AMERICAN ACADEMY *of* ACTUARIES

RISK TRANSFER IN P&C REINSURANCE: REPORT TO THE CASUALTY ACTUARIAL TASK FORCE OF THE NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

American Academy of Actuaries,
Committee on Property and Liability Financial Reporting

August 2005

The American Academy of Actuaries is the public policy organization for actuaries practicing in all specialties within the United States. A major purpose of the Academy is to act as the public information organization for the profession. The Academy is non-partisan and assists the public policy process through the presentation of clear and objective actuarial analysis. The Academy regularly prepares testimony for Congress, provides information to federal elected officials, comments on proposed federal regulations, and works closely with state officials on issues related to insurance. The Academy also supports the development and enforcement of actuarial standards of conduct, qualification and practice, and the Code of Professional Conduct for all actuaries practicing in the United States.

1100 17th Street NW Seventh Floor Washington, DC 20036 Telephone 202 223 8196 Facsimile 202 872 1948 www.actuary.org

RISK TRANSFER IN P&C REINSURANCE:
Report to the Casualty Actuarial Task Force of the National Association of Insurance Commissioners

TABLE OF CONTENTS

INTRODUCTION

Purpose of Report

This is a report from the Risk Transfer Subgroup (RTS) of the American Academy of Actuaries' (Academy") Committee on Property and Liability Financial Reporting (COPLFR) to the Casualty Actuarial Task Force (CATF) of the National Association of Insurance Commissioners (NAIC). The report contains the results of a survey of current industry practices regarding risk transfer, and alternative approaches to the evaluation of risk transfer.

In this report, the RTS has compiled information and ideas on the topic of risk transfer in reinsurance. This information includes responses and an evaluation of such responses from the survey of current industry practices. In addition, it includes a variety of alternatives to evaluating risk transfer suggested by actuarial professionals practicing in the industry. While we have provided a compilation of these approaches herein, including a high-level description and some possible advantages and disadvantages of each approach, the report does not endorse any one approach. Rather, the information and alternatives have been provided for the CATF for its consideration in evaluating reinsurance accounting and risk transfer requirements.

This report is not an Actuarial Standard of Practice. It has not been adopted by the Actuarial Standards Board (ASB) and is not binding on any actuary. It should not be deemed to describe or codify generally accepted actuarial practice. From the perspective of the actuarial profession, the evaluation of risk transfer is an evolving practice and there does not yet exist generally accepted practice for it.

Background

The Property and Casualty Reinsurance Study Group ("Study Group") of the NAIC Accounting Practices and Procedures (E) Task Force is currently studying the analysis of risk transfer to qualify for reinsurance accounting. In a memorandum dated March 24, 2005 the Study Group requested the following assistance of the CATF:

- Identify what risk transfer tests are being used in the industry today.
- Provide guidance on what the minimum transfer of risk standard should be.

The Study Group has indicated its intention to complete analysis and be prepared to adopt changes effective year-end, so they requested an update from the CATF at the Summer Meeting and a final report by the Fall National Meeting.

Risk Transfer Subgroup

COPLFR is a committee of the Academy that deals with property/casualty financial reporting issues. COPLFR formed the RTS, composed of property/casualty actuaries from a variety of consulting, regulatory and industry backgrounds, to provide technical assistance to regulators, standard-setters and other governing bodies as necessary in the risk transfer area.

At the request of the CATF, and as described in a letter dated April 13, 2005, COPLFR's RTS agreed to provide the following assistance to the CATF by performing two projects:

- Develop a survey of companies in the U.S. regarding their current risk transfer practices with respect to property/casualty insurance for the NAIC to issue.

- Develop a summary of alternative approaches, including pros and cons of each approach, for the CATF's consideration with respect to a standard on risk transfer.

Over the past five months the RTS, along with a liaison committee comprised of several CATF members, has conducted these two projects. This report contains the information and findings developed from both projects.

Organization of Report

The remainder of this report is organized as follows:

- "Executive Summary" contains a high-level summary of the RTS' findings and observations.

- "Key Accounting Principles" contains a brief description of the statutory and GAAP accounting principles for risk transfer in reinsurance contracts that are referenced frequently in this report.

- "Risk Transfer Survey" provides a summary of the responses to the NAIC's survey of U.S. property/casualty insurance companies regarding their practices for evaluating and documenting risk transfer in reinsurance contracts.

- "Risk Transfer Alternatives" provides a summary of responses from efforts to gather ideas from the property/casualty actuarial community regarding possible standards and approaches for evaluating risk transfer in reinsurance contracts.

- "Conclusion" contains our understanding of the next steps with respect to this effort, and a list of the RTS and CATF members who contributed to this effort.

- Appendix 1 contains the survey referenced above and a summary of the responses.

- Appendix 2 contains copies of the submissions from casualty actuaries regarding a proposed/suggested standard on risk transfer.

EXECUTIVE SUMMARY

This report and its appendices are a compilation of insurance company responses and ideas on the topic of risk transfer with reinsurance contracts. This information includes responses and an evaluation of such responses from the survey of current industry practices. In addition, it also includes a variety of alternatives to evaluating risk transfer suggested by actuarial professionals practicing in the industry. We are providing this information to the CATF in its entirety for its consideration in evaluating reinsurance accounting and risk transfer requirements.

COPLFR formed the RTS in April 2005. During the last five months, its members have received a significant amount of information on the topic of risk transfer. In addition to the survey and suggested alternatives, we have consulted the industry, spoken with insurance professionals serving in a variety of roles in the industry and received other unsolicited e-mails and ideas. Based on these interactions and our professional experience, we have several overriding considerations that we would like to provide to the CATF; these are discussed below.

The testing rules prescribed first by FAS 113 and then by SSAP 62 regarding the evaluation of risk transfer appear to have been designed to assess certain contracts that were designed in a manner that significantly reduced the reinsurer's downside risk. In the past ten years, subsequent to the introduction of the prescribed testing rules, a variety of new circumstances have occurred, from the 10/10 rule becoming a commonly used test to a proliferation of contracts that may have been designed to meet that rule only marginally.

We believe that until recently, perhaps as recently as 2004, cashflow testing to evaluate reinsurance risk transfer in an accounting context was mostly limited to contracts deemed to be "finite," in which the reinsurer's downside risk is significantly limited and in which the business purpose appears to have significant financial statement-related elements in addition to insurance-related elements. Reinsurance contracts deemed to be non-finite or "traditional" were not typically subject to cashflow testing, presumably because the reinsurer's potential downside risk was sufficiently severe that the presence of risk transfer was deemed to be self-evident.

As concerns over industry practice have emerged, it has been suggested that such testing should be expanded from finite agreements to traditional agreements. However, to our knowledge, there does not exist practical guidance on:

- What contracts should be cashflow tested, and whether certain types of contracts should be exempt;
- Why a traditional contract would or would not be cashflow tested;
- If necessary, how a traditional contract would be cashflow tested;
- Whether the "reasonable possibility of a significant . . . loss" provision in SSAP 62 is appropriate to apply to traditional contracts; and
- When, if ever, it is appropriate to consider bifurcating a reinsurance contract.

We believe that a lack of guidance and consensus on these issues is largely responsible for some of the difficulty in assessing whether or not companies are properly complying with accounting standards with respect to risk transfer. Irrespective of what changes, if any, are made by the NAIC to SSAP 62, we believe that guidance related to these questions is imperative to avoid two undesirable outcomes:

- Unnecessary effort and administrative expense associated with cashflow testing and modeling contracts where risk transfer is self-evident; and
- The potential for unintended consequences, such as counter-intuitive accounting decisions, as a result of a mismatch between the testing prescribed by SSAP 62 and the economic reality of reinsurance.

Regarding the second point, one of the traditional functions of reinsurance has always been to protect companies against potential losses whose probabilities are unknown and, in some instances, unknowable. Two examples of risks that were unknowable at the time reinsurers accepted them are the emergence of asbestos losses and the terrorist attacks of September 11. Although the probabilities of such extreme events may have been deemed remote or even zero at the time the reinsurers wrote the underlying contracts, nevertheless these events occurred and have been a significant share of reinsurers' underwriting losses. The RTS does not believe that a test that hinges on a reasonable estimate of the probability of the reinsurer's loss is sufficient to encompass the instance of the true transfer of unknown risk.

In addition, based on our reading the survey responses and the submissions to our call for risk transfer alternatives, we would like to identify several matters for the CATF's consideration:

- We do not believe a bright-line approach, without allowance for judgment, is an optimal approach. There are some contracts for which cashflow testing using a standard of "reasonable possibility of significant loss" as prescribed in SSAP 62 cannot always be appropriately applied, and for which a reasonable bright-line threshold would be difficult or impossible to establish. For example, there are contracts where, as it regards the business being reinsured, the ceding company's expense is fixed and known at the date it enters into a contract and the reinsurer is assuming the variability of the resultant loss experience. In these circumstances, when the probability of loss to the reinsurer is unknown or thought to be very small but the potential loss is very large, risk transfer can often be deemed self-evident, and cashflow testing coupled with bright-line standards may be neither appropriate nor relevant. Therefore, we believe these contracts, in which risk and reward are effectively transferred away from the cedant regardless of the probability of loss, should not be subject to cashflow testing using a standard of "reasonable possibility of significant loss" as prescribed in SSAP 62. We note that expansion of the Paragraph 11 Exception may be controversial, but that there may be other justifications sufficient for this purpose.

- Just as there are many acceptable loss reserving methods, we believe that there can be many acceptable risk transfer testing methods. No one method will always be better than the others, and the appropriateness of any given method will depend on the individual circumstances. Furthermore, just as with loss reserving, it is possible that a best practices approach for evaluating risk transfer might involve input from a combination of approaches.

- We believe that the Expected Reinsurer Deficit test described in the CAS Working Party report may be a useful testing method that follows the precepts for cashflow testing outlined in SSAP 62. However, we do not believe it is appropriate to apply it as a bright-line standard test, and we believe that further analysis is required to determine what threshold may be reasonable under various circumstances.

- We believe the concepts outlined in the Gluck, Wenitsky and Belfatti papers may also be helpful. This type of testing does not really follow the precepts for cashflow testing outlined in SSAP 62; rather, the tests in these papers focus on the relationship between the reinsurer's results and the ceding company's results to determine what portion of the risk is transferred.

- The methods described in the Gluck, Wenitsky and Belfatti papers all yield percentages that can be used either as a risk transfer test for "either-or" accounting or to bifurcate contracts. The RTS was not asked to evaluate, and has not evaluated, the feasibility of bifurcation as an accounting concept. Absent such an evaluation, RTS members have various opinions as to whether bifurcation is feasible as an accounting practice. If the NAIC wishes to consider these or other methods for the purpose of bifurcation, we recommend further analysis on real-life contracts to determine what types of situations are appropriate for bifurcation, how the accounting would be done, how complicated and useful the bifurcation process would be, and whether the results would improve the matching of accounting versus economics for the sample contracts.

- There were many valuable suggestions contributed to our question regarding safe harbors. Different respondents often focused on quite different factors, so we believe that there is no universally accepted definition of what constitutes "reasonable self-evidence" with respect to risk transfer. We believe that the publication of specific guidance by the NAIC regarding safe harbors, perhaps based on the suggestions contained in this report, would be a valuable and important development.

- According to the survey responses, the current practice regarding the evaluation and quantification of insurance risk appears to be largely an accounting function, with limited actuarial involvement. However, the alternatives suggested require a fairly sophisticated knowledge of actuarial concepts such as parameter risk, probability distributions, trending, etc. Should the tester of risk transfer not have adequate training in this area, we are concerned that the results of the tests may not be meaningful. Therefore, we believe that increased actuarial involvement in risk transfer testing is essential.

- We also believe that additional actuarial guidance on risk transfer testing should be developed within the actuarial profession. We would note that the RTS intends to develop a Practice Note on Risk Transfer Testing as a first step later this fall.

As the CATF evaluates the items in this report and prepares recommendations to the Study Group, there are many items to consider and evaluate. COPLFR is available to assist the CATF and the Study Group in this evaluation process. Since our primary focus would be financial reporting and policy issues, we further encourage the CATF to consider the Casualty Actuarial Society as an excellent resource for further technical research in this area.

KEY ACCOUNTING PRINCIPLES

Under Statement of Statutory Accounting Principles No. 62 "Property and Casualty Reinsurance" ("SSAP 62"), indemnification of a ceding entity against loss or liability relating to insurance risk in reinsurance requires both of the following:

a. The reinsurer assumes significant insurance risk under the reinsured portions of the underlying insurance agreements; and

b. It is reasonably possible that the reinsurer may realize a significant loss from the transaction.

Contracts satisfying both a. and b. above are typically viewed as contracts that "transfer risk"; this phrase is used frequently in this report.

SSAP 62 contains one exception, typically referred to as the "Paragraph 11 Exception," to these requirements in the case that "the reinsurer has assumed substantially all of the insurance risk relating to the reinsured portion of the underlying insurance contracts."

SSAP 62 also states that:

- A reinsurer shall not have assumed significant insurance risk under the reinsured contracts if the probability of a significant variation in either the amount or timing of payments by the reinsurer is remote.

- The ceding entity's evaluation of whether it is reasonably possible for a reinsurer to realize a significant loss from the transaction shall be based on the present value of all cashflows between the ceding and assuming companies under reasonably possible outcomes, without regard to how the individual cashflows are described or characterized.

The above provisions in SSAP 62 are essentially the same as those in FAS 113, "Accounting and Reporting for Reinsurance of Short-Duration and Long-Duration Contracts."

RISK TRANSFER SURVEY

The CATF issued a survey to U.S. domiciled insurance companies regarding the industry's current practice on evaluating and documenting risk transfer as it relates to reinsurance contracts. The survey was issued by the CATF in June 2005 to insurance company groups, and responses were received within approximately 30 days. The survey responses were then provided by the CATF to the RTS without information that could identify individual respondents. This section of the report contains a description of the survey and an evaluation of the survey responses.

Contents of Survey

The survey has the following sections:

- Background Questions
- Criteria: the criteria for choosing which reinsurance agreements will be tested for risk transfer,
- Risk Transfer Testing and Threshold: the nature of the risk transfer tests being used, and the threshold being used to determine whether or not an agreement meets the requirements for reinsurance accounting

Appendix 1 contains a copy of the survey and a summary of responses to the survey.

Summary of Observations

There were 390 survey responses provided to the RTS by the CATF; our observations as they relate to those responses are provided in detail below. Following are a few of our more significant conclusions:

- Approximately 25% of those receiving the survey provided responses – however, we believe it is possible that larger companies were underrepresented relative to small and mid-sized companies. Interestingly, where observed, and where we considered it to be statistically significant, the size of the company did not appear to have a significant bearing on most responses.

- Based on responses to question #3, for the majority of respondents, there are no individual terms, conditions or other characteristics that define a contract as "finite." This might suggest that the respondents generally believe such a definition is a matter of substance rather than form, and might arise from a combination of certain conditions.

- Approximately 23% of respondents have entered into at least one ceded finite contract in the past four years – large insurers were slightly more likely, at 29%.

- It is uncommon for a company to have a formal written policy regarding the evaluation of reinsurance accounting and risk transfer; this is even the case for those that have entered into finite ceded contracts in the past four years.

- As evidenced by the responses to question #16 and #17, the evaluation and quantification of insurance risk appears to be largely an accounting function. It is rare that actuaries actually lead the evaluation of ceding and assuming company risk transfer evaluations. It is also uncommon that the respondents have a requirement that risk transfer analyses require internal actuarial approval.

- Similarly, a minority of respondents (31%) employ statistical / modeling approaches to evaluate risk. This percentage is much higher (70%) when actuaries lead the risk analysis. Further, most companies

report that they do not explicitly consider process, parameter, or acceleration risk. This suggests that companies may either be performing an incomplete evaluation of risk, or that their approaches do not allow them to explicitly identify the types of risks being evaluated.

Although the need for risk-transfer testing arises from the application of accounting rules, we believe that it would be beneficial for actuaries, who have significant expertise in evaluation and quantification of insurance risk, to take a larger role in this process.

- Relatively few respondents rely exclusively on a numeric test to evaluate whether there is sufficient risk transfer. Most use calculations as a starting point, supplemented by other considerations and judgment. Where applicable, the 10/10 rule (i.e., 10% chance of a 10% loss) was the most common numerical threshold used by respondents in determining risk transfer. However, many respondents elected not to respond to this question.

The remainder of this report contains our evaluation of responses by category of questions in the survey. When reading the discussion below, it would be helpful to refer to the survey and summary of responses in Appendix 1.

It is important to note that additional evaluations of the survey's responses are possible based on different organizations of the responses – for example, responses for stock companies versus mutual companies.

Background Questions

Based on responses to question #1 regarding surplus, 71% of respondents were smaller companies (i.e., less than $100 million in surplus), 23% were mid-sized companies and 5% were larger companies (more than $1 billion in surplus). The responses were skewed even more to smaller companies based on net written premiums – 78% for smaller companies, (less than $200 million in net written premiums), 19% for mid-sized companies and 3% for larger companies (more than $2 billion in net written premiums). As such, it is possible that larger companies are underrepresented in this survey.

Hereafter, we will refer to companies as small, mid-size and large based on the levels of surplus in reference to the above questions.

For question #2, only 5% of respondents had a definition of finite reinsurance that was substantially different than that contained in the cover letter. For those who disagreed with the definition in the cover letter, the most common response was that the company did not have a definition because finite reinsurance is not used by the company. Several respondents provided alternate definitions, which varied widely from any contract not providing unlimited aggregate limits to contracts that had no risk transfer.

Based on responses to question #3, for the majority of respondents, there are no individual terms, conditions or other characteristics that define a contract as "finite." Also based on the responses to question #3, the characteristics that are mentioned most often, by an average of about 35% of respondents, were contracts where it is viewed as likely that the ceding company will exercise their unilateral right to commute shortly after the exposure period, quota share contracts with aggregate loss ratio caps, and funds withheld arrangements coupled with experience refund accounts. Contract features which are least often mentioned as indicating that a contract is finite are multiple year contracts, loss carry forwards and experience refunds.

For questions #4 and #5, only 7% (28 of 390) of respondents have entered into an assumed finite contract in the last four years, and only 1% (5 of 390) of respondents have dedicated units designed to write assumed finite reinsurance. All else equal, we would have expected a higher percentage than 1% - this might further suggest that larger companies are underrepresented in the survey, since it is usually larger companies that have such dedicated units.

For question #6, 23% of respondents entered into a ceded finite contract in the past four years – the range is 21% for small insurers, 25% for medium insurers and 29% for large insurers. This is a much higher percentage than those insurers that entered into assumed finite contracts in #4 above. While this is consistent with our expectation that most assumed finite contracts are written by a relatively small number of companies, a contributing factor could be that larger companies, which would be more likely to have units dedicated to writing finite contracts, might be underrepresented in the survey.

Criteria

For question #7, only 31% of respondents, excluding those who responded "not applicable," have a formal written policy regarding the evaluation of reinsurance accounting and the application of appropriate accounting rules and regulations to its ceded reinsurance products. Interestingly, for the respondents who indicated that they entered into a ceded finite contract in the past four years (question #6), only 29% have a formal written policy.

