changes in market levels associated with variable products with guarantees.
C4 – Business Risks:
the risk of general business losses.

C1 was eventually split into C1cs for common stock and C1o for the remaining assets. An additional category (C0) was added to the LRBC formula to capture the risk of default for certain affiliated investments.

With the major risk categories established, the next step was to quantify the potential surplus impact if the risks contained within each major risk category materialized. Stated differently, the next step was to determine the statistical distribution for each material risk contributing to each risk category. The capital required for each material risk within the major risk categories was established between the 92nd and 96th percentile over varying time horizons. As stated in the 1991 Proposal from the NAIC's Industry Advisory Committee, when all material risks were combined within the major risk category, the capital required for each major risk category was expected to be calibrated at the 95th percentile.

Every effort was made to maintain theoretical consistency within the four major risk categories listed above with respect to statistical confidence levels throughout the formula development process. For practical reasons, an assumption was made that the time horizon for most individual risk factors was established such that the resulting capital requirement would not change if the analysis were extended over a longer time horizon. This assumption was based on limited modeling of certain risks and the prevailing actuarial judgment at the time. A more detailed description of the capital requirement for each significant risk factor, including time horizon, is provided later.

The original LRBC requirements did not reflect an explicit calibration level for aggregate LRBC amounts. The focus was on the definition of capital requirements for each individual risk category and to calibrate the individual risk types at a level and time horizon appropriate for each identified risk. While there are many opinions regarding the intended or expected calibration level of aggregate LRBC, the LRBC formula was not designed to achieve a stated calibration level or maintain capital requirements at a stated calibration level as an outcome of the LRBC calculation.

Once the major risk categories have been quantified, consideration was given to the correlation of risks between these risk categories. For correlations pertaining to risks other than interest rates and equity returns, a simple assumption was made. Each major risk category was considered to be either completely independent of other risk categories, or completely correlated with the other risk categories. After this determination was made, a statistical adjustment was made to adjust for risk correlation among the major "C" risk categories, known as the "covariance adjustment."

While there was no explicit tax adjustment in the original RBC structure, taxes were considered in the calculations that led to the factors used to calculate RBC. These implicit tax considerations varied by the type of risk. With the adoption of new statutory accounting principles, explicit tax adjustments were introduced to provide additional information to regulators and reflect individual company circumstances. The adjustments reflected: (1) that tax rates for ordinary income losses could differ from those for capital gains/losses on some future date, (2) that statutory recognition of losses may differ from tax recognition, and (3) that the impact of taxes, the recognition of future taxes as a deferred tax asset, and future deductibility of surplus event losses were all of interest to the regulators.

When taxes were later included in the LRBC formula, the pre-tax risk factors were reduced by the aforementioned tax adjustment. The tax adjustment was applied to the pre-tax RBC amount for each major risk category ("C"). Details on the specific tax adjustments are contained in the AAA's Joint RBC Task Force Letter to the NAIC RBC Task Force on the Tax Effects of Codification on the 2001 RBC formulas, October, 2000.

Because of concerns raised regarding the recoupment of tax losses in tail scenarios, a required sensitivity test was added that calculated RBC on a pretax basis.

The regulatory action levels that are part of the original LRBC framework were established by the NAIC. The NAIC established the Company Action Level for LRBC. Additional trigger points for regulatory action were set for Regulatory Action Level, Authorized Control Level, and Mandatory Control Level. These additional levels are percentages of the Company Action Level.

The first official company filings of LRBC reports was year-end 1993. Since that time, the LRBC formula has undergone numerous refinements. These refinements were specific responses to capture the shifting risk profile of life insurers' asset and product portfolios, along with changes in the capital markets and risk management techniques.

Two of the major updates to the original formula are called "C3 Phase 1" and "C3 Phase 2". C3 Phase 1, implemented in 2000, is the introduction of company-specific modeling for fixed annuity interest rate risk. The capital requirements for C3 Phase 1 are based on the distribution of modeling results falling between the 92nd and 98th percentile. C2 Phase 2, implemented in 2005, introduced company specific modeling for variable annuity equity and interest rate returns, in order to measure risks such as those created by guaranteed death and living benefits. Phase 2 uses a "90% CTE" risk metric. The 90%

Conditional Tail Expectation (CTE) is the average of the worst 10% of the results of stochastic testing, and captures the effect of "tail risks" that may be small at the 95th percentile but more significant at higher levels of conservatism.

Another significant update was the introduction, in 2001, of a separate "C-1 cs" covariance component for common stock. This change reduced some of the unquantified conservatism of the original covariance adjustment. A common stock concentration risk component was also added at this time.

Other significant updates include refined RBC requirements for commercial mortgages, several updates for health insurance, and numerous updates to reflect various accounting changes. These changes did not generally include any change to the original 95th percentile level of conservatism.

The remainder of this report describes the development of this system in more detail.

C. **Technical Foundation of RBC**

In designing any solvency framework, there are a handful of basic framing issues that define much of the entire formula.   In the following section, we address a number of issues that have a bearing on the calibration level of RBC, some more directly than others.

1. What is the purpose of the current US regulatory risk-based capital system?

    The primary purpose of the US RBC system is the identification of potentially weakly capitalized companies so as to facilitate regulatory actions that will ensure that, in most situations, policyholders will receive the benefits promised without access to guarantee or taxpayer funds. Consequently, the RBC system includes objective trigger points that enable regulatory intervention in the operation of weakly capitalized companies. The RBC system is written into state laws, thereby enabling the takeover of an insurer with the force of law. Although not explicitly identified as an objective of the US RBC system, the implementation of the RBC system has resulted in a better industry awareness of risk exposures for many life insurance companies.

    It is important to acknowledge that RBC is not designed to rank the capital strength of companies. Any evaluation of relative capital strength based on the NAIC RBC system (e.g., by use of RBC ratios) would be inappropriate. Nevertheless, we recognize that other parties may use LRBC for other than its intended purposes, accepting the anomalies that can arise from this inappropriate use. In addition, it is also important to note that the LRBC formula was not designed to signal changes in an insurer's risk profile. Other regulatory tools, such as the RBC Trend Test, are part of the NAIC's solvency framework and are intended to identify a situation where a company might be at risk of becoming weakly capitalized.

2. What does the calculation level of RBC represent?

    As stated in the NAIC's LRBC Instructions, "Risk-based capital is a method of measuring the minimum amount of capital appropriate for an insurance company to support its overall business operations in consideration of its size and risk profile."   RBC was developed as a tool for regulators to identify potentially weakly capitalized companies. RBC creates a "reference point," via the RBC formula, whereby regulators can compare a company's actual statutory capital position to this regulatory reference point.

    Stated from a different perspective, the dollar amount of RBC does not represent an outsider's valuation of the company's business. RBC does not represent the amount a willing buyer would pay to assume a company's obligations or an "exit value" but it does represent the minimum amount of capital a willing buyer would have to maintain in the company if it were purchased. While some solvency systems in other jurisdictions express required capital relative to valuations performed under certain assumptions, the RBC amount defined in the NAIC RBC system is based on statutory accounting principles and is not related to the "value of business".

    If an insurer's Total Adjusted Capital (TAC) level falls below LRBC Company Action Level (CAL), then some type of regulatory intervention is triggered where the insurer works with the regulators to address its capital level. The LRBC CAL is based on a going concern assumption, meaning that all obligations except for debt and future business are intended to be covered by capital. Insolvency statutes may provide further specification in terms of the obligations beyond those to policyholders that are covered by capital.

3. What risks are covered by capital? By reserves?

   Policy reserves are intended to cover expected losses that arise under moderately adverse conditions. Often, moderately adverse conditions have been implicitly assumed (and sometimes explicitly assumed) to occur at one standard deviation (roughly the 83rd percentile for normally distributed risks). The LRBC system assumes that appropriate reserves have been established and provides a cushion for risk levels beyond those risks covered in reserves. As a result, LRBC establishes capital requirements for losses that arise under more adverse conditions (e.g., beyond one standard deviation).

   As with the LRBC formula, minimum reserve standards have changed over time to address new products and risks. However, these reserve standards were not specifically calibrated to cover the 85th percentile of losses. As such, the different product reserve standards provide different levels of risk coverage.

   In the development of principle-based approaches (PBA) to reserves and LRBC, an Academy work group has written a white paper recommending the risks that should be covered in reserves and those risks that should be covered by capital in a PBA framework. This document may provide additional insight into establishing funds to cover potential risks and can be found at http://www.actuary.org/pdf/life/consistency_sept07.pdf

4. Does the NAIC RBC's framework anticipate some explicit level of new business or only inforce?

   The current LRBC requirements do not include the capital impact of new business, even though capital requirements are based on the assumption of a going concern, not a liquidation environment. A going concern assumption may have different capital implications for longer term business as compared to shorter term business and may not be appropriate for shorter term business. If any business is underpriced, yet still being sold, additional concerns regarding capital adequacy may arise.

5. Is the current LRBC approach countercyclical, pro-cyclical or something else?

   In a pro-cyclical framework, capital requirements fall as economic conditions indicate lower levels of risk. When conditions change as a result of a higher risk environment, capital requirements increase. A pro-cyclical framework intensifies capital requirements along with economic swings as the capital requirements can encourage or enable companies to take greater risks when times are good and restrict their options when times are bad. In a countercyclical framework, capital requirements decrease as economic conditions deteriorate in an attempt to dampen the economic swings caused by the current economic conditions.

   The LRBC system is based on statutory accounting principles. Statutory accounting principles affect both the determination of a company's TAC position and the calculation of regulatory LRBC. Statutory accounting principles introduce some elements of pro-cyclicality into TAC (e.g., bond write-downs for other than temporary impairments). Write-downs increase the likelihood that a regulatory action level will be triggered during an economic downturn. By contrast, an asset valuation reserve (AVR) has a counter-cyclical impact on TAC.

   While economic and business environments may cause risk exposures to fluctuate in the short run, the LRBC formula was intended to establish cycle-neutral standards to capture the effects of

risks that could materialize over a short to medium time horizon (i.e., a time period over which regulatory action would not be triggered by increased requirements in higher risk environments). Certain elements of the LRBC formula vary with the economic environment to a degree. These elements include the mortgage experience adjustment factor (MEAF) and the C3 component, in part.

However, these aspects of the LRBC system notwithstanding, the LRBC factors are primarily independent of the current economic environment and would not be characterized as pro-cyclical. Since many of the factors are based on the average of past economic driven events, the averaging function builds in a countercyclical "muting" in contrast to that of risk based on current economic risk factors.

D. Calibration Level of Individual LRBC Components

In the LRBC formula, there are many risks captured within each of the major categories of risk. As stated previously, each LRBC factor has a different calibration level and time horizon. Generally, the factors were originally calibrated between the 92nd – 96th percentile, with the intent of aggregating to approximately the 95th percentile for each major risk category (i.e., each "C"). The time horizon for each factor was established to be consistent with the time period where risks could cause rapid deterioration in statutory solvency. In the following section, the calibration assumption (statistical risk metric and time horizon) level for each of the major risk categories is summarized, including the calibration assumption for individual risk types. More details on each of the risk factors can be found in various publications documenting the basis for each factor, including those listed in the Bibliography section.

1. **C0**

The C0 risk category covers the risk of default of assets for affiliated investments and certain off-balance sheet risks. For downstream insurance subsidiaries owned by an insurer, the C0 amount is equal to the risk-based capital requirement of the downstream insurance subsidiaries. For other subsidiaries, the C0 amount is calculated by applying a factor to the carrying value. In this way, a parent is required to include an equivalent amount of risk-based capital to protect against financial downturns of affiliates in its RBC. For life companies, off-balance sheet items are included in this risk component and these include non-controlled assets, derivative instruments, guarantees for affiliates and contingent liabilities.

Capital requirements for affiliated investments are based on a "look-through" approach, meaning that a parent's RBC is determined as the same level of RBC as would be required if the affiliate were stand-alone. As such, there was no additional risk analysis performed on the risks associated with affiliated investments where RBC for a parent was based on a specific time horizon and calibration level.

The RBC for insurance companies operating in other countries with a regulatory RBC type structure is assumed to be that determined by their respective capital formula. Similarly, non-insurance companies will use their GAAP surplus as required capital adjusted by the appropriate RBC factor.

2. **C1**

C1 risk represents the potential for default of principal and interest or fluctuation in fair value of assets. Fixed income assets include bonds, collateral loans and mortgage loans, short-term investments, cash, and other long-term invested assets. Equity assets include unaffiliated common and preferred stock, real estate, and certain long-term assets reported in Schedule BA. Factors are applied to the statutory carrying values to determine their risk- based capital charges.

The factors for bonds, commercial mortgage loans (assumed to be in good standing) and unaffiliated common stock were determined through stochastic modeling. Bond factors were modeled for each of the six NAIC bond rating categories. A bond's Nationally Recognized Statistical Rating Organization (NRSRO) rating directly maps to one of these six categories. Commercial mortgage

loans carry a factor independent of the NAIC rating categories which is adjusted for each company depending on their loss experience relative to the industry. Unaffiliated common stock and the lowest class of bonds (i.e., NAIC class 6) have the same factor since both are reported as marked to market in the statutory statements.