Question #8, which asked the same question as #7 from the assuming company's perspective, had similar responses. Excluding those who responded "not applicable," 22% of respondents have a formal written policy regarding the evaluation of reinsurance accounting as described above. Interestingly, however, nearly half (11 of 23) of the respondents that have written a finite contract in the past four years have a formal written policy.

Based on responses to question #9, the majority of the respondents (75%) believe there are classes of contracts that may be deemed to be clearly reinsurance and which therefore do not require detailed review to determine risk transfer or appropriate accounting treatment.

Question #10 asked, for ceded reinsurance, which reinsurance contracts are reviewed in detail for accounting treatment and risk transfer. Excluding those who responded "not applicable" (question #10f), the majority (71%) of the respondents reported that all contracts were reviewed. Based on the responses, it would appear that the other considerations listed, such as materiality, existence of catastrophe exposure, and the existence of loss limiting features were rarely determining items in selecting which contracts to review in detail for accounting treatment and risk transfer.

The results for #9 and #10, when considered together, appear to produce an inconsistent result. For example, based on question #9 the majority of respondents believe there are classes of contracts that clearly transfer risk and as such detailed review is not required. Nevertheless, a significant majority of these companies noted that all contracts were reviewed in detail for risk transfer.

Question #11 requested information as to what documentation is maintained by the respondent for its ceded reinsurance contracts; a summary of the responses is as follows (Note this summary excludes those respondents that answered "not applicable" to question #10f, since it is assumed those respondents do not have ceded reinsurance):

- The vast majority of respondents, approximately 95%, reported that relevant correspondence between the parties is maintained in the ceding companies' file.

- The majority of respondents, 63%, indicated there is typically a copy of each draft of the contract in the ceded reinsurance file.

- It was less common, about 37% of the time, that a risk transfer calculation was included in the contract file. Larger insurers were more likely to maintain such information (58% of respondents).

- Approximately 28% of the respondents maintain a memorandum from management describing the business purpose of the contract and other relevant concerns – similar to risk transfer documentation, larger companies were more likely to maintain such information (47% of respondents).

- Signoff from the internal accounting management and internal actuarial management were rarely included – internal accounting and internal actuarial signoff were included less than 15% of the time. In fact, even for respondents that included risk transfer analyses in the contract file, only 17% of these respondents included internal actuarial sign-offs. A somewhat greater percentage, 27%, of such respondents included internal accounting sign-off in the file.

- It was also rare, less than 15% of the time, that external auditor or regulatory signoff was included in the ceded reinsurance contract files.

Questions #12 and #13 were identical to question #10, except it was asked from the assuming company's perspective rather than the ceding company's perspective.

Question #12 asked which assumed reinsurance contracts are reviewed in detail for accounting treatment and risk transfer. Excluding those who responded "not applicable" to question #12f, approximately two-thirds of respondents mentioned that all contracts were reviewed – this was a similar percent as those who responded from a ceding company perspective in question #10. Also similar to question #10, the other considerations listed, materiality, existence of catastrophe exposure, etc., were rarely determining items in selecting which contracts to review in detail for accounting treatment and risk transfer.

Question #13 asked what documentation is maintained by the respondent for its assumed reinsurance contracts. Again, excluding those who responded "not applicable" to question #12f, the responses were similar to question #11, except that it was somewhat less likely that the assuming company would have as comprehensive a contract file as the ceding company:

- A significant majority of respondents, approximately 85%, reported that relevant correspondence between the parties is maintained in the ceding companies' file.

- Slightly more than half of respondents, 53%, indicated there is typically a copy of each draft of the contract in the ceded reinsurance file.

- A risk transfer calculation was included by 23% of respondents in the contract file. Unlike from the ceding company perspective, larger insurers were not more likely to maintain such information for assumed contracts.

- Approximately 16% of the respondents maintain a memorandum from management describing the business purpose of the contract and other relevant concerns. Larger companies were more likely to maintain such information (33% of respondents).

- Internal accounting management and actuarial management sign-offs were included by less than 10% of the respondents. For respondents that included risk transfer analyses in the contract file, 21% of these respondents included internal actuarial sign-offs, and 30%, of such respondents included internal accounting sign-off in the file.

- External auditor or regulatory signoff was included in the ceded reinsurance contract files by less than 10% of the respondents.

Risk Transfer Testing and Threshold

Questions #14 and #15 asked respondents if their group has a formal written policy regarding the evaluation of risk transfer for its ceded and assumed reinsurance products, respectively. Excluding those who responded "no ceded reinsurance" or "no assumed reinsurance'" it was evident that most companies do not have such written policies – only 17% for ceded reinsurance, and 13% for assumed reinsurance.

Questions #16 and #17 asked respondents who leads the evaluation of risk transfer for their ceded and assumed reinsurance products, respectively. Excluding those who responded "no ceded reinsurance" or "no assumed reinsurance," the responses to these questions were similar to one another. For both ceded and assumed reinsurance, the accountants were the most commonly identified group to lead the evaluation of risk transfer. In addition, there was a relatively large percentage (one-quarter for ceded contracts, one-half for assumed contracts) of respondents that answered "other" – a common written response to those who replied "other" was individual members of senior management, such as the Chief Financial Officer or a committee composed of several members of senior management.

Question #18 asked respondents what type of testing is performed in the evaluation of risk transfer for contracts that are tested for risk transfer, allowing multiple answers. Question #19 asked respondents to select the type of testing that is predominantly used.

- For question #18, the most common response, from 64% of respondents, was a review of historical results. The next most common response, from approximately one-third of respondents, was the development of a single scenario via judgment that could be viewed as reasonably possible. As it regards more statistical and modeling based analyses, approximately 31% of respondents performed either stochastic simulation or confidence level analysis; however, this percentage is much greater, approximately 70%, when actuaries lead the risk transfer analysis (question #16, response d).

- The responses for question #19 closely followed those for 18. Historical results were the most common test applied – 44% of respondents. Statistical and modeling based analyses were used by 24% of the respondents. A single scenario was used by 14%, while the remaining respondents cited "other."

Question #20 asked which risks are explicitly considered in the calculations used to evaluate risk transfer. Based on the responses, most companies report that they do not explicitly consider process, parameter, or acceleration risk. This suggests that companies may either be performing an incomplete evaluation of risk, or that their approaches do not allow them explicitly to identify the types of risks being evaluated. Companies that employ statistical/modeling approaches are significantly more likely to explicitly consider these multiple sources of risk; below are the percentage reported for each category of risk:

- One-third of respondents considered process risk in calculations. However, this percentage increased to 57% for those respondents that use either or both stochastic simulation and/or confidence level analysis.

- There were similar percentages for parameter risk; 37% of respondents considered parameter risk in calculations, and this percentage increased to 66% for those respondents that use either or both stochastic simulation and/or confidence level analysis.

- As it regards the consideration of timing risk/acceleration of payment patterns, similarly one-third of respondents considered such risk; this percentage increased to 50% for those respondents that use either or both stochastic simulation and/or confidence level analysis.

Approximately 25% of respondents answered "other"; based on our review of the written responses, the most common response was "not applicable" or the equivalent.

Based on the answers to question #21, approximately one-third of respondents compare actual results under contracts to expectations from the risk transfer calculations. This percentage increases to 45% for those respondents that used stochastic simulation and/or confidence level analysis per question #18. For the total 124 respondents that have performed such a comparison, 54% responded that actual risk transfer or variation in results was estimated to be the same as from the risk transfer calculations. 18% responded that there was more actual risk transfer than expected, while only 4% noted there was less risk transfer. The remainder of the respondents answered "unknown."

For question #22, which asked, what models are used to evaluate risk transfer for most or all contracts, the responses were about evenly distributed between internal models, external models and a separate spreadsheet based model for each contract.

Based on the responses to question #23, numerical calculations coupled with judgment and/or other considerations were overwhelmingly the most common approach used to equate a numerical criterion to the accounting risk transfer standard of a "reasonable possibility of a significant . . . loss". Responses "c" and "d" were similar, in that calculations were a starting point only and that other considerations and judgment are factored into the evaluation. Responses "a" and "b" differed in that the use of judgment was not included in the response. Of those respondents that answered "a" through "d", 87% responded with "c" or "d".

Question #24 asked, for those whose response to question 23 was (a) or (b) or (c), what numerical criteria equates to a reasonable possibility of significant loss for most contracts. For the 98 respondents that answered this question, 86% selected a 10% chance of a 10% loss.

RISK TRANSFER ALTERNATIVES

Call for Responses

On June 13, 2005, the RTS sent a letter to all members of the Casualty Actuarial Society ("CAS") requesting suggestions regarding the analysis of risk transfer in reinsurance agreements. Property/casualty actuaries interested in contributing suggestions were asked to submit responses to one or more of the following questions:

1) What is an effective test for risk transfer? (Respondents were asked to focus on actuarial methodology and provide examples as appropriate.)

2) What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer? (Respondents were asked to focus on decision criteria used to evaluate the results of the test described in question #1.)

3) What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract (i.e., in what instances is risk transfer "reasonably self-evident" and therefore cashflow testing is not necessary to demonstrate risk transfer)?

4) What are the advantages and disadvantages of the suggested approach versus other approaches commonly used?

The Casualty Actuarial Society formed a Research Working Party on Risk Transfer Testing ("CAS Working Party"), which developed a report ("CAS Report") in response to this call for suggestions. Besides the response of the CAS Working Party, submissions to the RTS call were received from 18 individual actuaries. The submissions from the CAS Working Party and individuals are contained in Appendix 2 to this report.

Summary of Findings

While the responses were very diverse, thoughtful and generally well designed, there were several commonly recurring themes. Following is a listing of several of the more common and more highly emphasized themes *(in this section, RTS comments are presented in italics)*:

- Many respondents stated that the "10/10 rule," defined as a 10% chance of a 10% loss, was inadequate for purposes of testing across the spectrum of reinsurance agreements, and noted that frequency and severity of loss should be combined into one test statistic. This was particularly emphasized for agreements that reinsured low frequency/high severity risks. *The RTS concurs with this view. Further, we do not believe a bright-line approach, without allowance for judgment, is an optimal approach.*

- Several respondents believed that a risk transfer analysis must not only consider the variability of the reinsurer's results but also the variability of the underlying business. *The RTS concurs with this view.*

- Many respondents emphasized the need to consider parameter uncertainty, and the mismatch in information between the ceding company and reinsurer, in assessing risk. *The RTS concurs with this view and would add that we believe parameter uncertainty is an important, and often misunderstood, element of risk transfer.*

- Several respondents provided alternatives to the 10/10 rule for the evaluation of risk transfer. *The RTS suggests that the NAIC may wish to consider these alternative methods, and evaluate these alternative methods among a variety of "real world" reinsurance agreements to assess their feasibility and effectiveness.*

  Several of the new risk transfer analysis methods suggested are worth serious consideration. The ones we consider most promising, in breaking new ground while attempting to strike a balance between theoretical soundness and practicality, are contained in the papers from the CAS Working Party, Gluck, Wenitsky and Belfatti. Furthermore, many of the ideas offered could be altered, or used in combination with each other; there is no one correct version of how to approach the subject of risk transfer.

- Several respondents believe that the binary, "either-or" nature of accounting (i.e., contracts are either 100% reinsurance or 100% deposits) was inadequate to encompass contracts that contain both risk and financing elements, and suggested approaches to bifurcate contracts so that these elements could be accounted for separately. *The RTS was not asked to evaluate, and has not evaluated, the feasibility of bifurcation as an accounting concept. Absent such an evaluation, RTS members have various opinions as to whether bifurcation is feasible as an accounting practice. If the NAIC wishes to consider these or other methods for the purpose of bifurcation, we recommend further analysis on real-life contracts to determine what types of situations are appropriate for bifurcation, how the accounting would be done, how complicated and useful the bifurcation process would be, and whether the results would improve the matching of accounting versus economics for the sample contracts.*

- Several respondents introduced new ideas, often related to the Paragraph 11 Exception, to identify and potentially expand the types of contracts for which risk transfer is reasonably self-evident.

  Although some of the ideas regarding safe harbors may be controversial, we believe that many of them have well-founded justifications and should be considered. We do not believe it is necessary to expand the Paragraph 11 Exception in order to justify safe harbors that exempt certain types of contracts from cashflow testing.

The remainder of this section contains a discussion of the responses, organized by major topic. We have also included a comparison of results for two sample agreements using evaluation methods contained in five of the responses.

Question 1: What is an effective test for risk transfer?

The responses to this question encompassed several major topics:

- Whether or not there should be a bright-line test;
- The general focus of a risk transfer test (e.g., distribution of ceded results, proportion of direct volatility ceded, etc.);
- Inputs used to model cashflows (e.g., should brokerage be deducted, should parameter risk be included, what discount factor should be used, etc.);
- Risk metric (e.g., tail value at risk ("TVaR") at a given percentile, conditional expected value, standard deviation of NPV results, etc.); and,
- Decision rule, including an indication of whether the decision between reinsurance and deposit accounting is "all or nothing" versus a continuum.

Following is a sampling of the responses received on each of these topics.

Should there be a bright-line test at all?

The CAS Report appears to imply that a bright-line quantitative test should not be the only method used to determine whether reinsurance accounting is appropriate. Some of the relevant comments are as follows:

- "No quantitative methodology will ever be fully successful in detecting intentional attempts at fraud or accounting abuse."
- "It would be a mistake to think that actuaries or any other quantitative expert can provide a formula that reduces the analysis of intent, good or bad, to a simple (or even complex) calculation."
- "The failure of a contract to meet a quantitative risk transfer test should not result in denial of reinsurance accounting treatment to a transaction without a thorough review of the all aspects of the deal, including the question of intent."

Other respondents made comments refuting the idea of a bright-line test; for example:

- (Koegel) "A common misconception in attempting to evaluate risk transfer in reinsurance is that probability of loss is a precise measure." Koegel recommends less emphasis on probability-based testing and more emphasis on the degree to which the cedant is indemnified once losses have occurred.
- (Hess) "The current role of judgment (from management on to the auditors) is an important part of the risk transfer rules. Applying an actuarially based measure of risk can be applied within the existing SSAP 62 and FAS 113 guidance...The 10/10 criteria or any other "bright line" test has never been included in any accounting guidance, nor should it be."

A few respondents, such as Bear, Cuzzi and Pastor, appeared to support bright-line tests and offered suggestions as to the types of tests that may be used.

As described by several respondents, the theoretical advantages of a bright-line test would be to reduce confusion regarding the meaning of the words "significant" and "reasonable" and increase consistency of practice. The RTS believes that the main disadvantages would be:

- The difficulty of designing a bright-line test that is effective, given the diversity of reinsurance agreements and subject business situations under which it must be applied;
- The necessary reliance on probability distributions and loss estimates that are imprecise, and often contain significant uncertainty;
- The reduction of reliance on professional judgment, and
- The potential for unintended consequences, such as the structuring of contracts to barely pass or in some way to get around the bright-line test.

Focus of a risk transfer test

Several authors made the point that a proper risk transfer analysis must take into account not only the reinsurer's results, but also the nature of the underlying business. For example, according to Hess:

> "A low probability, low severity transaction should pass risk transfer if the underlying book were similarly stable. A very unstable book could be insured by a reinsurance transaction that was low probability but high severity. Deposit accounting should be used for large variability underlying business protected by a low probability, low severity "reinsurance" transaction."

Further, according to Gluck:

> "The FAS 113 definition of risk transfer is fundamentally flawed, not just because of problems with the risk measures, but because the wrong risk is being measured. The two fundamental defects:

1. The definition of risk transfer does not contain the concept of risk transfer. Rather, the FAS 113 definition sets an absolute standard of the required level of assumed risk. A test of risk transfer requires a comparison of "before" and "after" risk. No single absolute standard can produce results that are meaningful regardless of the riskiness of the underlying cashflows.

2. The definition is influenced by fixed profit margins paid to the reinsurer. As discussed in the previous section, in determining proper accounting from the cedant's perspective, the relevant risk is the risk that the amounts carried in the cedant's financial statements are inadequate. Fixed profit margins are irrelevant. Furthermore, it is inappropriate for the risk transfer analysis to be influenced by the analyst's implicit second-guessing of the reinsurance pricing, which is unavoidably the case when applying the FAS 113 definition."

The CAS Working Party commented on this issue as follows: "We treat FAS 113 as it is currently constructed as a reasonable framework for evaluating risk transfer, subject to a fair interpretation of the critical elements of 'reasonable probability' and 'substantially all', despite some reservations about its focus on the financial effects (excluding brokerage and internal expenses) of a transaction on the reinsurer alone."

Further, White comments: "Accounting rules should not protect insurers from themselves. If insurers wish to purchase reinsurance that provides a windfall for the reinsurer, FAS 113/SSAP 62 should not be the regulation that protects them. In other words, reinsurers should not be forced to change terms of a contract to lower their profit because of an accounting rule. If regulators wish to offer such protections, they should pass such regulation."

Inputs used to model cashflows

In general, the submissions reflected similar reinsurance cashflow inputs to their models, corresponding to the guidelines in SSAP 62 and FAS 113. The CAS Working Party commented on this issue as follows: "Throughout the paper we use the FAS 113 definition of the reinsurer's loss, which ignores brokerage and the reinsurer's internal expenses. Our use of that definition should not be construed to mean that we endorse that definition for any purpose other than testing reinsurance contracts for compliance with FAS 113."

Several respondents expressed the opinion that it is important to reflect parameter uncertainty in the modeling of cashflows, for example:

- (CAS Working Party) "In any actuarial application where the knowledge of the loss distribution itself and not just its mean is important, it is very important that the modeling be based on loss models that incorporate parameter uncertainty, which is an important and frequently underestimated source of risk...Where the estimates are the result of applying large development and/or on-level factors, the likelihood of parameter error is especially large, and appropriately large adjustments must be made to the distribution to account for it."

- (Belfatti) "Very often, the data surrounding a risk is simply not sufficient to permit a reliable stochastic model from being developed. Lack of data, other things equal, suggests that it's more likely you've missed the mark widely in your estimates."

Risk metric

Some of the tests recommended in various submissions that focus on the reinsurer's results are as follows:

- CAS Working Party: Expected Reinsurer Deficit ("ERD")
- Wang: Transform 10-10 Rule and Right-Tail Deviation ("RTD")
- Cuzzi: TVaR
- Eramo: Value at Risk ("VaR") at a given percentile

Several of the authors suggested tests that reflect the relationship between the underlying business and the reinsurer's results, including:

- Gluck: Mean Square Adverse Deviation
- Wenitsky: Conditional Expected Downside
- Belfatti: Some combination of Conditional Expected Downside and TVaR

Please refer to the papers in Appendix 2 for a complete description of each of the above methods. Many of the above authors suggested more than one risk metric, and noted that additional research and testing should be done to determine the optimal risk metrics to be used in a risk transfer test.