Factors for other assets are based on a comparative risk judgment to the baseline factors for bonds, commercial mortgages and common stock. Generally when an asset has an NRSRO rating its factor follows the established mapping to one of the NAIC bond rating categories. Examples of this are agency backed mortgages and collateralized mortgage obligations (CMO's), preferred stock and non-modeled securitized assets. An exception to this is for modeled securitized assets such as residential mortgage backed securities (RMBS) and commercial mortgage backed securities (CMBS). The modeling performed annually by outside vendors provides an estimate of expected losses that are used to map each such security to one of the NAIC bond rating categories containing a similar expected loss level. Some assets do not have an NRSRO rating and are judged relative to other assets to assign a factor. Examples of this are owned real estate (home office and investment), foreclosed real estate, mortgages overdue or in process of foreclosure, Federal Home Loan Bank (FHLB) stock and counterparty exposure on derivatives.

Bonds and commercial mortgage loans were modeled to specific time horizons. Bonds were modeled over ten years, the industry average time-to-maturity. Mortgages were modeled to their maturity with a portfolio average time to maturity of seven years. Modeling for unaffiliated common stock determined that the greatest amount of loss could be expected to occur throughout a two year horizon. Even though modeling over a longer period was done to determine this, the time horizon is commonly stated as two years.

Calibration levels of the factors for bonds, commercial mortgage loans and unaffiliated common stock vary slightly from one another but are all based on a confidence level set in a range of 94% - 96%. Bonds were set at 92% by individual NAIC rating category which aggregated to over 96% for bonds as a whole. Commercial mortgage loans were set at 94%. When combined with other mortgage types, the calibration level for mortgages as a whole was established at 96%. Unaffiliated common stock was calibrated at 95%.

3. **C2**

C2 factors established minimum capital requirements to address the risks associated with the deterioration of mortality and/or morbidity experience.

C2 RBC factors for life insurance are established to protect capital from the rapid deterioration of mortality experience, approximately five to ten years. A combination of stochastic, risk theoretical and empirical approaches was applied to develop recommended C2 risk capital requirements for the major lines of life insurance business in force in the U.S. Major elements were the risks of improper pricing assumptions, random fluctuation, catastrophic events such as influenza pandemics and AIDS, and the "contagion" that creates sudden deterioration in experience, such as when price increases drive better risks away. Lesser risk elements were secular shifts over time and cyclical fluctuations in morbidity experience, due to their slower emergence as a solvency concern.

Extensive stochastic modeling was performed for a range of sizes of blocks of business, considering all the elements outlined above, with the results converted to factors that reflect the greater fluctuation inherent in smaller blocks. Reasonable, conservative assumptions were made about profit margins, use of reinsurance, and the potential for corrective actions such as premium or cost of insurance increases and dividend decreases. Because of this potential, a three year horizon was selected for group life insurance, and a ten year period for individual life. A 95% confidence level was targeted. While some believed expected claims was the most appropriate base for the factors, Net Amount at Risk (NAR) was used instead, due to easier availability and greater consistency among companies.

Morbidity risk associated with disability income policies has been a part of the LRBC system since the original formula. Because there was no source of independent modeling of morbidity risks available at the time, the original factors were based on analysis performed by the major writers of this business and assembled by the interested parties group.

An Academy work group completed a more extensive analysis of disability RBC in 2001. This analysis involved substantial stochastic modeling that considered the risk of adverse changes in morbidity results. A model was designed specifically for the purpose of developing RBC factors. Model assumptions were based on an analysis of historical data from a number of companies.

As a result of this morbidity modeling work, separate RBC factors were established for different types of disability insurance (e.g., noncancelable, guaranteed renewable), different sizes of company, and for active and disabled life reserves. Factors were established at the 95th percentile over a five year time horizon. These factors were adopted by the NAIC in 2001.

Morbidity risk associated with medical expense insurance is also part of the LRBC formula. Factors for underwriting risk were established using a stochastic "ruin theory" model. This model was used to determine the level of capital needed to give a 95% probability that an insurance company would not become insolvent over a five year time horizon. The model projected financial gains and losses on a year by year basis. This model was used to determine how capital requirements should vary for different volumes of business and for different types of coverage.

The key factors that impacted the risk for a given scenario included:

- The risk of catastrophic claims and other statistical fluctuations in claim levels.
- The risk of misestimating trends or other pricing errors.
- The length of time needed to recognize a pricing error, implement an adjustment, and have that adjustment become effective.

To model the risk of statistical fluctuations in claim levels, a claim probability distribution for an individual person was developed for each type of coverage. A Monte Carlo method was then used to develop a distribution of total claims for a portfolio of business.

To model the risk of misestimating trends and other pricing errors, the work group studied the fluctuation in loss ratios over time for different types of coverage. This information was used to

develop a probability distribution for pricing errors. This distribution, along with the individual claim distribution, became the basis for the model's stochastic simulation.[36]

C2 for Long Term Care (LTC) was established using the disability income model, modified to analyze solvency due to morbidity risk for long-term care insurance. Using data reflecting industry averages, the model simulated an insurance company's experience relating to emerging long-term care experience from in-force business and subsequent management actions. Consistent with disability income and other lines of business, C2 factors were developed to mitigate a 5% insolvency probability over a five year period. These factors vary by the size of the business as measured by premium and claim volumes. The C2 LTC factors were adopted by the NAIC in 2005.

Longevity risk was intentionally excluded from the LRBC calculation due to its very slow emergence. The original LRBC work focused on tail risks, and longevity risk does not fall into this category. Longevity risk takes many years to materialize and emerges slowly and is considered to be a risk that can be managed by the company through reserves.

4. **C3**

C3, Interest Rate Risk, Health Credit Risk and Market Risk is established for the risk of losses due to changes in interest rate levels, the risks associated with minimum interest rate guarantees, the risk that health benefits prepaid to providers become the obligation of the health insurer, and risk of losses due to changes in market levels associated with variable product guarantees.

For risk of loss due to interest rate changes, the risk charge depends on the degree of mismatch between the asset and liability cash flows. The original factors for life insurance were based on the degree of A/L mismatch over a one year time horizon. The original factors for annuity reserves with discretionary withdrawals at book value, were based on stochastic analysis of a typical block of business and mismatch (duration) risk and then identifying the 95th percentile worst result to develop a set of factors.

With more sophisticated modeling techniques being utilized by companies, C3 continues to evolve to reflect the unique risks and strategies of a company and incorporates a company's stochastic modeling into the reported value of C3 risk, including the market risk exposure of new guaranteed benefits on variable annuities, such as guaranteed living benefits.

- **C3 for life insurance:** C3 capital is set equal to 0.5% times (reserves – policy loans). The factor assumes an A/L duration mismatch < 0.25. Based on a review of the volatility of Treasury spot rates over the period 1977-1990, the volatility in annual rates is 350 – 400bp, with a 95% degree of confidence. Assuming interest rates change by 4% and the average mismatch is 0.125 (midpoint between 0 and 0.25), the additional surplus requirements = 0.125 * .04 = 0.5% of reserves.

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[36] Bell, Rowen B., and Robert Cumming. 2007. Risk-Based Capital Formulas. In *Group Insurance,* 5th edition. Winsted, CT: ACTEX Publications.

- **C3 Phase 1 (annuities and single premium life insurance):** C3 capital is based on the distribution of cash shortfalls or deficits modeled over the period of time such that the net modeled cash flows approach zero (e.g., thirty years). This cash flow position is estimated by modeling the business over a number of prescribed interest rate scenarios. The capital requirement for a given scenario is the worst present value of the projected deficit over the modeled time period, divided by the modeled reserves. The results for the scenarios are ranked and the required capital is based on scenario results falling between the 92nd and 98th percentile of the distribution.

- **C3 Phase 2 (VA):** C3 capital is based on a CTE 90 confidence level over the period of time such that the net modeled cash flows approach zero (e.g., thirty years). The risk metric is the worst present value over the time horizon. The multi-scenario based result is subject to a deterministic floor consisting of a single scenario with prescribed contractholder behavior assumptions.

- **C3 Health Credit risk:** The Health Credit Risk is an offset to some portions of the managed care discount factor. Since the managed care discount factor assumes that health risks are transferred to health care providers through fixed prepaid amounts, the Health Credit Risk compares these capitation payments to the securities held by the company. To the extent that the securities do not completely cover the credit risk of capitated payments, a risk charge is applied to the exposed portion. The charge ranges from 2-4% of capitations reported as paid claims, with reductions allowed when letters of credit have been secured.

5. **C4**

The C4 risk category includes the wide range of general business risks faced by life insurers. The characteristics of these risks are difficult to quantify in a general way for all companies. General business risk is based on premium income, annuity considerations and separate account liabilities. The formula factors were based on considering a company's exposure to guaranty fund assessments without attempting to exactly mirror the assessment formulas. Also considered were other general business risk exposures; e.g., litigation, etc. Many general risks were considered. Best guesses were often used for these tail risks, as limited industry-wide data were available. It was also assumed that not all of these business risk events would likely occur at the same time. Therefore, the factors were based on the largest estimates for the risks where data were available; assuming that by so doing the other risks would also be covered.

For life and annuity business, the LRBC pre-tax contribution is 3.08 percent of Schedule T life premiums and annuity considerations before taxes (based on the largest annual guarantee fund assessment). A smaller pre-tax factor of 0.77 percent is applied against Schedule T accident and health premiums. The reason for the smaller factor for accident and health business was a recognition that general business risk exposure is, in part, a function of reserves. Since life and annuity business typically carries higher reserves than accident and health business, a lower factor was used to achieve the same relative risk coverage as for life and annuity business.

To maintain general consistency with the health RBC formula, an amount was determined as risk related to the potential that actual expenses of administering certain types of health insurance will exceed the portion of the premium allocated to cover these expenses. Not all administrative expenses were included (commissions, premium taxes and other expenses defined and paid as a percentage of premium are not included and the expenses for administrative services contracts (ASC) and administrative service only (ASO) business have separate lower factors) and the factor is graded based on a two-tier formula related to health insurance premium to which this risk is applied. ASC is considered to have a separate business risk related to the use of the company's funds with an expectation of later recovery of all amounts from the contractholder, but this does not include Medicare Part D coverage.

Due to the difficulty of quantifying those risks classified as business risks, the LRBC factors were not based on a quantitative risk analysis with the capital requirements based on a specific calibration level.

E. **Calibration Level of Aggregate Capital Requirements**

1. Description of correlation assumptions for current LRBC formula

   All major risk categories (C0 – C4) are defined to be either 100% correlated or entirely uncorrelated, meaning in simple terms that not all risks will materialize at the same time. Consequently, total or aggregate LRBC is not set equal to the arithmetic sum of the risk capital for each risk category. The LRBC formula contains a covariance adjustment to reflect these correlation assumptions. The covariance adjustment is based on the assumption that the major LRBC risk categories are independent, normally distributed random variables. The covariance adjustment in the LRBC formula is known as the "square root adjustment."

2. Description of aggregate calibration level

   As described earlier, individual risks were evaluated and the regulatory capital required to absorb the fluctuations in capital as each risk materialized was established. The capital requirement for each risk was based on a different time horizon and confidence level where the time horizon and confidence level reflected the unique characteristics or distribution of each type of risk.

   The original intent of the covariance adjustment was to maintain the same level of conservatism for the aggregate LRBC requirement as for the separate risk components. A simple approach was chosen for aggregation where risk categories were assumed to be either independent (also described as uncorrelated or correlations of zero) or 100% correlated (i.e., likely to occur simultaneously).

   At the time of the original formula, this simple approach was considered to be reasonable. Later research showed the approach to be conservative, and led to a separation of the common stock portion of C1 risk (now called "C1cs") from the other portions of C1 risk ("C1o"). This research is described in the Academy's Life Risk-Based Capital Task Force Report to the NAIC on the Treatment of Common Stock in the Life RBC Formula, December 1997. Similar changes were made to separate certain health insurance related risks from other risks.

   In terms of total LRBC requirements, the original LRBC formula was not designed by establishing aggregate LRBC at an *explicit* calibration level where this calibration level results in a stated outcome. In other words, LRBC was not established by equating the numerical results of a process to a pre-defined calibration level. Rather, the original developers of the LRBC formula defined major risk categories (i.e., "C" categories) and established factors at approximately the 95% level. The LRBC factors are intended to be appropriate over a multi-year period and also acknowledge the inherent conservatism in statutory accounting principles.

   Since the original LRBC formula was designed, it is important to remember that many changes have been implemented. These changes will affect the aggregate calibration level implied in the current LRBC formula; however, given the structure of the LRBC, it is virtually impossible to determine the aggregate calibration implied in the current formula.