Decision rule

Most of the suggested tests were structured so that the outcome would be an "all-or-nothing" or binary decision, which means that an agreement would be accounted for either as 100% reinsurance or 100% deposit. However, several respondents stated that this type of "either-or" accounting was inadequate to encompass contracts that contain both risk and financing elements, and suggested approaches to bifurcate contracts so that these elements could be accounted for separately. The risk transfer tests suggested by Gluck, Wenitsky and Belfatti, and the RTD test suggested by Wang, resulted in calculated percentages of measured risk transferred that could be used to bifurcate contracts.

According to Wenitsky, "If the reinsurer is in the same risk position on the ceded exposure as the cedant would have been had they retained the exposure, then the relative risk positions are identical, and full credit (reinsurance accounting) would be granted. To the extent that the reinsurer has mitigated the risk and is thus not 'standing in the shoes' of the cedant, a portion of the transaction, commensurate with the extent of relative risk mitigation, should be deposit accounted."

Question 2: What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer?

In answering this question, most respondents offered a threshold against which the risk metric was compared, such that a calculated amount, or "score," below that threshold would generate a decision to use deposit accounting and above that threshold, reinsurance accounting. For comparison purposes, the focus of the 10/10 rule risk transfer test is whether the expected reinsurer's losses at the 90th percentile are greater than 10% of premium.

Some of the responses were as follows:

- CAS Working Party: Although no specific threshold was proposed, the paper suggested that a 1% ERD threshold should be considered to be superior to the 10/10 rule, due to low frequency/high severity coverages failing 10/10.
- Wang: For the Transform 10-10 Rule, a threshold of –10%.
- (Name Withheld): Proposed a modified 10/10 test for risk transfer. A contract would pass the test if there exists a point such that the product of the probability of a NPV loss to the reinsurer and the NPV loss at that probability is 1%.
- Cuzzi: A dual test -- first applying the 10/10 rule, and then a TVaR test that measures the average result as a percentage of premium in the worst 10% of outcomes, so that a loss of at least 15% of premium sufficiently demonstrates risk transfer.
- Bear: Require that the contract pass a 10/10 type test for at least two probabilities, whereby the probabilities are at least 3% apart. For example, if it passes a 10/10 and a 15/5 then it passes.
- Pastor: Offers different criteria for different types of contracts, Quota Share, Catastrophe Excess of Loss and Other Excess of Loss. The default test for all three is a modified 10-10, but requiring the probability multiplied by the loss amount to be 2%.

As previously stated, the tests suggested by Gluck, Wenitsky and Belfatti and the RTD test suggested by Wang, resulted in percentage scores that could be used to bifurcate contracts. However, Gluck

recommended that, in order to avoid unnecessary bifurcation, thresholds could be set at some level (such as below 20% and above 80%) such that contracts with scores outside those thresholds would be accounted for as 100% deposit or 100% reinsurance. The RTS would further note that any of the risk transfer tests suggested for use in bifurcated accounting could also be used as an "either-or" test. For example, if a threshold of 75% were set, a contract scoring below that threshold would be accounted for as a deposit, and above 75% would be accounted for as reinsurance.

Many of the authors suggested that additional research and testing of real-world contracts should be done to determine the optimal threshold to be used in a risk transfer test.

Question 3: What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract?

Many authors believe that the topic of safe harbors is an important area of discussion and offered criteria to define contracts in which risk transfer is "reasonably self-evident":

- Koegel's criteria were based on the maximum premium receivable as a percentage of the maximum loss, and reinsurance contract provisions that reduce the loss to the reinsurer compared to the subject loss.
- One respondent (name withheld) offered criteria that differed for proportional versus excess of loss contracts, also based on the relationship between maximum premium and maximum loss.
- Belfatti's criteria included comparison of the maximum premium receivable as a percentage of the maximum loss, and the absence of loss-sensitive provisions or aggregate limits.
- Gluck's criteria were based on contracts that contained only "natural" provisions and not "structural" provisions.

Many of the above authors also noted the Paragraph 11 Exception in response to this question. Additionally, the CAS Report contains extensive discussion on the Paragraph 11 Exception and suggests that a broader definition be used, as follows:

"What is the 'insurance risk relating to the...underlying insurance contracts?' We see it as the downside risk associated with the cedent's portfolio of insurance, i.e., the exposure faced by the underwriter to incurring a loss. If the downside risk assumed by the reinsurer is essentially the same as that faced by the cedent with respect to the original unreinsured portfolio, then the contract transfers 'substantially all' the insurance risk."

Instead of limiting the Paragraph 11 Exception to unrestricted quota share contracts, which we understand is a common interpretation of this rule, it would be extended to any contract where the expected underwriting deficit ("EUD") of the reinsurer meets or exceeds that of the ceding company. Using this thought process, combined with an analysis using an ERD-based standard of "significant" risk, the CAS Report safe harbors generally include:

- Most standard catastrophe and individual risk excess of loss contracts.
- Contracts with expected loss ratios above a minimum permissible loss ratio (defined in the paper).
- Immaterial contracts.
- Proportional facultative and treaty reinsurance with effective ceding commissions no less than cedant expenses.
- Proportional facultative or treaty reinsurance for which it can be shown that the reinsurer's EUD is essentially the same as the cedant's EUD on the unreinsured subject portfolio, irrespective of whether the contract includes a loss ratio corridor, loss ratio cap or other risk mitigating feature.
- Excess of loss facultative or treaty reinsurance for which it can be shown that the reinsurer's EUD is essentially the same as the cedant's EUD on the portion of the original subject portfolio that is exposed to the same risks as the excess of loss contract.

- Whole account quota share contracts with loss ratio caps no lower than the point at which the ceding company would exhaust its surplus.

The CAS Working Party provided a rationale to expand the traditional usage of the Paragraph 11 Exception. Based on our review, the RTS would offer the following observations:

- An advantage of the CAS interpretation is that a relatively small loss limiting feature, such as a small corridor, would not render an entire quota share contract a deposit, particularly when the economics are very similar to a contract that has no limiting features.

- The major disadvantage of this approach is that the accounting profession has largely adopted a position that this exception is very narrow. Therefore, expanding this exception to a broader set of contracts, and thus eliminating the need to evaluate risk transfer, might not be viewed favorably by regulators or auditors.

Several authors addressed this question by defining which contracts should be tested:

- Goldberg's criteria were based on materiality considerations, retrospective elements to the contract, multiple year retrospective rating and an assessment of whether amount and timing risk are obviously present.
- Wenitsky's criteria were based on loss limitations or loss-sensitive features in quota-share agreements, or profit sharing, loss-sensitive premiums or other loss-sensitive or time-sensitive features in any agreements.
- Pastor's criteria were based on the ratio of aggregate limits to aggregate premiums or contract provisions such as retrocessions, side agreements, funds withheld, experience accounts, or limits on the timing of recoveries.

One author (Fell) pointed out that any loophole presents opportunity for abuse, and recommended reliance on professional actuarial judgment to determine which contracts should be cashflow tested.

Question 4: What are the advantages and disadvantages of the suggested approach versus other approaches commonly used?

In this section, we provide a summary of views as to the advantages and disadvantages of the suggestions provided by the respondents for several of the more important points and considerations regarding risk transfer. These views include both those of the respondents, as well as those of the RTS as referenced below.

We would also like to provide several observations regarding the CAS Working Party's suggestion as to the use of ERD >=1% over the 10/10 rule:

- *Advantages*: Because ERD does not focus risk transfer decision on only one point in the reinsurer's loss distribution, it better addresses low frequency/high severity circumstances. Further, the ERD method, coupled with the supplemental test described in the CAS Report, addresses highly structured contracts that were designed to pass the 10-10 rule only marginally.

- *Disadvantages*: ERD may be perceived as a lower bar than the 10/10 Rule, since potentially more contracts would pass. However, many of these contracts, such as property catastrophe reinsurance, would presumably qualify for reinsurance accounting in that risk transfer is self-evident. Also, we understand that auditing firms are generally not accepting such approaches as of now. Further, it is still a binary approach, where the result is either 100% deposit or 100% reinsurance accounting; proponents of bifurcation may view this as a disadvantage.

According to Gluck, the following advantages of his suggested method were identified:

- Risk transfer is reduced to a simple single number with an intuitive meaning.

- Safe harbors for obvious risk transfer contracts are an integral part of the risk transfer definition, rather than exceptions.

- The approach is equally valid regardless of the relative amount of risk inherent in the subject losses.

- The approach is unaffected by profit margins and expenses. The approach avoids the second-guessing of the reinsurance pricing that is implicit in the FAS 113 definition.

Gluck did not enumerate any disadvantages. However, the RTS notes two potential disadvantages to Gluck's suggested approach. First, his proposal to re-evaluate the risk transfer percentage periodically may not be desirable or practical from an accounting consistency standpoint. Second, some of the reinsurance provisions identified as "structural" are common aspects of traditional reinsurance

According to Wenitsky, some of the advantages and disadvantages of his suggested method are as follows:

- *Advantages*: There is no arbitrary bright line beyond which risk transfer is achieved, and therefore the possibility of similar accounting benefit for dissimilar risk transfer is eliminated. It is sensitive to market conditions to the extent that the relative risk varies as those conditions change. It will create greater accounting consistency between cedants and reinsurers. The reinsurer and cedant may have different factors, but the differences will only be in degree. It fairly and consistently reflects the economic substance of transactions. It is only marginally more difficult to apply than current approaches.

- *Disadvantages*: Double accounting entries would be required for bifurcated agreements.

According to Belfatti, the advantages and disadvantages of his suggested method are as follows:

- *Advantages*: It eliminates the crucial "cutoff" element of current system and potential related incentive problems; the incentives caused by a "cutoff" system reflect most of the problem in today's system. It better reflects the underlying risk profile of a contract and therefore better aligns the substance of the contract with the depiction of it in financial statements. Provides significant safe harbors to avoid additional administrative complexity. Allows a great deal of flexibility in selection of metrics. Allows a great deal of flexibility in selection of the translation method to the "full risk" standard. The additional administrative burden of booking (twice the entries) could be viewed as a deterrent for doing these transactions.

- *Disadvantages*: It doesn't address the issue of little data and how the analysis could be adjusted for those situations. It still allows results that are very "model dependent." Still has the same implementation issues as today surrounding things like related contracts, interest rates to use, and reflection of non-cashflow aspects. Translation may produce counterintuitive results and/or some "cutoff" issues if not developed carefully. It still may allow for significant argument regarding which metrics should be used.

Other comments made by authors

There were several interesting comments submitted on related topics, including:

- (Belfatti) "Risk is the potential for adverse changes in the amount or timing of the payment or receipt of cash, due to the occurrence of future contingent events...The emphasis on *potential* for adverse changes will ensure that it remains clear that not having a loss does not mean risk was not borne."

- (Fell) "As a result of FAS 113 and SSAP62, the accounting profession has been charged with ensuring that reinsurance contracts are accounted for properly. Whether intended or not, these accounting pronouncements have put the accounting profession in the driver's seat of not only ensuring that the accounting is correct but of evaluating whether significant risk exists in a contract. However, evaluating risk is the business of the actuary."

- (Fell) "I believe that arbitrary regulations have helped to fuel the use of finite reinsurance and correcting these regulations would lessen the need for some finite transactions. Most importantly, the NAIC developed the Risk Based Capital calculation to establish minimum capital requirements. It seemed at the time that this would lessen the reliance on the IRIS leverage tests, namely the premium to surplus ratio, to determine whether a company is writing too much business for their level of surplus. However, it seems that everyone still focuses on a 3-to-1 premium to surplus ratio regardless of the riskiness of the business written."

- (Koegel) "A concerted effort to narrow the disparity between current regulatory financial ratio thresholds on a gross vs. net of reinsurance basis may further facilitate achievement of a workable solution to narrow gaps that currently exist between the reporting and economic substance of certain reinsurance transactions."

Hypothetical Reinsurance Examples

In order to provide a comparative illustration of several of the proposals described above, the RTS developed two simple examples of reinsurance contracts: a capped quota share and an aggregate excess of loss contract. We sent the examples to five of the authors, who applied their specific risk transfer evaluation techniques to these hypothetical transactions. The five authors and the suggested techniques are as follows:

	Belfatti	**CAS**	**Gluck**	**Wang**	**Wenitsky**
Risk Transfer Test	Maximum of ratios of three risk metrics to derive a percentage of risk transferred	ERD must be > 1%, and maximum possible loss > 20% of subject premium to pass risk transfer	Ratio of risk metric to derive a percentage of risk transferred	Selected multiple of risk metric divided by ceded premium to get percentage of risk transferred	Ratio of risk metric to derive a percentage of risk transferred
Risk Metric(s) used in Test	Variance, conditional expected downside, downside variance	Variance, conditional expected downside, downside variance	Mean Square Adverse Deviation	Right-Tailed Deviation	Conditional Expected Downside

Quota-Share Example

The critical features underlying the quota-share example are as follows:

- Expected Loss Ratio (ELR) = 70%
- Ceding Commission = 20%
- Payout Pattern = 100% paid immediately

- Loss Ratio Caps = 80%, 85%, 90%, 100%, and 110%
- Loss distribution is Lognormal
- Coefficient of Variation (CV) = 10% and 20%
- Reinsurer's share is 100%

The results by author are as follows:

Percent Risk Transfer if CV=10%

Cap	Belfatti	CAS	Gluck	Wang	Wenitsky
80%	83%	FAIL	0%	0%	0%
85%	93%	PASS	61%	3%	76%
90%	98%	PASS	90%	6%	95%
100%	100%	PASS	100%	7%	100%
110%	100%	PASS	100%	7%	100%
Unlimited	100%	PASS	100%	7%	100%

Percent Risk Transfer if CV=20%

Cap	Belfatti	CAS	Gluck	Wang	Wenitsky
80%	65%	FAIL	0%	0%	0%
85%	68%	FAIL	27%	5%	40%
90%	79%	FAIL	50%	9%	65%
100%	91%	PASS	75%	16%	89%
110%	100%	PASS	95%	21%	97%
Unlimited	100%	PASS	100%	26%	100%

Please note that the CAS Working Party uses a pass/fail test, whereby passing implies 100% risk transfer and failing implies 0% risk transfer.

As expected, all of the various tests assign a higher percentage of risk transfer as the loss ratio caps increase. In addition, with the exception of Wang, all of the tests assign a lower percentage of risk transfer as the CV assumptions increase. This is due to the fact that as the volatility of the business increases, the benefit of the loss ratio cap to the reinsurer increases since it becomes increasingly more likely that the cap will be exceeded.

The Wang method yields quite different results than the remaining methods, and it is interesting to note that it assigns only 7% risk transfer to an unlimited quota-share agreement on a book of business with a CV of 10%. The Wang method uses a ratio of Maximum Qualified Premium to actual ceded premium to determine the percentage of risk transfer, where the Maximum Qualified Premium is a selected multiple

of the downside risk as measured by the RTD. Since the Maximum Qualified Premium for quota share transactions is very small compared to the ceded premium, the risk transfer percentage is very small. In other words, the Wang method considers most of the premium ceded under a quota share, whether it is a capped or unlimited quota share, as "dollar trading."

Among the other methods, the CAS Working Party test appears to “pass” agreements with about a 90% or greater score on the Belfatti test. Of the remaining tests, the Belfatti test appears to yield the highest percentage of risk transfer for these examples, followed by Wenitsky then Gluck.

Aggregate Excess of Loss Example

The critical features underlying the aggregate excess of loss example are as follows:

- Subject Premium = $200
- Gross Expected Loss Ratio = 75.50%
- Retention = 80%
- Limit = 25%
- Ceded Premium = $12 (includes Reinsurer's Margin)
- Reinsurer's Margin = $5
- Profit Share of Experience Account is 100% (no investment crediting)
- Payout Pattern = 100% paid immediately
- Loss distribution is Lognormal
- Coefficient of Variation (CV) = 0.1638
-

Reinsurer's share is 100%

The results by author are as follows:

Percent Risk Transfer					
Belfatti	CAS	Gluck1	Gluck2	Wang	Wenitsky
100%	Pass	69%	92%	100%	73%

Some critical notes regarding the above results are as follows:

- Gluck1 assumes the ceding company accrues the profit share asset.
- Gluck2 assumes the profit share asset is not accrued.
-

The CAS Working Party uses a pass/fail test, whereby passing implies 100% risk transfer and failing implies 0% risk transfer.

In this instance, both the Wang and Belfatti methods yielded scores of 100% risk transfer. The CAS Working Party test yielded a “pass”. Only the Gluck test was sensitive to the profit share asset accrual.

CONCLUSION

It is our understanding that the CATF will evaluate this report and make recommendations to the Study Group in late August. We anticipate that the Study Group will discuss the CATF's recommendations and decide on their next course of action at the Fall National Meeting in September. As the CATF evaluates the items in this report and prepares recommendations to the Study Group, there are many items to consider and evaluate. COPLFR is available to assist the CATF and the Study Group in this evaluation process. Since our primary focus would be financial reporting and policy issues, we further encourage the CATF to consider the Casualty Actuarial Society as an excellent resource for further technical research in this area.

COPLFR has appointed a subgroup to develop a Practice Note on Risk Transfer Testing, in order to give high-level, non-binding guidance to actuaries who may be asked to assist in the evaluation of risk transfer. The Practice Note is anticipated to be completed in the fall of 2005.

The American Academy of Actuaries is pleased to have worked with the NAIC on this very important issue, and we would be happy to answer any questions or provide further information about the report. We would like to thank the members of the actuarial community who submitted ideas for the report. We also want to thank the RTS and CATF members who worked together on the project. They are as follows:

Academy Risk Transfer Subgroup

Nancy Watkins, FCAS, MAAA (Co-Chair)
Marc Oberholtzer, FCAS, MAAA (Co-Chair)
Ralph Blanchard, FCAS, MAAA
Holmes Gwynn, ACAS, MAAA
Anne Kelly, FCAS, MAAA
David Murray, FCAS, MAAA
Marvin Pestcoe, FCAS
Thomas Wallace, FCAS, MAAA
Scott Weinstein, FCAS, MAAA
Russell Wenitsky, ACAS

CATF Liaison Group

John Purple, FCAS, MAAA (Chair)
Larry Bruning, FSA, MAAA
David Dahl, FCAS, MAAA
Wendy Germani, FCAS, MAAA
Missy Greiner
Richard Marcks, FCAS, MAAA
Sarah McNair-Grove, FCAS, MAAA
Mary Miller, FCAS, MAAA
Rae Taylor, FCAS, MAAA
Kris DeFrain, FCAS, MAAA

Appendix 1: Risk Transfer Survey

1. NAIC Finite Reinsurance Survey
2. RTS Summary of Results

NATIONAL ASSOCIATION OF INSURANCE COMMISSIONERS

June 16, 2005

EXECUTIVE HEADQUARTERS

2301 MCGEE STREET
SUITE 800
KANSAS CITY MO
64108-2662
VOICE 816-842-3600
FAX 816-783-8175

GOVERNMENT RELATIONS

HALL OF THE STATES
444 NORTH CAPITOL ST NW
SUITE 701
WASHINGTON DC
20001-1509
VOICE 202-624-7790
FAX 202-624-8579

SECURITIES VALUATION OFFICE

48 WALL STREET
6TH FLOOR
NEW YORK NY
10005-2906
VOICE 212-398-9000
FAX 212-382-4207

WORLD WIDE WEB

www.naic.org

To Property and Casualty Insurance Groups:

The NAIC's Casualty Actuarial Task Force is assisting the NAIC's Property and Casualty Reinsurance Study Group in their review of reinsurance accounting treatment. As part of this effort, we are requesting that all property/casualty groups participate in an industry survey to better understand the current analyses of reinsurance risk transfer that qualifies contracts for reinsurance accounting versus deposit accounting. Your participation is important so that the NAIC can gain an understanding of current practice and determine what changes, if any, may be needed to accounting guidance on risk transfer. We want to be aware of potential market impacts which presents additional challenges without the knowledge of current practices.