3. Description of the LRBC Formulas and Associated Regulatory Action Levels

   The LRBC resulting from the formula(s) is compared to the amount defined as the Total Adjusted Capital (TAC) divided by the Authorized Control Level Risk-based Capital. Total Adjusted

Capital is equal to statutory capital and surplus plus AVR plus one-half of the dividend liability (including amounts in life subsidiaries). (Note that a change affecting the RBC included for subsidiaries was adopted for 2011 RBC that will slightly modify this formula.)

The Company Action Level LRBC is calculated from the following formula:

$$C0 + C4a + \text{Square Root of } [(C1o + C3a)^2 + (C1cs + C3c)^2 + (C2)^2 + (C3b)^2 + (C4b)^2]$$

The Authorized Control Level Risk-based Capital is 50% of this Company Action Level RBC.

4. Description of process for determining regulatory action levels

There are different levels defined where regulatory intervention will be triggered. The regulatory action levels are triggered when the Total Adjusted Capital is lower than the corresponding regulatory action level. The regulatory action levels were empirically established by regulators by looking at the initial sample of RBC ratios for actual life insurance companies and deciding which of those companies should be subject to regulatory intervention. According to the NAIC Life Risk-Based Capital Overview and Instructions:

- The Company Action Level is defined above and triggered when the TAC falls below the dollar level of the CAL, requiring the company to prepare and submit an RBC Plan to the commissioner of the state of domicile. After review, the commissioner will notify the company if the plan is satisfactory.
- The Authorized Control Level is defined as 50% of the Company Action Level. The Authorized Control Level is triggered when the TAC falls below this level, authorizing the commissioner of the state of domicile to take whatever regulatory actions is considered necessary to protect the best interest of the policyholders and creditors of the insurer.
- The Regulatory Action Level is defined as 150% of the Authorized Control Level. The Regulatory Action Level is triggered when the TAC falls below this level, requiring the insurer to submit to the commissioner of the state of domicile an RBC Plan, or if applicable, a Revised RBC Plan. After examination or analysis, the commissioner will issue an order specifying corrective actions (Corrective Order) to be taken.
- The Mandatory Control Level is defined as 70% of the Authorized Control Level, The Mandatory Control Level is triggered when the TAC falls below this level, authorizing the commissioner of the state of domicile to take actions necessary to place the company under regulatory control (i.e., rehabilitation or liquidation).

F. Additional Considerations in Establishing Calibration Levels

1. Do calibration levels need to be the same for life, health, and casualty businesses?

    The NAIC has established three separate RBC formulas. The risks inherent in each of the three business models are very different and will materialize over different time horizons. Since the objective is to identify when there could be significant declines in capital, the time horizon can range from days to decades for different risks and insurance products and should vary accordingly. While there may be a desire to implement the same confidence level in each of the formulas for regulatory consistency, the LCAS sees no technical reasons for the calibration levels to be the same.

2. How do prescribed elements of LRBC affect the articulation of a calibration statement?

    There are several prescribed elements of the LRBC formula, including floors and caps for different components, such as the following:
    - Minimum floor on C3 Phase 1 (the cap was eliminated in 2008)
    - The C3 Phase 2 standard scenario
    - Company specific risks: original formula reflected size, concentration, and diversification differences by company.

    Further formula refinements have incorporated specific risk profiles for part of an individual company's assets and liabilities through the introduction of internal model results in the LRBC formula (e.g., the C3 component).

    These prescribed elements and internal model results will affect each company's LRBC calculation differently. The prescribed elements have the effect of circumventing the intended calibration levels. Risk charges have been calibrated from? the underlying risk distribution, prior to any externally imposed limit. Imposition of prescribed elements or caps/floors will preclude the establishment of capital requirements at a specified calibration level for an individual company.

3. How does the accounting framework influence the choice of calibration? In other words, would a different calibration level be set if RBC were based on stat values vs. GAAP values?

    The accounting framework directly influences the calculation of LRBC and the resulting dollar amount of LRBC, since the RBC system has been defined within the statutory accounting paradigm. The accounting framework influences when failure will be reported and will drive the reported volatility of surplus in some components. The LCAS believes that the selection of the confidence level (e.g., 95th percentile) should apply independent of the accounting method.

4. How do taxes influence the choice of calibration?

    The current LRBC system bases regulatory triggers on the comparison of the dollar amount of the TAC to the various regulatory levels of RBC. For life insurance, the various regulatory levels of RBC are calculated after tax. That said, we do not believe that the reflection of taxes in LRBC has any bearing on the calibration level. Note that the original formula was a mixture of post-

and pre-tax factors. In 2002, LRBC was changed to be post-tax for all factors; some individual risk factors were changed as a result.

G. Calibration levels in other Solvency Frameworks

In designing any solvency framework, there are a handful of basic framing issues upon which many of the formulaic details are based. While there are differences between solvency frameworks, the following chart provides a useful perspective on the major framing issues that need to be resolved when designing or refining a solvency framework. In it we provide a comparison of each of the framing issues for the LRBC, Solvency II, and Canadian frameworks as we understand them, recognizing that all three are under review by their respective regulatory authorities. We have compared the LRBC framework to each of the aforementioned frameworks, with particular emphasis on calibration. In addition, we have provided a description of the bond default rating methodologies followed by most of the major rating agencies since the default methodologies are often used as a proxy for calibrating solvency models.

	LRBC	Solvency II	Canadian MCCSR	Economic Capital (common practices)
Time Horizon • One year • N years • Runoff	• Specified number of years for most C1 and C2 factors • Runoff for C3 factors	One year	Runoff for insurance risks. Specified number of years for C1 factors.	Practice varies, but usually either one year or runoff
Definition of Capital (*surplus simulation or cash flow basis*) • Stat , after tax, for existing business only • GAAP • Economic (i.e. MV or fair value)	• Statutory after-tax surplus simulation • RBC held for existing business	Fair Value	Based on Canadian GAAP surplus with certain adjustments / deductions. Available capital is stratified in Tiers of different quality with limitations as to composition.	On an economic basis, i.e. fair value for liabilities, market value for assets
Measure of Risk • Risk of ruin • VAR • CTE or Percentile (CTE for C3, varying percentiles for all other	CTE or Percentile (CTE for C3, varying percentiles for all other risks)	VAR	CTE or Percentile (CTE for segregated fund guarantee risk, varying percentiles for all other risks)	Practice varies, but often VAR,