Please respond via e-mail to Dswanson@naic.org by July 8, 2005.

The individual survey responses will be held confidential by the NAIC. Response data will be compiled by the NAIC so that individual companies are not identified (other than establishment that a group is "small", "medium", or "large") to state regulators and interested parties. The American Academy of Actuaries (AAA) will use the compiled data (without identification of individual companies) and report the results to the NAIC.

CLARIFICATION OF SURVEY

The following provides some details concerning completion of the survey:

Definition of Finite Reinsurance:
Please use the following definition of finite reinsurance (based on one developed by the American Institute of Certified Public Accountants (AICPA), as provided in a Financial Accounting Standards Board (FASB) Alert from April 2005, "Accounting by Noninsurance Enterprises for Property and Casualty Insurance Arrangements That Limit Risk") unless your company uses a different established definition.

Finite reinsurance contracts are contracts that transfer a clearly defined and restricted amount of insurance risk from the cedant to the reinsurance company, and the cedant retains a substantial portion of the related risks under most scenarios. Nevertheless, under certain finite contracts there may be a reasonable possibility that the reinsurance company will incur a loss on the contract.

Report Entire Group or Individual Company?
If your company is not part of a group, report for your individual company. If your company is a part of the group and your group has similar procedures, report with respect to the entire group. If companies in the group have different procedures, submit separate surveys, and report data for the company or combined companies in place of the requested group information.

Current or Past Practice
Answer with respect to current policy and practice within your group. Answers should correspond to how you would treat a contract that you might enter into in 2005, except where specifically asked about past contracts.

Exceptions to General Practice
The questions are meant to solicit your general practice, with the understanding that there may be legitimate exceptions to your general practice.

Accounting Guidance
Accounting guidance for reinsurance contracts can be found in the Statement of Statutory Accounting Principles (SSAP) No. 62, Property and Casualty Reinsurance.

The NAIC Casualty Actuarial Task Force appreciates your participation in this confidential survey. Should you have any questions, please contact NAIC staff:

- Questions about the Survey Content: contact Kris DeFrain at (816) 783-8229.
- Questions about the Excel file: contact Dan Swanson at (816) 783-8412.

Sincerely,

John Purple, FCAS, MAAA
Chief Actuary, Connecticut Department of Insurance
Chair, NAIC Casualty Actuarial Task Force

NAIC Finite Reinsurance Survey
June 16, 2005

Definition of Finite Reinsurance

Please use the following definition of finite reinsurance (based on one developed by the American Institute of Certified Public Accountants (AICPA), as provided in a Financial Accounting Standards Board (FASB) Alert from April 2005, "Accounting by Noninsurance Enterprises for Property and Casualty Insurance Arrangements That Limit Risk") unless your company uses a different established definition.

"Finite reinsurance contracts are contracts that transfer a clearly defined and restricted amount of insurance risk from the cedant to the reinsurance company, and the cedant retains a substantial portion of the related risks under most scenarios. Nevertheless, under certain finite contracts there may be a reasonable possibility that the reinsurance company will incur a loss on the contract."

Report Entire Group or Individual Company?

If your company is not part of a group, report for your individual company. If your company is a part of the group and your group has similar procedures, report with respect to the entire group. If companies in the group have different procedures, submit separate surveys, and report data for the company or combined companies in place of the requested group information.

Current or Past Practice

Answer with respect to current policy and practice within your group. Answers should correspond to how you would treat a contract that you might enter into in 2005, except where specifically asked about past contracts.

Background Questions

1. For year-end 2004, provide the following background information for your group:

Net Premium Volume:

Choose one:
(a) under $200 million,
(b) $200 million to $2 billion
(c) $2 billion or greater.

Policyholder Surplus:

Choose one:
(a) under $100 million
(b) $100 million to $1 billion
(c) $1 billion or greater

Type of company (for the lead company):

Choose one:
(a) mutual or reciprocal
(b) stock company that is publicly traded or part of a group that is publicly traded
(c) stock company that is not publicly traded
(d) other

2. Is your group's definition of Finite contracts substantially similar to that defined in the cover letter?

Choose one:
Yes
No

If No, provide your group's definition of finite:

3. Does your group's definition of Finite consider contracts containing the following features to be Finite? Check all that apply:

- ☐ (a) Quota shares with sliding scales and/or retained loss corridors of less than 10 loss ratio points
- ☐ (b) Quota shares with sliding scales and/or retained loss corridors of more than 20 loss ratio points
- ☐ (c) Quota shares with aggregate loss ratio caps
- ☐ (d) Funds withheld arrangements coupled with experience refund accounts
- ☐ (e) Contracts with commutation clauses where the ceding company has the unilateral right to commute and, at inception, it is viewed as likely that the ceding company will commute the contract shortly after the exposure period expires
- ☐ (f) Retroactive reinsurance
- ☐ (g) Whole account stop loss or aggregate reinsurance covers
- ☐ (h) Contracts that cover more than one year
- ☐ (i) Contracts where the ratio of premium to maximum reinsurer's loss is greater than a given percentage
- ☐ (j) Treaties with retrospective premium adjustments (other than property catastrophe covers, or per risk covers)
- ☐ (k) Contracts that consider the time value of money
- ☐ (l) Contracts with experience refunds
- ☐ (m) Contracts with loss carry-forwards
- ☐ (n) Contracts with payment schedules
- ☐ (o) Contracts with net present value (NPV) caps
- ☐ (p) Other

4. Has your group entered into any assumed reinsurance contract(s) in the past four years that your group would consider to be a Finite product?

Choose one:

Yes

No

5. Does your group have a business unit or segment that is designed to reinsure Finite products?

Choose one:

Yes

No

6. Has your group entered into any ceded reinsurance contract(s) in the past four years that your group would consider to be a Finite product?

Choose one:

Yes

No

Criteria

7. Does your group have a formal written policy regarding the evaluation of reinsurance accounting and the application of appropriate accounting rules and regulations to its ceded reinsurance products?

   Choose one:

   Yes

   No

   No Ceded Reinsurance

8. Does your group have a formal written policy regarding the evaluation of reinsurance accounting and the application of appropriate accounting rules and regulations to its assumed reinsurance products?

   Choose one:

   Yes

   No

   No Ceded Reinsurance

9. Are there classes of contracts that you deem to be clearly reinsurance and which therefore do not require detailed review to determine risk transfer or appropriate accounting treatment?

   Choose one:

   Yes

   No

10. For ceded reinsurance, which reinsurance contracts are reviewed in detail for accounting treatment and risk transfer?
    Check All that apply:

    ☐ (a) All ceded reinsurance contracts

    ☐ (b) Material ceded reinsurance contracts

    ☐ (c) Material non-catastrophe ceded contracts

    ☐ (d) Contracts having one or more contract features (e.g. items in Question #3)

    ☐ (e) Only those contracts that are viewed to be “Finite”

    ☐ (f) None or N/A

11. For ceded reinsurance, what documentation is typically contained in the contract file?
    Check all that apply:

    ☐ (a) Relevant correspondence between the parties

    ☐ (b) Each draft of the contract

    ☐ (c) Risk transfer calculation

    ☐ (d) Memorandum from management describing the business purpose of the contract and other relevant concerns

    ☐ (e) Sign-offs of accounting treatment from internal accounting management

    ☐ (f) Sign-offs of risk transfer analysis from internal actuarial management

    ☐ (g) Sign-off from regulator and/or auditor

12. For assumed reinsurance, which reinsurance contracts are reviewed in detail for accounting treatment and risk transfer? Check All that apply:

- ☐ (a) All assumed reinsurance contracts
- ☐ (b) Material assumed reinsurance contracts
- ☐ (c) Material non-catastrophe assumed contracts
- ☐ (d) Contracts having one or more contract features (e.g. items in Question #3)
- ☐ (e) Only those contracts that are viewed to be "Finite"
- ☐ (f) None or N/A

13. For assumed reinsurance, what documentation is typically included in the contract file? Check all that apply:

- ☐ (a) Relevant correspondence between the parties
- ☐ (b) Each previous draft of the contract
- ☐ (c) Risk transfer calculation
- ☐ (d) Memorandum from management describing the business purpose of the contract and other relevant concerns
- ☐ (e) Sign-offs of accounting treatment from internal accounting management
- ☐ (f) Sign-offs of risk transfer analysis from internal actuarial management
- ☐ (g) Sign-off from regulator and/or auditor

Risk Transfer Testing and Threshold

14. Does your group have a formal written policy regarding the evaluation of risk transfer for its ceded reinsurance products?

Choose one:
Yes
No
No Ceded Reinsurance

15. Does your group have a formal written policy regarding the evaluation of risk transfer for its assumed reinsurance products?

Choose one:
Yes
No
No Ceded Reinsurance

16. For most or all ceded reinsurance meeting the criteria discussed in question (10), is the evaluation of risk transfer led by:

Choose one:
(a) internal actuaries
(b) the underwriter
(c) accounting department
(d) external actuaries
(e) the intermediary
(f) the counterparty to the transaction
(g) other (please specify below)

If "Other" is selected above, please specify:

17. For most or all assumed reinsurance meeting the criteria discussed in question (12), is the evaluation of risk transfer led by

Choose one:

(a) internal actuaries

(b) the underwriter

(c) accounting department

(d) external actuaries

(e) the intermediary

(f) the counterparty to the transaction

(g) other (please specify below)

If "Other" is selected above, please specify:

18. For ceded reinsurance contracts, what type of testing is performed in the evaluation of risk transfer for contracts meeting the criteria discussed in question (10)?
Check all that apply:

☐ (a) Stochastic testing simulating results under many scenarios

☐ (b) Confidence level testing

☐ (c) Review of historic results

☐ (d) The development of a single scenario via judgment that could be viewed as reasonably possible

☐ (e) Other (please specify):

If "Other" is selected above, please specify:

19. Which of the types of testing listed in Question (18) is predominately used?

Choose one:

(a) Stochastic testing simulating results under many scenarios

(b) Confidence level testing

(c) Review of historic results

(d) The development of a single scenario via judgment that could be viewed as reasonably possible

(e) Other (please specify below)

If "Other" is selected above, please specify:

20. Which of the following risks are explicitly considered in the calculations used to evaluate risk transfer?
Check all that apply:

☐ (a) Process risk

☐ (b) Parameter risk

☐ (c) Timing risk / acceleration of payout patterns

☐ (d) Other (please specify below)

If "Other" is selected above, please specify:

21. Does your group compare actual results under contracts to expectations from the risk transfer calculations?

Choose one:

Yes

No

If yes, over many contracts, do actual results suggest:

Choose one:

(a) More actual risk transfer or variation in results than expected from risk transfer calculations

(b) Actual risk transfer or variation in results approximately estimated to be the same as those expected risk transfer calculations

(c) Less actual risk transfer or variation in results than expected from risk transfer calculations

(d) Unknown

22. For both ceded and assumed contracts, what models are used to evaluate risk transfer for most or all contracts? Check all that apply:

☐ (a) An internally-developed model

☐ (b) An externally-developed model

☐ (c) A separate spreadsheet-based model for each contract

23. Which of the following describes the approach you use to equate a numerical criteria to the risk transfer standard of a reasonable possibility of a significant loss:

Choose one:

(a) Each part of the standard is equated to a single percentage which is applied consistently across all tested contracts

(b) As in (a) but excluding some or all property catastrophe coverages

(c) As in (a) but the standard is a guideline rather than an absolute and exceptions are made based on other appropriate considerations

(d) Numeric calculations are the starting point for a judgmental assessment of risk transfer

(e) Other (please specify below)

If "Other" is selected above, please specify:

24. If the answer to question 23 was (a) or (b) or (c) what numerical criteria equates to a reasonable possibility of significant loss for most contracts?

Choose one:

(a) A 10% chance of a 10% loss

(b) A 10% chance of a 15% loss

(c) A 15% chance of a 10% loss

(d) A 15% chance of a 15% loss

(e) A 1% expected value loss (i.e., 10% chance times a 10% loss)

(f) Other (please specify below)

If "Other" is selected above, please specify:

Submit the Survey to:
dswanson@naic.org

Contacts
Questions on the contents of the survey:
Kris DeFrain, NAIC
816-783-8229
kdefrain@naic.org

Questions on how the Excel file is working:
Dan Swanson, NAIC
816-783-8412
dswanson@naic.org

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Questions 1 and 2

Question 1A

Premium Size	Count of 2 1A	Total
< $200 million	a	306
$200M– $2 billion	b	73
>$2.0 billion	c	11
	Grand Total	390

Question 1B

Surplus Size	Count of 2 1B	Total
< $100 million	a	278
$100M– $1 billion	b	91
>$1.0 billion	c	21
	Grand Total	390

Question 1C

Insurer Type	Count of 2 1C	Total
Mutual or Reciprocal	a	148
Publicly Traded Stock	b	49
Non-Public Stock	c	174
Other	d	19
	Grand Total	390

Question 2

Similar definition of finite reinsurance ?	Count of 1A 2	Total
		3
	No	19
	Yes	368
	Grand Total	390

Question 1 distribution

Surplus Size - Question 1B	Premium Size - Question 1A	Count of 2 1B	1A	Insurer Type –from Qusetion 1C 1C a	b	c	d	Grand Total
< $100 million	< $200 million	a	a	103	8	148	14	273
	$200M– $2 billion		b	1		3	1	5
$100M– $1 billion	< $200 million	b	a	12	13	8		33
	$200M– $2 billion		b	22	18	14	4	58
>$1.0 billion	$200M– $2 billion	c	b	6	4			10
	>$2.0 billion		c	4	6	1		11
		Grand Total		148	49	174	19	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 3

Question 3a

Surplus	Count of 1A	3a		
Size	1B	TRUE	FALSE	Grand Total
small	a	57	221	278
medium	b	28	63	91
large	c	6	15	21
	Grand Total	91	299	390

Question 3b

Surplus	Count of 1A	3b		
Size	1B	TRUE	FALSE	Grand Total
small	a	72	206	278
medium	b	32	59	91
large	c	6	15	21
	Grand Total	110	280	390

Question 3c

Surplus	Count of 1A	3c		
Size	1B	TRUE	FALSE	Grand Total
small	a	90	188	278
medium	b	39	52	91
large	c	7	14	21
	Grand Total	136	254	390

Question 3d

Surplus	Count of 1A	3d		
Size	1B	TRUE	FALSE	Grand Total
small	a	74	204	278
medium	b	41	50	91
large	c	11	10	21
	Grand Total	126	264	390

Question 3e

Surplus	Count of 1A	3e		
Size	1B	TRUE	FALSE	Grand Total
small	a	93	185	278
medium	b	42	49	91
large	c	11	10	21
	Grand Total	146	244	390

Question 3f

Surplus	Count of 1A	3f		
Size	1B	TRUE	FALSE	Grand Total
small	a	76	202	278
medium	b	41	50	91
large	c	10	11	21
	Grand Total	127	263	390

Question 3h

Surplus	Count of 1A	3h		
Size	1B	TRUE	FALSE	Grand Total
small	a	37	241	278
medium	b	11	80	91
large	c	2	19	21
	Grand Total	50	340	390

Question 3i

Surplus	Count of 1A	3i		
Size	1B	TRUE	FALSE	Grand Total
small	a	58	220	278
medium	b	31	60	91
large	c	9	12	21
	Grand Total	98	292	390

Question 3j

Surplus	Count of 1A	3j		
Size	1B	TRUE	FALSE	Grand Total
small	a	47	231	278
medium	b	29	62	91
large	c	4	17	21
	Grand Total	80	310	390

Question 3k

Surplus	Count of 1A	3k		
Size	1B	TRUE	FALSE	Grand Total
small	a	57	221	278
medium	b	31	60	91
large	c	11	10	21
	Grand Total	99	291	390

Question 3l

Surplus	Count of 1A	3l		
Size	1B	TRUE	FALSE	Grand Total
small	a	35	243	278
medium	b	28	63	91
large	c	7	14	21
	Grand Total	70	320	390

Question 3m

Surplus	Count of 1A	3m		
Size	1B	TRUE	FALSE	Grand Total
small	a	38	240	278
medium	b	20	71	91
large	c	4	17	21
	Grand Total	62	328	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 3

Question 3g

Surplus Size	Count of 1A 1B	3g TRUE	FALSE	Grand Total
small	a	55	223	278
medium	b	32	59	91
large	c	7	14	21
	Grand Total	94	296	390

Question 3n

Surplus Size	Count of 1A 1B	3n TRUE	FALSE	Grand Total
small	a	46	232	278
medium	b	26	65	91
large	c	9	12	21
	Grand Total	81	309	390

Question 3h

Surplus Size	Count of 1A 1B	3h TRUE	FALSE	Grand Total
small	a	37	241	278
medium	b	11	80	91
large	c	2	19	21
	Grand Total	50	340	390

Question 3o

Surplus Size	Count of 1A 1B	3o TRUE	FALSE	Grand Total
small	a	64	214	278
medium	b	37	54	91
large	c	12	9	21
	Grand Total	113	277	390

Question 3p

Surplus Size	Count of 1A 1B	3p TRUE	FALSE	Grand Total
small	a	27	251	278
medium	b	8	83	91
large	c	1	20	21
	Grand Total	36	354	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Questions 4 – 9

Question 4

Surplus	Count of 1A	4			
Size	1B	No	Yes	(blank)	Grand Total
small	a	263	14	1	278
medium	b	80	11		91
large	c	18	3		21
	Grand Total	361	28	1	390

Question 5

Surplus	Count of 1A	5		
Size	1B	No	Yes	Grand Total
small	a	277	1	278
medium	b	88	3	91
large	c	20	1	21
	Grand Total	385	5	390

Question 6

Surplus	Count of 1A	6			
Size	1B	No	Yes	(blank)	Grand Total
small	a	218	59	1	278
medium	b	67	23	1	91
large	c	15	6		21
	Grand Total	300	88	2	390

Question 7

Surplus	Count of 1A	7				
Size	1B	NA	No	Yes	(blank)	Grand Total
small	a	19	206	49	4	278
medium	b	1	52	36	2	91
large	c	1	11	9		21
	Grand Total	21	269	94	6	390

Question 8

Surplus	Count of 1A	8				
Size	1B	NA	No	Yes	(blank)	Grand Total
small	a	132	119	24	3	278
medium	b	33	36	21	1	91
large	c	7	11	3		21
	Grand Total	172	166	48	4	390

Question 9

Surplus	Count of 1A	9			
Size	1B	No	Yes	(blank)	Grand Total
small	a	67	204	7	278
medium	b	22	68	1	91
large	c	2	19		21
	Grand Total	91	291	8	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 10

Question 10a

Surplus	Count of 1A	10a		
Size	1B	TRUE	FALSE	Grand Total
small	a	161	117	278
medium	b	51	40	91
large	c	13	8	21
	Grand Total	225	165	390

Question 10b

Surplus	Count of 1A	10b		
Size	1B	TRUE	FALSE	Grand Total
small	a	16	262	278
medium	b	9	82	91
large	c	3	18	21
	Grand Total	28	362	390

Question 10c

Surplus	Count of 1A	10c		
Size	1B	TRUE	FALSE	Grand Total
small	a	13	265	278
medium	b	9	82	91
large	c		21	21
	Grand Total	22	368	390

Question 10d

Surplus	Count of 1A	10d		
Size	1B	TRUE	FALSE	Grand Total
small	a	34	244	278
medium	b	18	73	91
large	c	3	18	21
	Grand Total	55	335	390

Question 10e

Surplus	Count of 1A	10e		
Size	1B	TRUE	FALSE	Grand Total
small	a	24	254	278
medium	b	13	78	91
large	c	2	19	21
	Grand Total	39	351	390

Question 10f

Surplus	Count of 1A	10f		
Size	1B	TRUE	FALSE	Grand Total
small	a	66	212	278
medium	b	7	84	91
large	c	2	19	21
	Grand Total	75	315	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 11

Question 11a

Surplus	Count of 1A	11a		
Size	1B	TRUE	FALSE	Grand Total
small	a	248	30	278
medium	b	87	4	91
large	c	20	1	21
	Grand Total	355	35	390

Question 11b

Surplus	Count of 1A	11b		
Size	1B	TRUE	FALSE	Grand Total
small	a	174	104	278
medium	b	54	37	91
large	c	11	10	21
	Grand Total	239	151	390

Question 11c

Surplus	Count of 1A	11c		
Size	1B	TRUE	FALSE	Grand Total
small	a	84	194	278
medium	b	32	59	91
large	c	11	10	21
	Grand Total	127	263	390

Question 11d

Surplus	Count of 1A	11d		
Size	1B	TRUE	FALSE	Grand Total
small	a	62	216	278
medium	b	23	68	91
large	c	9	12	21
	Grand Total	94	296	390

Question 11e

Surplus	Count of 1A	11e		
Size	1B	TRUE	FALSE	Grand Total
small	a	24	254	278
medium	b	15	76	91
large	c	4	17	21
	Grand Total	43	347	390

Question 11f

Surplus	Count of 1A	11f		
Size	1B	TRUE	FALSE	Grand Total
small	a	14	264	278
medium	b	9	82	91
large	c	2	19	21
	Grand Total	25	365	390

Question 11g

Surplus	Count of 1A	11g		
Size	1B	TRUE	FALSE	Grand Total
small	a	38	240	278
medium	b	9	82	91
large	c	3	18	21
	Grand Total	50	340	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 12

Question 12a

Surplus	Count of 1A	12a		
Size	1B	TRUE	FALSE	Grand Total
small	a	69	209	278
medium	b	22	69	91
large	c	6	15	21
	Grand Total	97	293	390

Question 12b

Surplus	Count of 1A	12b		
Size	1B	TRUE	FALSE	Grand Total
small	a	10	268	278
medium	b	6	85	91
large	c		21	21
	Grand Total	16	374	390

Question 12c

Surplus	Count of 1A	12c		
Size	1B	TRUE	FALSE	Grand Total
small	a	3	275	278
medium	b	2	89	91
large	c		21	21
	Grand Total	5	385	390

Question 12d

Surplus	Count of 1A	12d		
Size	1B	TRUE	FALSE	Grand Total
small	a	9	269	278
medium	b	8	83	91
large	c	3	18	21
	Grand Total	20	370	390

Question 12e

Surplus	Count of 1A	12e		
Size	1B	TRUE	FALSE	Grand Total
small	a	11	267	278
medium	b	7	84	91
large	c	2	19	21
	Grand Total	20	370	390

Question 12f

Surplus	Count of 1A	12f		
Size	1B	TRUE	FALSE	Grand Total
small	a	181	97	278
medium	b	55	36	91
large	c	12	9	21
	Grand Total	248	142	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 13

Question 13a

Surplus	Count of 1A	13a		
Size	1B	TRUE	FALSE	Grand Total
small	a	113	165	278
medium	b	54	37	91
large	c	14	7	21
	Grand Total	181	209	390

Question 13b

Surplus	Count of 1A	13b		
Size	1B	TRUE	FALSE	Grand Total
small	a	74	204	278
medium	b	28	63	91
large	c	7	14	21
	Grand Total	109	281	390

Question 13c

Surplus	Count of 1A	13c		
Size	1B	TRUE	FALSE	Grand Total
small	a	28	250	278
medium	b	9	82	91
large	c	3	18	21
	Grand Total	40	350	390

Question 13d

Surplus	Count of 1A	13d		
Size	1B	TRUE	FALSE	Grand Total
small	a	17	261	278
medium	b	10	81	91
large	c	5	16	21
	Grand Total	32	358	390

Question 13e

Surplus	Count of 1A	13e		
Size	1B	TRUE	FALSE	Grand Total
small	a	8	270	278
medium	b	7	84	91
large	c	2	19	21
	Grand Total	17	373	390

Question 13f

Surplus	Count of 1A	13f		
Size	1B	TRUE	FALSE	Grand Total
small	a	2	276	278
medium	b	4	87	91
large	c	2	19	21
	Grand Total	8	382	390

Question 13g

Surplus	Count of 1A	13g		
Size	1B	TRUE	FALSE	Grand Total
small	a	15	263	278
medium	b		91	91
large	c	2	19	21
	Grand Total	17	373	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Questions 14 – 17

Question 14

Surplus	Count of 1A	14				
Size	1B	NA	No	Yes	(blank)	Grand Total
small	a	19	225	32	2	278
medium	b	1	65	22	3	91
large	c	1	12	8		21
	Grand Total	21	302	62	5	390

Question 15

Surplus	Count of 1A	15				
Size	1B	NA	No	Yes	(blank)	Grand Total
small	a	146	120	10	2	278
medium	b	31	43	15	2	91
large	c	8	12	1		21
	Grand Total	185	175	26	4	390

Question 16

Surplus	Count of 1A	16									
Size	1B		a	b	c	d	e	f	g	(blank)	Grand Total
small	a	2	9	21	84	26	38	6	74	18	278
medium	b		14	6	26	5	16	2	22		91
large	c		4		4	2	3		6	2	21
	Grand Total	2	27	27	114	33	57	8	102	20	390

Question 17

Surplus	Count of 1A	17									
Size	1B		a	b	c	d	e	f	g	(blank)	Grand Total
small	a	2	5	9	55	10	13	3	97	84	278
medium	b		9	5	18	2	4	1	37	15	91
large	c		3	1				1	10	6	21
	Grand Total	2	17	15	73	12	17	5	144	105	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Question 18

Question 18a

Surplus	Count of 1A	18a		
Size	1B	TRUE	FALSE	Grand Total
small	a	46	232	278
medium	b	30	61	91
large	c	10	11	21
	Grand Total	86	304	390

Question 18b

Surplus	Count of 1A	18b		
Size	1B	TRUE	FALSE	Grand Total
small	a	41	237	278
medium	b	23	68	91
large	c	5	16	21
	Grand Total	69	321	390

Question 18c

Surplus	Count of 1A	18c		
Size	1B	TRUE	FALSE	Grand Total
small	a	171	107	278
medium	b	66	25	91
large	c	13	8	21
	Grand Total	250	140	390

Question 18d

Surplus	Count of 1A	18d		
Size	1B	TRUE	FALSE	Grand Total
small	a	89	189	278
medium	b	37	54	91
large	c	5	16	21
	Grand Total	131	259	390

Question 18e

Surplus	Count of 1A	18e		
Size	1B	TRUE	FALSE	Grand Total
small	a	47	231	278
medium	b	15	76	91
large	c	5	16	21
	Grand Total	67	323	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Questions 19 – 21

Question 19

Surplus	Count of 1A	19							
Size	1B		a	b	c	d	e	(blank)	Grand Total
small	a	3	27	15	115	31	38	49	278
medium	b		17	14	25	14	14	7	91
large	c		7		6		6	2	21
	Grand Total	3	51	29	146	45	58	58	390

Question 20a

Surplus	Count of 1A	20a		
Size	1B	TRUE	FALSE	Grand Total
small	a	81	197	278
medium	b	42	49	91
large	c	6	15	21
	Grand Total	129	261	390

Question 20b

Surplus	Count of 1A	20b		
Size	1B	TRUE	FALSE	Grand Total
small	a	87	191	278
medium	b	46	45	91
large	c	10	11	21
	Grand Total	143	247	390

Question 20c

Surplus	Count of 1A	20c		
Size	1B	TRUE	FALSE	Grand Total
small	a	82	196	278
medium	b	42	49	91
large	c	9	12	21
	Grand Total	133	257	390

Question 20d

Surplus	Count of 1A	20d		
Size	1B	TRUE	FALSE	Grand Total
small	a	67	211	278
medium	b	21	70	91
large	c	8	13	21
	Grand Total	96	294	390

Question 21

Surplus	Count of 1A	21				
Size	1B		No	Yes	(blank)	Grand Total
small	a	2	156	90	30	278
medium	b		59	28	4	91
large	c		13	6	2	21
	Grand Total	2	228	124	36	390

Question 21y

Surplus	Count of 1A	21y						
Size	1B		a	b	c	d	(blank)	Grand Total
small	a	9	11	49	5	20	184	278
medium	b		9	14		5	63	91
large	c		2	4			15	21
	Grand Total	9	22	67	5	25	262	390

NAIC Finite Reinsurance Survey
June 16, 2005
Results for Questions 22 – 24

Question 22a

Surplus	Count of 1A	22a		
Size	1B	TRUE	FALSE	Grand Total
small	a	72	206	278
medium	b	34	57	91
large	c	6	15	21
	Grand Total	112	278	390

Question 22b

Surplus	Count of 1A	22b		
Size	1B	TRUE	FALSE	Grand Total
small	a	54	224	278
medium	b	31	60	91
large	c	7	14	21
	Grand Total	92	298	390

Question 22c

Surplus	Count of 1A	22c		
Size	1B	TRUE	FALSE	Grand Total
small	a	86	192	278
medium	b	35	56	91
large	c	8	13	21
	Grand Total	129	261	390

Question 23

Surplus	Count of 1A	23							
Size	1B		a	b	c	d	e	(blank)	Grand Total
small	a	2	12	3	28	124	59	50	278
medium	b		11	4	17	38	11	10	91
large	c		2		6	8	2	3	21
	Grand Total	2	25	7	51	170	72	63	390

Question 24

Surplus	Count of 1A	24								
Size	1B		a	b	c	d	e	f	(blank)	Grand Total
small	a	6	46	1	2	5	1	24	193	278
medium	b		33		1	1	1	7	48	91
large	c	1	5				2	2	11	21
	Grand Total	7	84	1	3	6	4	33	252	390

Appendix 2: Risk Transfer Alternatives

1. CAS Research Working Party
2. Robert A. Bear, FCAS, MAAA, CPCU
3. Michael J. Belfatti, FCAS, MAAA
4. Joseph Boor, FCAS, MAAA
5. Gregory A. Cuzzi, ACAS, MAAA
6. Rod Davis, ACAS, MAAA
7. Bob Eramo, ACAS, MAAA
8. Bruce D. Fell, FCAS, MAAA, CFA
9. Spencer M. Gluck, FCAS, MAAA
10. Steven B. Goldberg, ACAS, MAAA
11. Todd J. Hess, FCAS, MAAA
12. Lawrence Katz, FCAS, MAAA
13. David Koegel, ACAS, MAAA
14. Nicholas H. Pastor, FCAS, MAAA
15. John Pierce, FCAS, MAAA
16. Shaun Wang, PhD, FCAS, MAAA
17. Russell B. Wenitsky, ACAS
18. Jeffrey D. White, FCAS, MAAA
19. Name Withheld

CAS Research Working Party

Risk Transfer Testing of Reinsurance Contracts: Analysis and Recommendations

CAS Research Working Party on Risk Transfer Testing

Abstract

This paper was prepared in response to a call from the American Academy of Actuaries Committee on Property and Liability Financial Reporting (COPLFR). The call requested ideas about how to define and test for risk transfer in short duration reinsurance contracts as required by FAS 113 and SSAP 62. These accounting standards require that a reinsurance contract must satisfy one of two conditions in order to qualify for reinsurance accounting treatment: 1) the contract must transfer "substantially all" of the underlying insurance risk, or failing that, 2) it must at least transfer "significant" insurance risk. The paper presents methods to test for both conditions, but the main focus is on testing for "significant" risk transfer. The shortcomings of the commonly used "10-10" test are discussed and two alternative testing frameworks are presented as significant improvements over "10-10". The first of these, which is presented in detail, is based on the expected reinsurer deficit (*ERD*). Conceptually, that approach is a refinement and generalization of "10-10" that addresses its major shortcomings. The second framework, based on the right tail deviation (*RTD*), is presented more briefly. It has certain desirable properties but at the cost of greater complexity.

Keywords: risk transfer testing, FAS 113, "10-10" test, downside risk, expected reinsurer deficit (*ERD*), right tail deviation (*RTD*), tail value at risk (*TVaR*), parameter uncertainty

1. INTRODUCTION

The purpose of this paper is to propose an improved framework for testing short-duration reinsurance contracts for risk transfer compliance with FAS 113. Under that accounting statement, reinsurance accounting is allowed only for those indemnity contracts that transfer insurance risk. The aim of the paper is to present a theoretically sound but practical approach to determining whether a contract meets the risk transfer requirements of FAS 113.

1.1 Context

The working party that prepared this paper was formed by the CAS to respond to a call by the American Academy of Actuaries Committee on Property and Liability Financial Reporting (COPLFR) for the submission of actuarially sound ideas about how to define and test for risk transfer in reinsurance transactions. The American Academy call arose out of the need for a constructive response from the actuarial profession following some widely publicized cases of alleged abuse of finite reinsurance and related accounting principles. Those cases have led to renewed scrutiny of reinsurance contracts to ascertain whether they comply with the existing accounting requirements and to a broader inquiry as to whether

FAS 113 goes far enough in specifying the manner in which contracts will be accounted for either as reinsurance or otherwise.

In a letter dated June 13, 2005, and addressed to members of the CAS, the chair of COPLFR framed the request as follows:

"Property/casualty actuaries interested in contributing suggestions…are asked to submit responses to one or more of the following questions:

1. What is an effective test for risk transfer? (Respondents are asked to focus on actuarial methodology and provide examples as appropriate.)
2. What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer? (Respondents are asked to focus on decision criteria used to evaluate the results of the test described in question #1.)
3. What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract (i.e., in what instances is risk transfer "reasonably self-evident" and therefore cash flow testing is not necessary to demonstrate risk transfer)?
4. What are the advantages and disadvantages of the suggested approach versus other approaches commonly used?"

There is very little published actuarial literature on the subject. The only significant paper appears to be the one prepared in 2002 by the CAS Valuation, Finance, and Investments Committee entitled, "Accounting Rule Guidance Statement of Financial Accounting Standards No. 113—Considerations in Risk Transfer Testing"[1]. That paper provided an excellent summary of FAS 113 and the risk transfer testing methods that emerged in response (including the "10-10" test) as well as a discussion of a number of alternative methods. However, the paper was fairly muted in its criticism of "10-10", and it did not strongly advocate replacing it with an alternative.

In this paper we seek to respond to all four of the questions posed by COPLFR. The members of the working party believe the time has come to be explicit about the shortcomings of the "10-10" test that has come into common use and to advocate its replacement with a better framework. Accordingly, in this paper we include an extensive critique of the "10-10" test and describe two frameworks, one in detail and the other in summary, that would be significant improvements over "10-10". We also identify methods for determining whether individual reinsurance contracts should be subject to detailed testing.

The frameworks described in the paper primarily address the issue of developing a more consistent and rigorous quantitative approach for the evaluation of risk transfer. As a result, the approaches described might reduce the potential for accounting mistakes simply by virtue of the higher level of clarity and consistency that result from their application. But the working party wants to make it very clear that no quantitative methodology will ever be fully successful in detecting intentional attempts at fraud or accounting abuse. Regulators and auditors face a difficult but necessary task in ferreting out the motives and intent of the producers of accounting statements. Actuaries are important partners and advisors in the area, especially in areas such as risk transfer. But it would be a mistake to think that actuaries or any other quantitative expert can provide a formula that reduces the analysis of intent, good or bad, to a simple (or even complex) calculation. This is important, because many of the alleged acts that have topped recent headlines are in fact much more about bad intent than risk transfer. No matter how good this working party's work, the methodologies developed here would not likely have prevented many of the alleged abuses, at least not without other efforts to discern the intent of the transactions.

At the same time, it is important to remember that in most reinsurance transactions the parties are acting in good faith and their intentions are good. Just as a mathematical test cannot identify bad intent, it cannot by itself discern the likely good intent of the parties. Therefore, the failure of a contract to meet a quantitative risk transfer test should not result in denial of reinsurance accounting treatment to a transaction without a thorough review of the all aspects of the deal, including the question of intent.

1.2 Disclaimers

While this paper is the product of a CAS working party, its findings do not necessarily represent the official view of the Casualty Actuarial Society. Moreover, while we believe the approaches we describe are very good examples of how to address the issue of risk transfer, we do not claim they are the only acceptable ones.

In the course of the paper, in order to make our ideas as clear as possible, we present a number of numerical examples that require assumptions about the distribution of losses and appropriate threshold values for the risk transfer tests we describe. We recognize that any loss model we choose is an approximation to reality at best and might even be a poor one, and that with respect to the decision about appropriate risk transfer threshold values, other constituencies, including regulators, accountants and outside auditors have a key role to play. In making such assumptions for purposes of illustration, we are not necessarily endorsing any particular loss model or threshold value.

In many of our examples we display the results of calculations to two decimal places, which suggests an unreasonably high level of precision. We do so only in order to highlight the differences in what are frequently very small numbers. We are not suggesting that use of two decimal places is appropriate in the practical application of the methods we describe.

Throughout the paper we use the FAS 113 definition of the reinsurer's loss, which ignores brokerage and the reinsurer's internal expenses. Our use of that definition should not be construed to mean that we endorse that definition for any purpose other than testing reinsurance contracts for compliance with FAS 113.

1.3 Organization of Paper

The paper is structured in nine sections.