risks)				
Risks Included	All material risks for inforce business	All material risks for inforce business	All material risks (explicit components for asset default and market risk, mortality risk, morbidity risk, lapse risk, C3 risk, segregated fund guarantee risk, foreign exchange risk. No explicit component for operational risk – this is addressed implicitly via scale up to required MCCSR ratio	All material risks; operational risk not always included
Quantification Method • Stochastic modeling • Stress testing • Factor based	• Factor based for C0, C1, C2, and C4. Note that many of the factors were derived from stochastic modeling or a risk applied to a representative product type and/or average period • Stochastic modeling for certain C3 risks	Stochastic Modeling	Factor based asset default and market risk with 50% lower factors for assets backing qualifying par business. Factor based C3, morbidity and foreign exchange risks. Deterministic model calculations for mortality and lapse risks. Stochastic modeling for segregated fund guarantee risk.	Stress testing currently most common, but stochastic modeling is gaining some ground
Aggregation Method • Additive • Correlation matrix applied to risk capital results for each	Correlation matrix where correlation is either 0 or 1, but with an aggregate covariance adjustment.	Correlation matrix applied to risk capital results for each risk or business unit	No diversification credit. Individual risk components are added together.	Correlation is most common, but structural model is gaining some ground

risk or business unit • Structural model (i.e., one model that includes all risks and expected risk distributions) 1. Copulas used to combine individual risk distributions		where correlations can be 0, 0.25, 0.50, and 0.75. 1.0		

1. **Ratings provided by NRSROs**

   Rating agencies provide a number of rating opinions and/or guidance for different purposes. For example,

   a. **Rating Opinions**: Rating opinions issued by Nationally Recognized Statistical Rating Organizations tend to be credit-only quality opinions and may not comment on other factors such as the adequacy of market price or market liquidity. Rating opinions are relative rankings and not based on any specific probability of default. Rating opinions tend to have a longer forecast horizon attempting to "look through" any temporary cyclicality.

   b. **Implied ratings based on Credit Default Swaps/Bond Spreads**: These market-implied ratings are generally software-based algorithms using credit and equity market valuations. Implied ratings enable relative value analyses both within and across different market instruments globally. Typically, implied ratings are only available for publicly-traded firms and would not necessarily be available for mutual organizations. Implied ratings can be quite volatile experiencing "shocks" unrelated to the issue.

   c. **Default Studies**: Each rating agency does a "look-back" of credit performance. These studies tend to show that higher rated securities (i.e., AAA, AA, etc) tend to have lower defaults than lower rated securities. In essence, the default studies attempt to validate the relative ranking of the Rating Opinions. While many have equated the results of these studies to be "calibration", these empirical studies may be affected by 1) low frequency events where a smooth default transition may not be evident between two rating categories or maturities, 2) how asset sectors are grouped such as public finance, corporates, structured finance, and 3) the length of the exposure period. For example, a default study would yield significant differences if the period were 2007-2009 versus 1997-2007.

   Although none of the above is a perfect solution, in combination, the ratings opinion, implied spreads, and default studies provide guideposts in judging the appropriate level of confidence in solvency models.

2. **Solvency II**

Solvency II, once it is implemented, will establish new capital requirements for European companies and their American subsidiaries. Under Solvency II, a market value balance sheet is created, with assets held at market value and liabilities held at fair value. The fair value of liabilities is calculated using a stochastic approach with both the projection and discount rate equal to the swap curve plus an illiquidity premium. The liabilities are based on best estimate assumptions and reflect cashflows for the lifetime of the liability. The liability best estimate assumption includes a risk margin for the current cost of funding. Liabilities are typically discounted at a lower rate than in the US statutory system.

The Solvency Capital Requirement (SCR) is the level of capital needed to withstand the wide variety of risks that an insurer faces with a 99.5% certainty over a one-year period (i.e., 99.5% Value at Risk (VAR) confidence level). If the SCR level is breached, increased regulatory scrutiny results, but the shortfall will not force a company to cease operations. This scrutiny is comparable to the RBC's Company Action Level (CAL). The SCR applies to an insurance group as a whole (which differs from RBC), so some members of the group with higher capital can offset members with lower capital, if the entire group is above the SCR.

The Minimum Capital Requirement (MCR) is calibrated to an 85% VAR over a one-year period. The MCR defines the minimum solvency level for each legal entity within a group. Breach of the MCR would result in the company cessation of operations.

The actual calculation of the SCR begins by quantifying the impact of a series of stress tests on the company's balance sheet. The stress tests are organized by risk categories, known as modules (in contrast to the US use of a C0-4 risk classification scheme). The modules are Life, Non-Life, Health, Market Risk, Counterparty Default, and Operational Risk, plus a Deferred Tax Adjustment. Each of these modules captures a number of risks. For example, in the "Life" module, risks include mortality, longevity, disability, expense, and lapse. Once the stress tests are performed, the results are aggregated by risk module. The calculation recognizes that these risks are not perfectly correlated, resulting in correlation assumptions applied within each risk module. The stress test results for each risk module are aggregated into a total number, which also assumes the risks are not perfectly correlated with each other.

The Solvency II approach has some similarities to the US RBC approach, but there are a number of differences:

- The liability calculation under Solvency II explicitly reflects risk information derived from current market prices. By contrast, the liability calculation under US statutory principles uses a discount rate based on an approximation of the industry asset earnings rate of the life (and annuity) business issued in that year..

- Under Solvency II, current market conditions form the starting point for all future risk parameters. In stressful economic times, additional capital will be required under Solvency II, as the then current stressful economic situation will become the starting point for valuing future extreme stress events.

- The Solvency II measurement essentially finds an exit value based on the projected market value after one year. This is a banking concept, where the objective is to find an amount that it would take to fully "close the position" in the market based on current

market values. The RBC measurement assumes that the company will not issue new business going forward and the resulting capital requirement calculation is meant to determine whether the current assets are sufficient under adverse situations (and based on conservative assumptions) to allow the insurer to meet its future inforce obligations. In theory, both systems could result in similar levels of required capital; but in practice, required capital amounts will likely be different. Understanding when and why they are different will be an important future concept to explore.

- The Solvency II framework allows the insurer to use an internal model that meets the criteria outlined in the framework requirements, with prior approval. An internal model may allow the insurer to create a measure more appropriate to its specific circumstances than the standard model. A significant hurdle to the approval of the internal model is the "use test". The company must demonstrate that the model is an integral part of the company's management system, including risk management processes and internal capital allocation. A company may be able to use a partial internal model. LRBC only allows the use of an internal model in specific circumstances (e.g., C-3 Phase 1 and 2) and does not require prior approval of those models.

3. **Canada**

The Office of the Superintendent of Financial Institutions (OSFI), the Canadian federal regulatory authority, regulates solvency at both the Life operating company level and the Holding company level. For Life Insurance operating companies the solvency framework is the Minimum Continuing Capital and Surplus Requirement (MCCSR). The key metric is the ratio of Available Capital to Required Capital. Available Capital is distinguished as Tier 1 (highest quality) and Total Available Capital. OSFI establishes both a minimum regulatory and target supervisory ratio for each of Tier 1 and Total Available Capital per the table below.

	Minimum	Supervisory Target
Total MCCSR Ratio	120%	150%
Tier 1 MCCSR Ratio	60%	105%

Required capital is based on explicit risk-based requirements covering market, credit, insurance, segregated fund guarantee, and foreign exchange risks. Operational risks are incorporated via a multiple scale-up.

The intervention process is not a rigid regime under which every situation is necessarily addressed with a predetermined set of actions. OSFI has a broad range of tools under the Insurance Act to intervene and correct or liquidate an institution depending upon the particular circumstances of that institution.

MCCSR was introduced in 1992 coincident with a change in reserve valuation requirements. At that time reserves changed from a stipulated assumption modified net premium approach to a more principle-based Policy Premium Method with assumptions determined by the actuary. The

Policy Premium Method was subsequently replaced in 2000 by the Canadian Asset Liability Method (CALM), which is a model-based method encompassing a series of deterministic scenarios in which the company's asset-liability management practice and valuation assumptions are determined by the actuary. There are prescribed standards of practice regarding the determination of valuation assumptions and the reflection of the company's asset-liability management practice in the CALM models.

Required Capital under the MCCSR formula originally consisted of amounts for:

- C 1 Asset Default and Market Risk
- C 2 Interest Margin Pricing Risk
- C 3 Changes in Interest Rate Risk
- Mortality Risk
- Morbidity Risk

Since its introduction, the MCCSR formula has been modified annually:

- In 1997 the Lapse Risk component was added to the formula, subject to a 3 year transition. It has generally been OSFI's practice to apply a 3 year transition whenever substantive changes have been made to the formula.

- In 2000, OSFI introduced rules for Segregated Fund Guarantees.

- Prior to 2002 C 1 asset default requirements were identical for assets backing participating policies and assets backing non-participating policies and surplus. The revised MCCSR asset default factors for assets backing *qualifying participating policies* are 50% of the factors used for assets backing non-participating policies and surplus. Explicit criteria must be met in order to be categorized as *qualifying participating policies.*

- In 2003 the Lapse Risk Component was further revised, subject to a 3 year transition.

- In 2005 there were substantial changes to the requirements for mortality and segregated fund guarantee risk. Changes to mortality risk were subject to a 3 year transition. Changes to segregated fund guarantee risk were subject to a 2 year transition.

- In 2009 OSFI eliminated the C 2 Pricing Risk Component, introduced a new Foreign Exchange Risk Component and made substantive changes to the rules for segregated fund guarantee risk. There was no transition related to these changes.

4. **Economic Capital**

The term "economic capital" (EC) is typically used to refer to a measure of required capital under an economic accounting convention, where assets and liabilities are valued using economic principles. EC is an internal calculation of the capital required, based on the company's view of risks. EC is the amount of capital required to give a specified level of security (i.e., the calibration

level) to policyholders in relation to the payment of their policy benefits. The measure of risk tolerance varies, but is usually probability of ruin (a.k.a., Value at Risk (VaR)), Tail Value at Risk (TVaR), or conditional tail expectation (CTE). The other key element of the calibration is the period over which risk is assessed. Most life insurance companies use a one-year mark-to-market approach, but a significant number also assess risk over the runoff of the liability portfolio.

The calculated level of EC is designed to provide a target level of protection to shareholder value, determined in such a way that this target can be communicated meaningfully to all the relevant stakeholders (including regulators and rating agencies). This target security level forms one component of the company's risk appetite. There is no prescribed way in which such a target security level should be expressed, although it is logical to relate it in broad terms to other measures of financial strength and resilience, such as rating agency assessments (AAA, AA, A, etc.) of the company's corporate debt (if any) and insurance financial strength rating, of which policyholders (or, at a minimum, their agents) will be aware.

Under a one-year mark-to-market approach, companies often calibrate EC to a target security level using the available data on corporate bond annual rates of defaults, which are meant to take into account all risks to which the organization is exposed to over a one-year period. A weakness to this approach is that there have not been that many insurer defaults, so calibration is usually performed on a broader set of corporate bonds. An example calibration level could be 0.5% or 0.1% VaR over the one year period.

Calibration of a liability runoff approach to an external data source is more difficult. The block of business (and therefore the risk exposure) will typically be reducing over time, and the projection would typically not include all risks for all time periods (e.g., new business). Therefore, there will not typically be external statistics available against which to calibrate the target security level, and some approximations will need to be made. In addition, different lines of business run off over different periods and may need different calibrations. Example calibration levels could be 90% or 95% VaR over the liability runoff period. In effect, EC levels are not based on an external calibration, but rather a statement of the desired level of assets that need to be held to fund a promised set of cashflows.

H. Risks and Risk Management Practices Not Captured in Capital Requirements

Some risks have been intentionally excluded from the LRBC system. The excluded risks fall into three areas:

- Immaterial (i.e., immaterial over the LRBC time period which generally covers risks that could materialize over a short to medium time frame, such as three to five years)

- Tail Risks, or risks that could materialize beyond the tested portion of the risk distribution (i.e., in the outside tails of the distribution beyond the 95th percentile)

- Risks that would not be pre-funded by capital, such as liquidity.

Some of the excluded risks, while potentially material, would materialize over a long time horizon. As discussed throughout this report, RBC for life insurance is designed to identify companies that are or could become weakly capitalized in a short to medium time horizon. The LRBC framework is defined within the statutory accounting framework and focuses on risks that could have a material impact on an insurer's statutory capital position.

The LCAS does not believe that any material risks have been excluded consistent with the established objectives and design of the LRBC framework. Further, the LCAS does not believe that any significant risk mitigation practices are being excluded from the LRBC framework. While some risk mitigation practices have been excluded (as described below), the LCAS does not believe these exclusions would affect the capacity of the LRBC tool to identify weakly capitalized companies.

The following is a list of risks that have been excluded from the current LRBC formula:

1. **Liquidity**

   Liquidity risk arises when assets cannot be traded with the expected bid/ask spread, anticipated price continuity or sufficient depth, thus causing price realization or execution that is unfavorable or nonexistent.

   Liquidity risk is associated with financial distress that can be security specific, broadly market based or company specific in nature. The primary cause of liquidity risk is the need to sell an asset to fund a policyholder payment. Liquidity risk occurs in these situations when there are no alternative internal or external funding sources available to avoid selling an asset at an unfavorable price. A secondary cause is the need to reduce holdings of an asset if concentration limits are exceeded when an asset's quality deteriorates.