Section 1 describes the impetus for and context of the paper as well as a summary of the risk transfer requirements of FAS 113, which we treat as a reasonable framework for evaluating risk transfer, subject to a fair interpretation of the critical elements of "reasonable probability" and "substantially all". To meet the FAS 113 risk transfer requirements, a contract must satisfy one of two conditions: 1) the reinsurer must assume "substantially all" of the underlying insurance risk, or 2) the reinsurer must assume "significant" insurance risk and it must be "reasonably possible" that the reinsurer may realize a "significant" loss.

In Section 2 we present a systematic approach for determining whether "substantially all" of the underwriting risk has been transferred under a reinsurance contract. If "substantially all" the risk has been transferred, then the contract meets the risk transfer requirement of FAS 113 without it being necessary to show that the risk transfer is "significant". This section partially addresses the third question.

In Section 3 we present a detailed critique of the "10-10" test itself and how it has been applied in practice. We first describe the emergence of the "10-10" approach as a method of testing contracts for "significant" risk. Then we illustrate the application of the "10-10" benchmark to three reinsurance contracts that clearly contain risk, including a property catastrophe contract and two quota shares of primary portfolios. All the tested contracts "fail" the "10-10" test, implying that the test is flawed. In the context of one of the examples we also emphasize the importance of taking parameter uncertainty into account in the risk assessment. Finally, we point out some unintended consequences of "10-10", namely that it implicitly imposes price controls on reinsurance contracts. We conclude that "10-10" is inadequate as a measure of risk and therefore unsuitable as a universal test for

determining the "significance" of risk transfer. At best, one may argue that "10-10" is a sufficient test for risk transfer. It is not, however, a necessary condition.

Section 4 discusses two specific shortcomings of "10-10" and describes a different approach that addresses those shortcomings, thus addressing the first, second and fourth questions to varying degrees. The improved test we present here is based on the *expected reinsurer deficit* (*ERD*), which incorporates present value underwriting loss frequency and severity into a single measure. The loss severity embedded in the *ERD* is the tail value at risk (*TVaR*) measured at the economic breakeven loss ratio. We show that the *ERD* test is effectively a variable *TVaR* standard. We point out that a "significance" threshold of $ERD \geq 1\%$ has the merit of a certain amount of continuity with the "10-10" but without that test's major shortcomings. In order to address concerns that "10-10" might not be a strict enough standard, we also suggest the possibility of a supplemental minimum downside requirement. However, we do not advocate retesting of contracts already on the books that have already been found to pass "10-10".

Section 5 shows the application of the *ERD* test to the same contracts tested in Section 3 as well as to additional quota share contracts with loss ratio corridors or loss ratio caps, as well as to excess swing-rated contracts and individual risks. Using an illustrative standard of $ERD \geq 1\%$, we show that contracts that most people would consider risky receive a "passing" score, with one exception. This further addresses the first two questions.

Section 6 discusses the identification of contracts subject to the "significant" risk requirement, but which do not require individual testing, and thus addresses the third question.. The NAIC is considering a requirement that the CEO and CFO attest that a risk transfer analysis has been completed for all reinsurance contracts, except those for which it is "reasonably self-evident" that significant risk has been transferred. We seek to put some definition to "reasonably self-evident". In this section we illustrate the application of the $ERD \geq 1\%$ test to several classes of reinsurance contracts with certain structural features. We show, using conservative assumptions, that 1) standard catastrophe excess of loss treaties, 2) contracts covering individual risks and 3) certain other excess of loss reinsurance structures, could all be "pre-qualified" as meeting the "significant" risk requirement (unless there is reason to believe they include other features that might affect the amount of risk transferred). We also describe an additional approach that could potentially be used to further expand the set of such contracts.

Section 7 discusses the possible evolution of risk measurement beyond the application to risk transfer testing that is the focus of this paper. This section offers an alternative way to

address the first two questions. It briefly presents a framework proposed based on *right tail deviation* (*RTD*) that tightly links risk transfer testing and risk loading. We present two examples. While the *RTD*-based approach has theoretical appeal, it has the drawback of being more complex and thus less understandable to a non-actuarial audience than the *ERD* approach.

Section 8 is a summary of the key points of the paper.

Section 9 provides suggested priorities for areas of further research.

Appendix A gives the mathematics underlying the *ERD* test. Appendix B explains the comparison between S&P 500 equity risk and quota share reinsurance risk (which is used in examples in Sections 3 and 5). References are listed in Section 10, which follows the appendices.

1.4 Background

FAS 113 ("Accounting and Reporting for Reinsurance of Short-Duration and Long-Duration Contracts") was implemented in 1993[1] to prevent, among other things, abuses in GAAP accounting for contracts that have the formal appearance of reinsurance but do not transfer significant insurance risk and thus should not be eligible for reinsurance accounting. FAS 113 amplified the earlier requirement of FAS 60 that reinsurance accounting only applies to contracts that transfer insurance risk. SSAP 62, which largely incorporates the same language as FAS 113, was implemented shortly thereafter to address the same issues with respect to statutory accounting. Our references to FAS 113 should be understood to refer collectively to FAS 113 and SSAP 62.

In order for a contract to qualify for reinsurance accounting treatment in accordance with FAS 113, it must transfer insurance risk from an insurer to a reinsurer. To meet the risk transfer requirement, a reinsurance contract must satisfy one of two conditions:

1. It must be evident that "the reinsurer has assumed substantially all of the insurance risk relating to the reinsured portion of the underlying insurance contracts" (paragraph 11), or
2. The reinsurer must "assume significant insurance risk under the reinsured portions of the underlying insurance contracts"(paragraph 9a) and it must be "reasonably possible that the reinsurer may realize a significant loss from the transaction" (paragraph 9b).

[1] It was issued in December 1992 for implementation with respect to financial statements for fiscal years commencing after December 15, 1992. Since insurance companies generally have fiscal years that coincide with calendar years, in effect it was implemented for the 1993 fiscal year.

We are aware that our presentation of the two FAS 113 conditions in this order (i.e., first the paragraph 11 condition and then the paragraph 9 condition) is unusual. In practice, the "significant" risk requirement has often been considered first, and only if the contract "fails" is paragraph 11 considered. However, because part of our aim is to determine how to avoid testing every contract, we find it useful to start with the consideration of whether the contract meets the risk transfer requirement by virtue of "substantially all" the underlying risk having been transferred. If it does, then the "significant" risk question does not need to be considered at all. Accordingly, throughout the paper we will present and work with the FAS 113 risk transfer conditions in that conceptual order.

This paper is not intended to be a critique of FAS 113. We treat FAS 113 as it is currently constructed as a reasonable framework for evaluating risk transfer, subject to a fair interpretation of the critical elements of "reasonable probability" and "substantially all", despite some reservations about its focus on the financial effects (excluding brokerage and internal expenses) of a transaction on the reinsurer alone.

While all reinsurance contracts must satisfy the requirements of FAS 113, it is up to each company to determine which contracts should be subjected to detailed testing and which contracts clearly satisfy the requirements of FAS 113 based upon inspection. In this paper we describe an approach that can help guide both ceding companies and reinsurers through that decision process.

2. DETERMINING WHETHER THE CONTRACT TRANSFERS "SUBSTANTIALLY ALL" UNDERLYING INSURANCE RISK

We suggest it makes sense to begin by determining whether the contract meets the FAS 113 condition of transferring "substantially all" the insurance risk. If it does, then the contract meets the risk transfer requirement. If it does not, then the contract is subject to the other condition that the risk transfer must be "significant".

What is the "insurance risk relating to the...underlying insurance contracts?" We see it as the *downside risk* associated with the cedent's portfolio of insurance, i.e., the exposure faced by the underwriter to incurring a loss. If the downside risk assumed by the reinsurer is essentially the same as that faced by the cedent with respect to the original unreinsured portfolio, then the contract transfers "substantially all" the insurance risk.

The trivial case is a quota share or other proportional contract with a flat ceding commission equal to the ceding company's expense ratio, where there are no features such a sliding scale commission, profit commission, loss ratio corridor or aggregate loss ratio limit.

In such a case, the comparison between the ceding company's position and that of the reinsurer is obvious. The contract clearly transfers not only "substantially all" the risk to the reinsurer but literally all of it. Facultative reinsurance is often written on this basis, but more often than not, quota share treaties include one or more of the features identified above.

Sliding scale and/or profit commission features are often used by reinsurers as incentives to reinforce the ceding company's motivation to underwrite its business in a disciplined way. Their use can promote a win-win situation for the ceding company and the reinsurer. These and other features such as loss ratio corridors or caps appear frequently in traditional reinsurance contracts as a means of making otherwise unattractive treaties acceptable to the reinsurance market. Usually the context for incorporation of caps or corridors is poor historical underwriting experience in the portfolio for which reinsurance is being sought. The ceding company believes it has taken the necessary corrective actions to turn the portfolio around, but the reinsurance market is skeptical. The inclusion of caps and corridors in a reinsurance contract can often make it possible for a ceding company that has confidence in its own business plan to obtain the reinsurance capacity it requires to execute that plan. Sometimes, but not always, such features have the effect of taking "too much" risk out of a reinsurance deal to allow the "substantially all" requirement to be met. We need to be able to compare the downside risk in the ceding company's unreinsured policies with the downside risk of the reinsurer.

We describe two ways of making this comparison – there may be other good methods as well – and illustrate them with an example. The first method is easier to understand but is not always conclusive, while the second method is somewhat more complicated but can always be applied.

Method 1 – Comparison of All Underwriting Downside Scenarios

Compare the cedent's underwriting margin over a range of loss ratios on the original unreinsured portfolio to the reinsurer's underwriting margin over the same range of loss ratios. The cedent's underwriting margin is defined as 100% less its unreinsured loss ratio less its actual expense ratio on the unreinsured portfolio[2]. The reinsurer's underwriting margin is defined as 100% less its assumed loss ratio less the ceding commission[3]. If the cedent's margin equals or exceeds the reinsurer's margin for the loss ratios that imply an

[2] Expenses before reinsurance divided by premiums before reinsurance. Whether expenses should be marginal or average is a matter of debate.

[3] This definition of the reinsurer's underwriting margin does not reflect other expenses of the reinsurer, including brokerage and internal expenses. While this approach to measuring the reinsurer's profitability is consistent with the FAS 113 definition, it does not reflect economic reality.

underwriting loss, then clearly the reinsurer has assumed "substantially all" of the insurer's downside risk. Even if the cedent's margin is less than the reinsurer's margin, if that difference is small (as it is in Example 2.1), then the "substantially all" test may be met. Note that unless there are significant cash flow differences between the ceding company and the reinsurer, it is not necessary to conduct a full analysis of cash flows, since they will affect both parties in the same way.

Method 2 – Comparison of Cedent and Reinsurer Expected Underwriting Deficits

Compare the expected underwriting deficits (*EUD*) of the cedent and the reinsurer. The *EUD* can be calculated either directly as the pure premium of an aggregate excess of loss cover attaching at the breakeven loss ratio or as the product of the frequency and severity of underwriting loss, (*Freq(UL*) and *Sev(UL)*, respectively)[4].

If the *EUD* faced by the reinsurer is greater than or equal to the *EUD* of the cedent, then the "substantially all" test is clearly met. Because "substantially all" is less than "all", if the *EUD* faced by the reinsurer is within a small tolerance of the expected underwriting deficit faced by the cedent, say, within 0.1%, then we would also say the "substantially all" test is met.

Let's consider an example to illustrate these two methods.

Example 2.1: Non-Standard Auto Share with Sliding Scale Commission

Suppose quota share of a non-standard auto portfolio is under consideration. The ceding commission is on a sliding scale. A minimum commission of 19.5% is payable if the loss ratio is 73% or higher. The commission slides up at a rate of one point for every one point of reduction in the loss ratio ("1:1 slide") below 73%, up to 30% at a loss ratio of 62.5%. The commission increases above 30% at a rate of 0.75% for every one point of loss ratio reduction ("0.75:1 slide") below 62.5%, up to a maximum commission of 39%, which is achieved at a loss ratio of 50.5% or lower. The ceding company's direct expense ratio on the subject business is 20%, so at the minimum ceding commission of 19.5%, it recoups virtually all of its direct costs. Its underwriting breakeven loss ratio is 80%. The reinsurer's FAS 113 underwriting breakeven loss ratio (i.e., ignoring brokerage and reinsurer internal expenses) is 80.5%.

---

[4] If x represents the loss ratio and B is the underwriting breakeven loss ratio, then

$EUD = \int_B^\infty (x - B)\ f(x)\ dx = Freq(UL) \cdot Sev(UL)$, where $Freq(UL) = \int_B^\infty f(x)\ dx$ and $Sev(UL)$ is the "tail value at risk" (*TVaR*) at the underwriting breakeven: $Sev(UL) = \int_B^\infty (x - B)\ f(x)\ dx \ / \int_B^\infty f(x)\ dx$

The results of Method 1 are given in Table 1 and the accompanying Chart 1. The table compares the ceding company's expense ratio and underwriting margin on the unreinsured portfolio over a wide range of loss ratios to the reinsurer's ceding commission expense and underwriting margin at the same loss ratios.

TABLE 1

"Substantially All" Risk Transfer Analysis - Method 1
Comparison of Reinsurer vs. Cedent Margins
Example 2.1

Subject Loss Ratio	Cedent Expense Ratio	Cedent Margin	Reinsurance Ceding Commission	Reinsurer Margin
30.0%	20.0%	50.0%	39.0%	31.0%
50.5%	20.0%	29.5%	39.0%	10.5%
62.5%	20.0%	17.5%	30.0%	7.5%
73.0%	20.0%	7.0%	19.5%	7.5%
80.0%	20.0%	0.0%	19.5%	0.5%
80.5%	20.0%	-0.5%	19.5%	0.0%
100.0%	20.0%	-20.0%	19.5%	-19.5%

The accompanying chart compares the ceding company's margin and the reinsurer's margin graphically. From Table 1 and Chart 1 we see that above an 80% loss ratio (the ceding company's breakeven on the unreinsured portfolio), the ceding company's margin and reinsurer's margin are virtually undistinguishable, which indicates the reinsurer has assumed "substantially all of the insurance risk" of the reinsured policies.

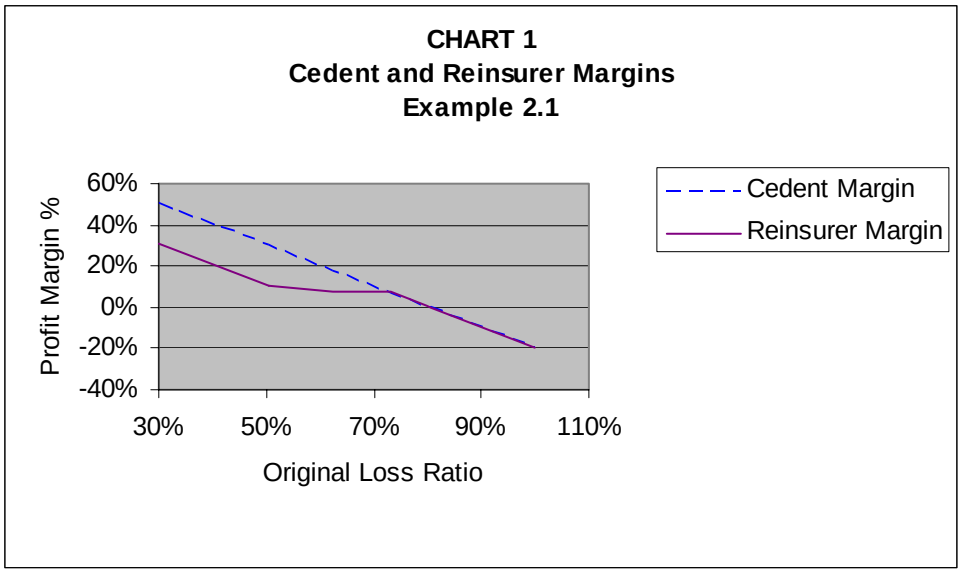


Table 2 summarizes the Method 2 comparison of expected underwriting deficits. It shows the insurer's and reinsurer's comparative underwriting downside risk by examining their respective *Freq(UL)*, *Sev(UL)* and *EUD*. In this example, the ceding company's frequency of underwriting loss is 11.28% vs. 10.45% for the reinsurer. The ceding company's underwriting loss severity is 8.33% vs. the reinsurer's 8.48%. The ceding company's *EUD* is 0.94% vs. the reinsurer's *EUD* of 0.89%[5]. While these measures vary slightly between the ceding company and the reinsurer, they are clearly very close. Thus, we would say that Method 2 also indicates that the reinsurer has assumed "substantially all" of

TABLE 2

"Substantially All" Risk Transfer Analysis - Method 2
Reinsurer vs. Cedent Margins in Downside Scenarios
Example 2.1

	Breakeven Loss Ratio	*Freq(UL)*	*Sev(UL)*	*EUD*
Cedent	80.0%	11.3%	8.3%	0.940%
Reinsurer	80.5%	10.5%	8.5%	0.886%
Difference	-0.5%	0.8%	-0.2%	0.054%

[5] Losses have been modeled using a lognormal distribution modified for parameter uncertainty, the details of which are not important for this example.

the ceding company's downside risk and the contract therefore meets the risk transfer requirements of FAS 113.

We conclude that in this example either Method 1 or Method 2 indicates the contract transfers "substantially all" the underlying insurance risk to the reinsurer.

While this approach works most naturally for quota share contracts, it can potentially be applied to excess of loss treaties as well. In that case, the reinsurer's *EUD*, calculated in the same way as above in the quota share case as a ratio to the ceded premium, should be compared to the cedent's *EUD* on the portion of the original subject portfolio which is exposed to the same risks as the excess of loss reinsurance contract. If the reinsurer's *EUD* is close to or greater than the cedent's, then the reinsurer can be judged to have assumed "substantially all" the cedent's insurance risk in this context. For example, suppose the portion of original insurance risk assumed by a catastrophe reinsurance contract covering a portfolio of business has a 1% probability of a claim of a certain size. In that case the reinsurance of that portion of the risk also requires no more than a 1% probability of loss of the same size, because the *EUD* s of the ceding company and the reinsurer are the same with respect to the original catastrophe exposure.

If our argument about the applicability of the comparative *EUD* approach to excess of loss contracts and contracts with loss ratio caps is not found to be compelling, note that in section 6 we will also demonstrate that catastrophe reinsurance and some other contracts with aggregate loss limitations can meet the "significant" risk requirement under many circumstances.

Finally, there is a case to be made that, to the extent that a ceding insurance company is limited in its ability to meet net losses by its surplus, it is reasonable to allow a similar limitation of the reinsurer's aggregate liability. If this is accepted, then it is possible to calculate the minimum loss ratio cap that can be imposed by the reinsurer without violating the condition that "substantially all" of the underlying risk has been transferred. This potentially represents a third way of determining whether the "substantially all" risk transfer condition has been met.

For example, suppose a ceding company enters into a whole account quota share reinsurance arrangement that results in a net premium to surplus ratio of 200%. If the quota share has a ceding commission of 25% (approximating the ceding company expenses), then a loss ratio cap as low as 125% would be consistent with the transfer of "substantially all" of the risk, because at a combined ratio of 150% the ceding company has lost all of its surplus.