   Typically the greatest liquidity risk occurs on a company specific basis. In this situation a "run on the bank" scenario unfolds where policyholders sensing critical financial distress exercise their withdrawal options. We do not believe it is appropriate to monitor or regulate liquidity risk through RBC requirements. Holding more assets that cannot be sold with favorable trade execution does not reduce the liquidity risk. Company specific liquidity risk can be mitigated by

investment diversification and managing concentrations of assets in relation to the withdrawal rights, amounts and timeframes, of policyholders.

2. **Investment risks**

Security specific risk involving leverage, currency, and spread risks may not be covered under RBC. C3 Phase 1 requirements do not address currency or spread risks. These risks may be reflected in cashflow testing, but practice varies by company. Assets with leverage may be tested under C3 Phase 1 if those assets are aligned with tested products. As more liabilities are brought under cash flow testing under principle-based approaches, this gap in risk coverage will decrease. Cash flow testing is a method for evaluating reserve adequacy.

Typically, leverage is associated with structured securities. Leverage risk is the risk associated with increasing the volatility of periodic payments. Using leverage, principal repayment terms also may be structured to increase their uncertainty, which increases credit risk. Security specific leverage is generally accomplished through structuring periodic payments according to formulae.

Currency risk is the risk that a non-dollar denominated bond (i.e., a bond whose payments occur in a foreign currency) has uncertain U.S. dollar cash flows. The dollar cash flows are dependent on the foreign exchange rate at the time the payments are received. Hedging with other assets or matching foreign bonds with foreign liabilities mitigates foreign exchange rate risk.

Spread risk is an incremental interest rate risk to Treasury interest rate risk. The spread or difference between an asset's yield and corresponding Treasury rate may change. Except for default causing a debt instrument to be valued at market, under statutory accounting spread risk is only reported if a bond is sold before maturity. However, the degree of mismatch risk between a company's assets and liabilities is influenced by spread risk. If a company needs to sell assets to generate cash flow, the spread will influence the cash proceeds generated from the asset sale.

Similar to the security specific risks discussed above, the leveraged risk of derivatives may not be covered unless tested under C3 Phases I or II. But, company hedging strategies mitigate the risk as will future expansion of C3 principle-based testing.

3. **Asset/Liability Risk for Long Term Care** is not included in the C3 component. While LTC pricing risks are covered in the LRBC formula, there is no explicit C3 risk charge for LTC business.

4. **Operational Risks** are assumed to be covered in C4, at least in part. However, when the original RBC system was developed, methods for measuring operational risk were largely based on Delphi type estimates with limited actual industry-wide data. Consequently, the relationship between operational risk exposure and the risk charge implied in the C4 component does not reflect state of the art practices for measuring operational risk and could be improved as better techniques for measuring operational risk are developed.

5. **The Risk of Poor Internal Risk Management** is not explicitly reflected in the LRBC system due to the inability to measure "poor management". This risk may be covered in C4, at least in part. Companies who cannot identify their net risk positions, or have sound tracking of their major risk exposures do not get charged any additional capital nor do good companies get credit for less required capital.

6. **Emerging Risks** are assumed to be covered in C4, at least in part. It is virtually impossible to establish capital requirements for an emerging risk that is, by definition, not yet a material risk and the extent of the risk magnitude is unknown. However, the use of a factor driven RBC requirement will likely contribute to a delay in recognizing emerging risks.

7. **Regulatory, Political, Sovereign Risks** are implicitly covered in C1 for asset risk to the extent that these risks have affected default rates. More generally, these risks are reflected in C4 at least in part, to the extent that these risks affect general business performance.

8. **Annuity Mortality/Longevity risks** have been "intentionally excluded" rather than "missing". The 1991 RBC Report on the C2 factors discusses the fact that this risk "takes so long to emerge that the solvency threat over a 5 to 10 year time horizon is negligible." Longevity was not considered a material tail risk that would emerge in the LRBC time horizon and should be reflected in reserves as the risk emerges.

9. **The Risks Associated with Writing New Business** is not included in the current LRBC system.

In addition to certain risks explicitly excluded from the LRBC formula, certain risk mitigation practices are excluded from the determination of LRBC. For example, some believe that companies writing participating business (e.g., universal life with adjustable pricing, and other experience-rated business) do not consistently receive an appropriate level of credit to RBC for the ability to manage risks by directly reflecting experience in dividends (e.g., non-participating insurance) or by adjusting policy terms. Also, companies engaging in hedging techniques to mitigate credit risk are not receiving credit in the LRBC formula.

There is also the risk that the impact of capital requirements may cause companies to manage to a regulatory capital requirement (or to a capital level based on regulatory requirements) instead of managing to the actual risk exposures based on fundamental economics. In recent years, the US life insurance industry has seen elements of the regulatory capital requirements increase, when the risk exposure declined (e.g., for variable annuities with guaranteed living benefits).

Exacerbating these counter-intuitive results is the misperception by some observers of results that LRBC can be used as a basis for comparing the safety and soundness of insurers.

Summary

This report has been prepared for the NAIC's Solvency Modernization Initiative RBC Work Group. The LCAS has provided relevant background on the historical development of the LRBC framework, along with an extensive documentation of the technical foundation of the LRBC formula and the individual components.

The LRBC system was designed more than twenty years ago, but has been updated numerous times since the initial implementation. One of the main objectives in designing the formula was to establish minimum capital requirements based on a high level of confidence. In doing so, the LRBC system provided a high degree of confidence in the resiliency of the US life insurance industry. The LRBC system was also designed as a tool for regulators to identify weakly capitalized companies with the LRBC formula providing the objective tool for triggering different levels of regulatory intervention.

Generally, the LRBC formula was designed with the following concepts in mind:

- The risk of solvency is measured within the statutory accounting framework.
- LRBC has been designed assuming reserve levels are appropriate; therefore, the LRBC is the additional amount needed in excess of appropriate aggregate reserves to absorb catastrophic losses or unusual variations in experience.
- The LRBC formula should provide a focus on the quantification of risks that could have a material effect on an insurer's statutory capital position, if the risks materialized over a short to medium time horizon, such as three to five years.
- The major risk categories (the "Cs") have mostly been calibrated at approximately the 95th percentile; the individual risk elements that comprise the major risk categories have been calibrated at varying risk levels and time horizons, but with the expectation that the aggregate risk elements will be calibrated at the 95th percentile for the major risk category.
- Aggregate LRBC will be derived from the capital requirements for each major risk category, adjusted for specific correlation between the risk categories.

Generally, most material risks and risk mitigation practices that could affect the identification of companies that are or could become weakly capitalized have been reflected in the LRBC formula.

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