Naturally such an interpretation would have to be made after due consideration of all other relevant features of the reinsurance contract in question.

If a contract does not meet the "substantially all" test, then it is subject to the second FAS 113 condition that "significant risk" must be transferred in order for the contract to qualify for reinsurance accounting. We now turn our attention to the question of what constitutes "significant" risk.

3. "SIGNIFICANT" RISK TRANSFER AND THE "10-10" TEST

3.1 "10-10" and its Shortcomings

A contract that does not meet the FAS 113 requirement for risk transfer by transferring "substantially all" the underlying insurance risk is subject to the second condition that "significant" risk be transferred. The so-called "10-10" test emerged in the years following the implementation of FAS 113 as a common benchmark for determining whether a reinsurance contract satisfies the requirement of a reasonable chance of "significant" loss to the reinsurer, which the test defines as "at least a 10% chance of a 10% loss". "10-10" is usually referred to as a "risk transfer" test, which implies an understanding of "risk" as a measure of exposure to loss rather than as exposure to volatility of results. "10% chance of a 10% loss" is usually interpreted to mean that the underwriting loss at the 90th percentile (of the probability distribution of underwriting results[6]) must be at least 10% of the ceded reinsurance premiums, where both underwriting loss and premiums are understood to be present values. Another term for "the underwriting loss at the 90th percentile" is "the value at risk" at the 90th percentile" or "$VaR_{90\%}$" with respect to the underwriting result. Accordingly, the "10-10" test can also be succinctly described as requiring $VaR_{90\%} \geq 10\%$.

The "10-10" benchmark arose as an informal method for testing whether purported reinsurance contracts contained sufficient risk transfer to meet the requirements of FAS 113 under the reasonable chance of significant loss criterion. It was not intended to be a universally applicable risk transfer test. Indeed, it has long been recognized that many reinsurance contracts having the characteristics of low underwriting loss frequency but high severity (such as property catastrophe excess of loss reinsurance) fail "10-10" on the basis that the probability of a 10% loss is less than 10%. In addition, if they do not meet FAS 113 risk transfer requirements by virtue of transferring "substantially all" risk, ordinary quota share reinsurance of many primary insurance portfolios (e.g., low limits private passenger

[6] Low percentiles represent better results; high percentiles represent poorer results. Underwriting losses are represented as positive numbers. References to "underwriting results" and "underwriting losses" should be understood to refer to present values.

auto), which have the characteristics of high frequency of underwriting loss but relatively low severity, may also fail. Until recently that was not seen as a problem because experienced practitioners understood the target of FAS 113 to be highly structured contracts that limited the transfer of insurance risk. As a consequence, traditional reinsurance contracts were typically not even tested.

In the wake of the recent revelations of new accounting abuses related to "reinsurance contracts" apparently involving little or no risk transfer, the situation has changed. There is greater sentiment now that (a) more contracts should be routinely tested for significant risk transfer and (b) "10-10" is not a stringent enough standard. The view that "10-10" may not be stringent enough arises in part from the fact that some highly structured contracts have been carefully engineered to allow for exactly a 10% probability of a 10% loss and little or no possibility of a loss greater than 10%.

It is clear from the failure of the "10-10" benchmark to correctly identify both catastrophe excess of loss and some quota share reinsurance as risky and its failure to flag certain highly structured contracts as not significantly risky that "10-10" is insufficiently discriminating to serve as a universal measure of risk transfer in reinsurance contracts. We need a better test for measuring significant risk transfer in contracts that are subject to that requirement.

The interpretation of FAS 113's paragraph 9b is a critical issue. Paragraph 64 states that "an outcome is reasonably possible if its probability is more than remote." Despite this definition, the expectation appears to have developed that "reasonably possible" means a probability substantially greater than "remote". While the accounting literature gives no specific guidance on these probabilities, a 10% chance has come to be widely accepted as the smallest probability that should be categorized as "reasonably possible." It is our position that a different interpretation of "reasonably possible" is more appropriate, one that depends on the context of the risk and recognizes that some weight should be given to loss scenarios that, while rare, are not remote.

In particular, we propose that, in establishing the threshold probability for "reasonably possible", consideration must be given to the probability of loss (and indeed the size of that loss) arising from the reinsured portions of the underlying insurance contracts. For example, in the context of catastrophe reinsurance, "reasonably possible" should be associated with a probability that reflects the inherently low probability of the covered event. For other reinsured portfolios, where the inherent probability of loss is greater, "reasonably possible" is appropriately associated with a higher probability value.

This interpretation goes a long way toward eliminating the apparent inconsistency of according reinsurance accounting to some contracts that do not satisfy an invariant probability threshold of 10%. That property catastrophe contracts are typically accorded reinsurance accounting treatment even though they often do not meet a "reasonable possibility" requirement, defined as 10%, implicitly reflects this kind of interpretation.

In section 4 we will present a framework for capturing the interaction between the "reasonably possible" and "significant loss" components of paragraph 9b in a way that automatically makes the appropriate contextual adjustment without having to resort to situation-based arguments.

First, let us continue our critique of "10-10".

3.2 Illustration of the Shortcomings of "10-10"

Through a series of examples we will show why "10-10" is an unsatisfactory test for establishing whether or not a reinsurance contract transfers significant risk. Example 3.1 illustrates the application of the test to a property catastrophe contract and shows that it "fails" to transfer significant risk. Example 3.2 illustrates the application (and misapplication) of "10-10" to a low volatility primary quota share, given a set of historical loss ratio experience. We also use that example to warn of the pitfalls of simply fitting a loss distribution to on-level loss ratio experience and using that for risk transfer analysis. Example 3.3 shows that a quota share of an insurance portfolio having the volatility characteristics of the S&P 500 would frequently fail the "10-10" test.

We begin with the property catastrophe example.

Example 3.1: Property Catastrophe Excess of Loss Reinsurance

A property catastrophe reinsurance contract paying a premium equal to 10% of the limit[7] is typically priced to a loss ratio of around 50%. That implies an expected loss of 5% of the limit. Catastrophe reinsurance contracts, especially for higher layers, run loss free or have small losses in most years but occasionally have a total limit loss. This pattern is illustrated by the simplified catastrophe loss distribution shown in Table 3 below.

[7] This is frequently referred to as a "10% rate on line".

TABLE 3
Catastrophe Loss Distribution for Example 3.1

Loss as % of Limit	Loss as % of Premiums	Probability of Given Loss
0%	0%	67%
5%	50%	20%
10%	100%	10%
100%	1000%	3%
5%	50%	100%

The loss at the 90th percentile of the catastrophe loss distribution is 100% of premiums. Assuming standard reinstatement premium provisions, the 90th percentile of the underwriting result distribution is an underwriting profit of 10% of premiums (100% original premiums plus 10% reinstatement premiums minus 100% loss). This contract fails the "10-10" test.

There is universal agreement among accountants, regulators, insurers, reinsurers and rating agencies that contracts like this one are risky. Clearly, the failure of "10-10" to identify the contract in this example as risky is an indication of a problem with "10-10" and not the contract.

Example 3.2: Primary Quota Share Reinsurance

Assume a cedent and reinsurer have negotiated a quota share treaty on a primary insurance portfolio. The treaty has a ceding commission of 25%. Does the treaty contain "significant" risk transfer[8]?

To measure the risk transferred we need to model the prospective underwriting result. Because the underwriting result is the breakeven loss ratio minus the actual loss ratio, the key to modeling the underwriting result is the probability distribution of the prospective loss ratio x. There are a number of reasonable actuarial methods for modeling prospective loss

[8] Let's assume the treaty does not meet the condition of transferring "substantially all" of the underlying risk, perhaps because the cedent's expenses are substantially greater than the ceding commission. As a result the treaty is subject to the "significant" risk transfer requirement.

ratios[9]. In actuarial pricing applications the principal focus is on the mean of the prospective loss ratio distribution. Not much attention is paid to the full distribution. In contrast, risk transfer analysis requires the full distribution. This means there are pitfalls associated with using the output from the pricing analysis for the risk transfer analysis without full consideration of the issues affecting the full loss ratio distribution.

Let's review the underwriting experience analysis of the insurance portfolio that is the subject matter of the quota share. Five years of loss ratio experience is available together with information of varying quality about historical loss development and claim trends as well as the rate level history and the cedent's expectation of rate actions during the treaty period. This is summarized in Table 4, which shows the reported, estimated ultimate and estimated ultimate "on-level" loss ratios[10] together with the loss development, premium on-level and loss on-level factors used in the analysis. The means, variances and standard deviations of the on-level loss ratios x_i and their natural logs $\ln x_i$ are tabulated using the assumption that exposure has been constant over the experience period.

The historical experience has been poor. Given the ceding commission of 25% and ignoring brokerage and internal expenses (as per FAS 113), the reinsurer's present value breakeven loss ratio is 75%[11]. Three of the five years have estimated ultimate loss ratios significantly greater than 75% and in two of the years the loss ratio is over 75% even on a reported basis. The good news is that the ceding company has taken action to increase rates significantly, which results in estimated on-level loss ratios that are much lower than the actual historical loss ratios. The on-level mean of 70.67% compares very favorably with the historical mean of about 80%. Moreover, the on-level loss ratios are not very variable as indicated by the standard deviations of 7.45% with respect to x and 10.88% with respect to $\ln x$.

[9] The models we use for the purposes of illustrating the issues related to risk transfer testing are not intended to be prescriptive and are independent of the risk measurements we describe.

[10] This means the loss ratios have been adjusted to reflect the projected premium rate and claim cost levels expected to apply during the treaty term.

[11] Note that given typical brokerage of 1.5% and internal expenses of 3% to 5%, reinsurers would regard their real breakeven loss ratio as 68.5% to 70.5%, depending on expenses. As we shall see, this treaty is a breakeven or slightly worse than breakeven proposition and would not be attractive to most reinsurers.

TABLE 4
On-Level Loss Ratio Experience
For Quota Share in Example 3.2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Accident Year	Reported L/R	Age to Ult Factors	Est Ult L/R	Prem On-Level Factors	Loss On-Level Factors	On-Level L/R x_i	$\ln x_i$
1	92.8%	1.039	96.4%	1.963	1.364	67.0%	-0.401
2	75.6%	1.048	79.3%	1.737	1.307	59.7%	-0.516
3	77.0%	1.095	84.3%	1.376	1.246	76.4%	-0.269
4	61.2%	1.141	69.9%	1.139	1.181	72.5%	-0.321
5	52.5%	1.415	74.3%	1.061	1.111	77.8%	-0.251
				Mean	$\bar{x}$	70.7%	-0.352
				*Var**	s^2	0.554%	1.18%
*Unbiased				*St. Dev.**	s	7.45%	10.88%

We are first going to illustrate *how not to apply* the "10-10" benchmark in this scenario. We do this in order to point out the problems associated with this approach, which we believe may be in relatively common use.

Let's assume the underlying random process governing the prospective loss ratio is lognormal. Then the "best fit" distribution, given the on-level loss ratio, experience is defined by parameters $\mu = \bar{x}$ and $\sigma = s$. From this it is easy to determine whether the present value underwriting loss corresponding to $VaR_{90\%}$ exceeds 10%. If B is the present value FAS 113 breakeven loss ratio and FV and PV represent "future value" and "present value" operators, respectively, then from the characteristics of the lognormal distribution we know that

$$N^{-1}(90\%) = \frac{ln[\,FV(\,B + VaR_{90\%}\,)] - \mu}{\sigma} \tag{3.1}$$

which implies

$$VaR_{90\%} = PV(e^{\mu + N^{-1}(90\%)\cdot\sigma}) - B \tag{3.2}$$

If ceded loss payments lag ceded premium payments by one year on average, the risk free interest rate is 5%, $\mu = \bar{x} = -0.3518$ and $\sigma = s = 10.88\%$, then formula (3.2) implies

$$\begin{aligned} VaR_{90\%} &= e^{(-0.3518)+(1.2815)(0.1088)} \cdot (1.05^{-1}) - .75 \\ &= 2.02\% \end{aligned}$$

Since "10-10" requires $VaR_{90\%} \geq 10\%$, according to this analysis the quota share treaty in this example does not transfer "significant" risk. In fact, the $VaR_{90\%}$ of 2.02% suggests that the treaty contains hardly any risk at all. Yet when we look back at the historical experience, we see that the reinsurer would have lost more than 10% in one year and would have lost money over the entire period. The conclusion that the reinsurer does not face a "reasonable possibility of significant loss" seems strange.

Why did we get this result? There are two reasons. The first, as we hinted at the beginning, has to do with inadequacies in the loss model we selected. The second has to do with shortcomings in the "10-10" test itself.

Let's discuss the problem with the approach we described for identifying a loss ratio model. Fundamentally, the problem is that we fitted a single distribution to the on-level loss ratios and then used that distribution as though we knew with certainty that it is the correct one. In that case the only source of risk being modeled is process risk, because we have assumed we have the correct model. In fact, there are multiple sources of parameter uncertainty, some of which we enumerate below:

- The ultimate loss estimates might be wrong;
- The rate level history might be inaccurate;
- The prospective rate changes assumptions might be wrong;
- The historical claim trend estimates might be inaccurate;
- The prospective claim trend assumptions might be wrong;
- The experience period might be too short to include rare but very large losses;
- The prospective loss ratios might not be lognormally distributed;

- The lognormal assumption is right, but the "best fit" distribution is not the actual;
- Cash flow timing assumptions, particularly regarding claims, might be wrong;
- The prospective exposure mix might be different from expected;
- For multi-year reinsurance contracts, the level of parameter uncertainty from all sources increases as the length of the coverage period increases.

In any actuarial application where the knowledge of the loss distribution itself and not just its mean is important, it is very important that the modeling be based on loss models that incorporate parameter uncertainty, which is an important and frequently underestimated source of risk[12]. Risk transfer testing, given its dependence on the right tail of the loss ratio distribution is one of those applications.

Accordingly, actuaries should be cautious about placing too much confidence in a single distribution fitted to estimated loss ratios. Where the estimates are the result of applying large development and/or on-level factors, the likelihood of parameter error is especially large, and appropriately large adjustments must be made to the distribution to account for it.

While it is beyond the scope of this paper to discuss specific methods for estimating the impact of parameter uncertainty, for the sake of illustration, suppose the effect of reflecting parameter uncertainty in the current example is to increase σ in the lognormal model to 15%. If we constrain μ such that $E(x)$ remains unchanged, then $\mu = -0.3571$ and formula (3.1) yields $VaR_{90\%} = 5.76\%$, which still fails to meet the "10-10" threshold for "significant" risk transfer. In this case, an adjustment to try to take account of parameter uncertainty is not sufficient to show "significant" risk transfer in the contract, at least if we use "10-10" to measure it.

The next example brings into question the appropriateness of the "10-10" criterion of $VaR_{90\%} \geq 10\%$ by examining its implications for how we think about stock market risk.

Example 3.3: Primary Quota Share Reinsurance (Volatility of S&P 500)

Assume we are considering a quota share treaty on a second primary insurance portfolio. As in Example 3.2 the treaty ceding commission is 25%, which implies a FAS 113 breakeven present value loss ratio of 75%. Suppose this portfolio has the distributional and volatility characteristics commonly attributed to the S&P 500 equity index and an on-level loss ratio of

[12] Kreps[2] and Van Kampen [3] provide examples of large effects in loss reserve estimates and aggregate excess pure premiums, respectively, due to the recognition of parameter uncertainty.

70%. This implies an assumption that the prospective loss ratio is lognormally distributed[13] with a mean of 70%. Let's also assume the claim payments lag premiums by one year. In order to pass the "10-10" test, which requires a present value loss ratio of at least 85% at the 90th percentile, if the risk free interest rate is 5%, the minimum value of the lognormal σ parameter is about 21%[14].

Actual annualized volatility in the price of the S&P 500 index exchange traded fund (symbol SPY) between early May 2004 and early May 2005 was 10.64%.[15] On May 4, 2005, the broadly based CBOE Volatility Index (VIX), a measure of the expected annualized volatility in the S&P 500 stock index implied by the market pricing of index options, closed at 13.85%. The market was using a higher estimate of future volatility for pricing purposes than that observed in the recent past, which might reflect an adjustment for parameter uncertainty or simply the opinion that volatility would increase. Both estimates of σ fall below the threshold of 21% required to pass "10-10", implying that a "quota share" of the S&P 500 index[16] would fail to meet the FAS 113 requirement for significant risk transfer!

This is not merely a temporary aberration. During the period from early May 2004 through early May 2005 the actual volatility observed on a one-year look-back basis averaged 10.77%. Over the same time period, VIX averaged 14.39%. Chart 2 shows this graphically. The persistent pattern of VIX greater than actual historical volatility suggests that VIX reflects an adjustment for parameter uncertainty rather than a forecast that volatility will increase.

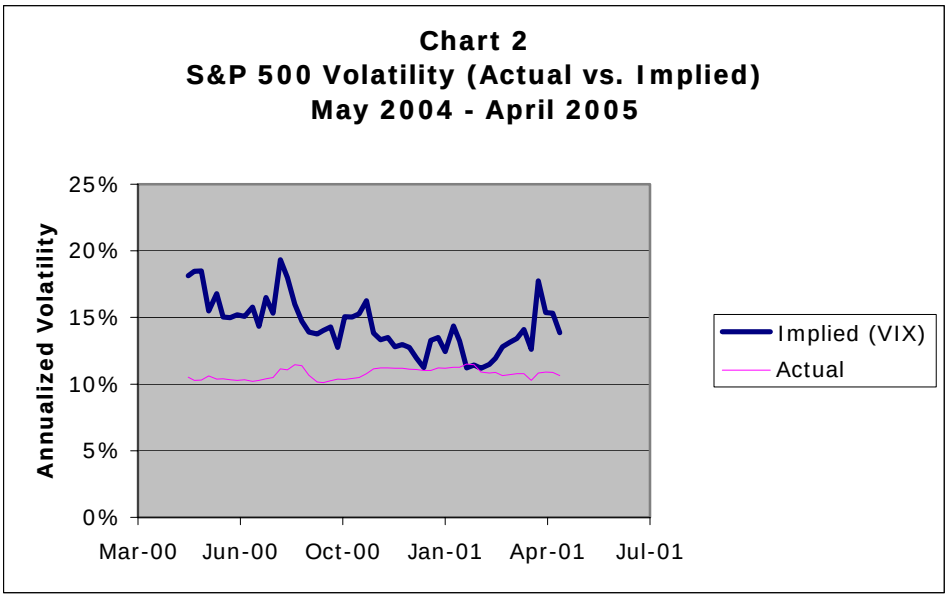
---

[13] For a discussion of the basis for this assumption, see Appendix B.

[14] $\sigma = \frac{ln[(.85)(1.05)] - \mu}{N^{-1}(.9)}$ and $\mu = ln(.70) - .5\sigma^2$ imply $\sigma = 20.6\%$ or 236%, the former being the only reasonable solution in this context. This threshold assumes a ceding commission of 25%, a risk free interest rate of 5% and lognormal stock prices. The threshold will vary depending on the parameters.

[15] Calculated as the annualized standard deviation of weekly log returns $\ln(P_w / P_{w-1})$ between May 2004 and May 2005.

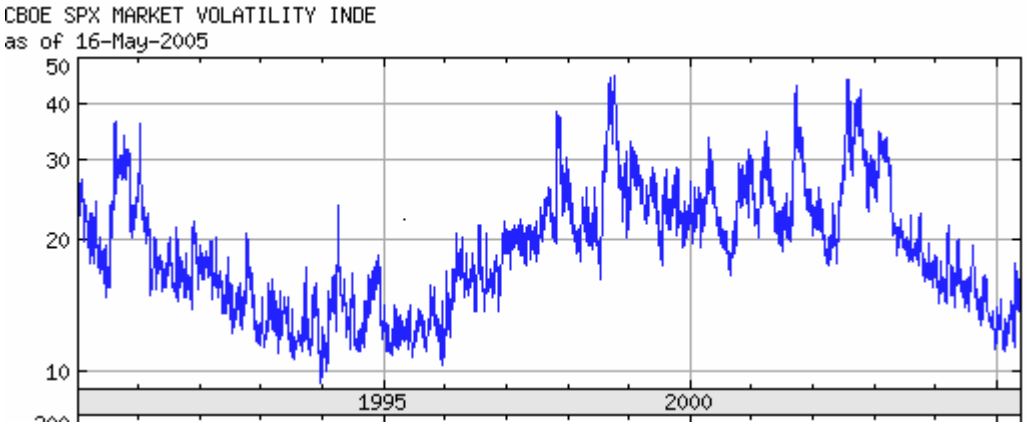
[16] We put "quota share" in quotation marks because the S&P 500 index transaction comparable to a quota share of an insurance portfolio involves a short sale. Since a short sale is usually considered to be even riskier than a long position, the failure to "pass" a risk transfer test is all the more surprising. See Appendix B for details.



Source: Yahoo! Finance

Over a longer period of time the market opinion of the prospective volatility of the S&P 500 has varied considerably, ranging from a high of about 50% in 2002 to a low of about 9% in 1993[17]. Chart 3 shows this graphically.

CHART 3



Source: Yahoo! Finance

[17] For more information about VIX and its calculation, see the white paper published by the CBOE, which is available at its website: http://www.cboe.com/micro/vix/vixwhite.pdf. The paper included the history between 1990 and August 2003.

Chart 4 shows the probability of a present value loss of 10% or more on the quota share of this example, given σ = VIX values as of the last trading day of each year from 1990 through 2004 plus May 4, 2005. It shows that the probability exceeds 10%, given the VIX values at the end of 1990 and those for every December from 1996 through 2002. However, the probability is less than 10%, given the VIX values from every December 1991 through 1995 and those for December 2002 and 2003 as well as that for May 2005[18]. Almost no one would argue that an investment in equities, even in a diversified portfolio such as the S&P 500, is not risky. Yet the implication of the "10-10" benchmark is that a quota share reinsurance that has the same volatility characteristics ascribed to the S&P 500 by the options market over the period since 1990 would have been considered risky only about half the time! Unless the intention is to set the bar for "significant" risk at a level higher than the typical volatility of the S&P 500, we must conclude that the "10-10" criterion is an inadequate measure of significant risk.

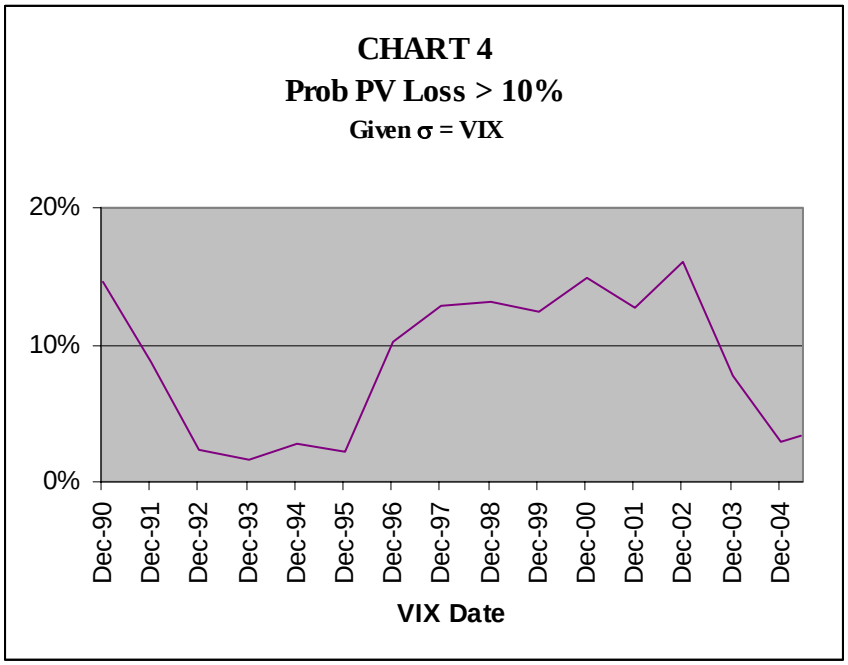


Table 5 illustrates the "10-10" analysis for a quota share of a portfolio whose loss ratio has the volatility characteristics of the S&P 500, for two volatility scenarios: 9% (representing the low end of the VIX range since 1990) and 13.85% (representing the VIX value on May 4, 2005). The ceding commission is 25%. The table shows (a) the loss at the

[18] The data underlying Chart 4 can be found in Appendix B.

90th percentile of the present value underwriting result distribution, and (b) the probability of a present value loss of 10% or more, for σ = 9% and 13.85%. Both of these volatility scenarios fail to meet the "10-10" threshold for significant risk transfer.

If σ = 9%, which represents the low end of the range of S&P 500 implied volatility since 1990, the quota share actually has a negative loss (i.e., small profit) at the 90th percentile ("10% chance of a (0.49%) or greater loss") and a miniscule 0.30% probability of a 10% loss or more. This scenario fails the "10-10" test badly!

For σ = 13.85% Table 5 shows a 10% chance of a 3.85% or greater loss and a 3.41% chance of a 10% loss or more. This contract scenario also fails "10-10" by a long way[19].

TABLE 5
"10-10" Risk Transfer Analysis
for Quota Share in Example 2.3
Given Portfolio with Volatility of S&P 500

VIX	σ	(a) 90th Percentile P.V. Underwriting Loss	(b) Probability of ≥10% P.V. Underwriting Loss
Low	9.00%	(0.49%)	0.30%
May 2005	13.85%	3.85%	3.41%

For further discussion of the comparability of quota share reinsurance with the S&P 500, see Appendix B.

3.3 Unintended Consequences: The Impact of "10-10" on Reinsurance Pricing

There is a further troubling implication of "10-10". It implicitly imposes price controls on reinsurance contracts at such a low level that, if that benchmark were to be enforced as a

[19] Note that even at an expected loss ratio of 75%, which is the treaty breakeven point, there is a 10% chance of only a 9.49% or greater loss. See Appendix B (Table B-2) for details about the sensitivity of the analysis to changes in the expected loss ratio assumption.

rule, reinsurance capacity for certain types of business is likely to be reduced, if not eliminated entirely.

To illustrate this we will assume the prospective loss ratio is lognormally distributed[20]. The mean of a lognormal distribution is given by

$$E(x) = e^{\mu+0.5\sigma^2} \tag{3.3}$$

If we solve for μ in formula (3.1) and substitute the result for the μ in formula (3.3) we obtain the formula for *E(x)* constrained by $VaR_{90\%} = 10\%$:

$$E(x) = Exp\{\ln[FV(B + VaR_{90\%})] + N^{-1}(90\%) \cdot \sigma + 0.5\sigma^2\} \tag{3.4}$$

For example, in the treaty scenario with no ceding commission, $B + VaR_{90\%} = 110\%$, and the minimum permissible loss ratio is:

$$E(x) = Exp\{\ln[FV(110\%)] + 1.2815 \cdot \sigma + 0.5\sigma^2\} \tag{3.5}$$

Table 6 is a tabulation of the minimum permissible loss ratios allowed by "10-10" for a range of values of σ and average net claim payment lags of zero, one year, two years and three years. Chart 5 is a graphical representation of the data in Table 6. We see that for small values of σ and claim lags of a year or more, the minimum permissible loss ratios are greater than 100%, implying the reinsurer is required to price its business at an underwriting loss even before taking into account brokerage and its own internal expenses. Even at somewhat higher values of σ that might correspond to certain excess of loss business, the reinsurers's net underwriting margins (after typical brokerage of 10% and comparable internal expenses) are quite low.

For example, given $\sigma = 9\%$ and assuming no claim payment lag (and hence no investment income), the reinsurer's minimum permissible loss ratio is 98.4%. That implies a maximum allowable margin before brokerage and internal expenses of 1.6%. The maximum

[20] We choose the lognormal merely for purposes of illustration. A different distribution might be more appropriate.

permissible loss ratio rises as the claim payment lag increases. The effect of the $VaR_{90\%} = 10\%$ constraint is that all the investment income earned as a result of the claim payment lag is credited to the cedent, and the present value of the reinsurer's margin remains at 1.6%. For example, given a three-year payment lag and a 5% interest rate, the breakeven loss ratio is 115.8% and the minimum permissible loss ratio is 113.9%, which leaves a future value margin for the reinsurer of 1.9%. The present value of that 1.9% is 1.6%. Clearly, given brokerage costs and internal expenses, no reinsurer could afford to write business at such a meager margin.

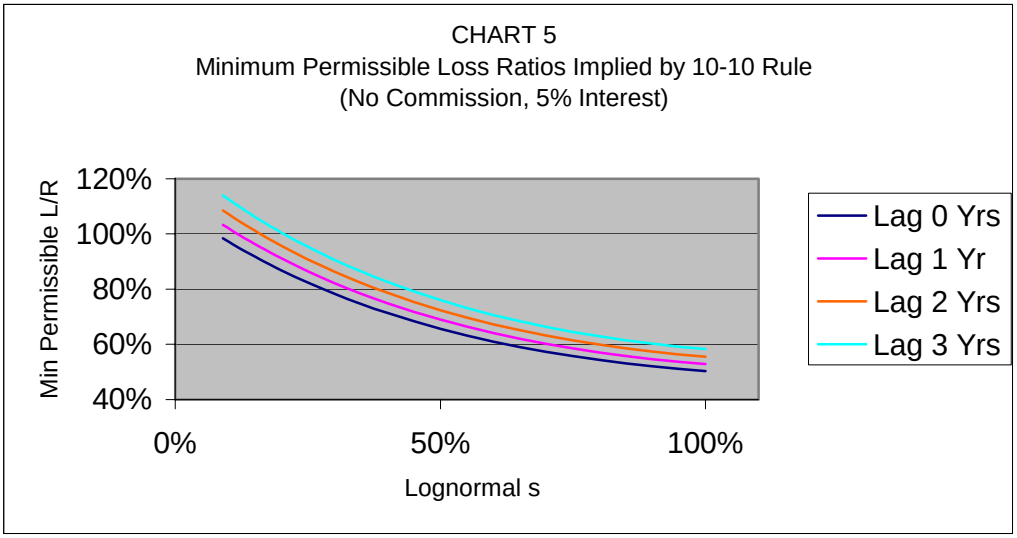
TABLE 6

Minimum Permissible Loss Ratio
Implied by "10-10"

Contracts with No Ceding Commission
Interest at 5% per annum

By σ and Claim Lag

σ	No Lag	1 Yr Lag	2 Yr Lag	3 Yr Lag
9.0%	98.4%	103.3%	108.5%	113.9%
10.0%	97.3%	102.1%	107.2%	112.6%
11.0%	96.1%	100.9%	106.0%	111.3%
12.0%	95.0%	99.8%	104.7%	110.0%
13.0%	93.9%	98.6%	103.5%	108.7%
14.0%	92.8%	97.5%	102.4%	107.5%
15.0%	91.8%	96.4%	101.2%	106.3%
20.0%	86.8%	91.2%	95.8%	100.5%
25.0%	82.4%	86.5%	90.8%	95.4%
30.0%	78.3%	82.3%	86.4%	90.7%
40.0%	71.4%	74.9%	78.7%	82.6%
50.0%	65.7%	69.0%	72.4%	76.0%
60.0%	61.0%	64.1%	67.3%	70.7%
75.0%	55.7%	58.5%	61.4%	64.5%
100.0%	50.3%	52.9%	55.5%	58.3%



In light of our earlier discussion of parameter uncertainty, it may well be that σ values as low as 9% will never be used in practice. However, the problem remains to some extent at higher values of σ. For example, for $\sigma = 30\%$ the maximum gross reinsurer's margin is 21.7% (100% less the minimum loss ratio with no claims lag). If the reinsurance is on an excess of loss basis, brokerage is likely to be 10% and internal expenses are likely to be a similar amount. That leaves only 1.7% as a net present value margin for the reinsurer, which is not likely to be attractive.

3.4 Section Summary

The discussion in this section should make it clear that the "10-10" benchmark is a flawed measure of "significant" risk transfer. The test used to measure risk transfer should accurately distinguish between contracts that clearly contain significant risk from those that don't. That "10-10" fails to identify both catastrophe reinsurance treaties and contracts with the characteristics of equity investments as risky tells us that it is a poor test. "10-10" also implies very restrictive caps on reinsurance pricing that can never have been intended. At the same time it has received criticism from the other direction that it does not do an adequate job of screening out contracts that meet its minimum requirements but in such a contrived way that the intent of FAS 113 is thwarted. For all of these reasons it makes sense to identify a better test than "10-10", which we seek to do in the next section.

4. TOWARD A BETTER TEST

There are at least two major shortcomings of the "10-10" test. First, the focus on the present value loss only at the 90th percentile ($VaR_{90\%}$) ignores the information in the remainder of the tail represented by the percentiles beyond the 90th. A better test would take account of the loss potential in the right tail of the distribution, which sometimes can be extreme (as in the case of catastrophe reinsurance). Second, both the 10% probability and 10% loss thresholds are arbitrary. The risk transfer test should be generalized to allow for both low frequency-high severity (e.g., 5%-20%) and high frequency-low severity (e.g., 20%-5%) combinations.

The first shortcoming could be remedied by replacing $VaR_{90\%}$ with the mean severity of present value underwriting losses at and beyond the 90th percentile, a measure known as the "tail value at risk" or $TVaR_{90\%}$ [21]. This measure of severity incorporates the information about the loss potential in the right tail that the "10-10" test misses. Indeed, the 2002 VFIC paper suggested replacing $VaR_{90\%}$ in the "10-10" test with $TVaR_{90\%}$. However, simply replacing $VaR_{90\%}$ with $TVaR_{90\%}$ is not by itself a full solution to the problems associated with "10-10", because it leaves unaddressed that test's second shortcoming that the 10% thresholds wrongly screen out low frequency-high severity and high frequency-low severity contracts.

That second shortcoming can be corrected by relaxing the requirement that the probability of loss and the severity of loss must both exceed 10%. We can do this by making use of the fact that the *expected reinsurer deficit* (*ERD*)[22] is equal to the probability (or *frequency*) of the present value underwriting loss times its average *severity*, where the latter is *TVaR* measured at the economic breakeven point. Since *ERD* incorporates information about both the frequency and severity of the reinsurer's downside risk into a single measure, it makes sense to use that measure to define a threshold for measurement of significant risk transfer rather than to define it in terms of frequency and severity separately:

$$ERD = Freq \times Sev \geq A \tag{4.1}$$

[21] Also known as the "tail conditional expectation" or "*TCE*", *TVaR* has been praised by VFIC[1] , Meyers [4], and others as a coherent measure of risk as well as for its incorporation of the information contained in the right tail of the distribution.

[22] The *ERD* is the expected cost of all present value underwriting loss scenarios. It is also the expected value of Mango's [5] contingent capital calls. Conceptually, it is related to the *EUD* defined in Section 2, but the *EUD* is defined in nominal terms and the *ERD* is defined in present value terms.

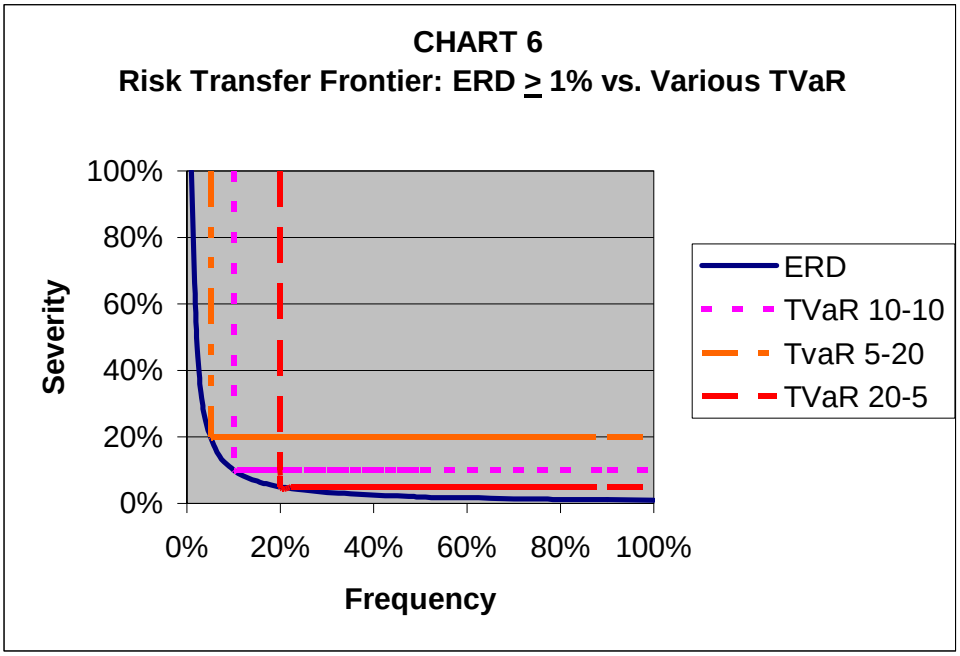
where *A* represents the threshold above which a contract is considered to have provisionally "passed" the "significant" risk transfer test and below which is it is considered to have "failed". *Freq* and *Sev* refer to the frequency of present value loss and the average severity of such loss, respectively. See Appendix A for the mathematical definitions of all the elements of formula (4.1).

This approach, which we will refer to as the "*ERD* Test", addresses both shortcomings of the "10-10" test by (a) reflecting the full right tail risk in the definition of severity and (b) replacing separate frequency and severity requirements with a single integrated measure that treats low frequency-high severity, high frequency-low severity and moderate frequency-moderate severity contracts in the same way.

We will illustrate the application of the *ERD* test with a threshold A of 1%, because it has the merit of a certain amount of continuity with the "10-10" test[23]. The way to think about that is that first we have changed the $VaR_{90\%} \geq 10\%$ embodied in the "10-10" test to $TVaR_{90\%} \geq 10\%$. Then we have generalized the *TVaR* standard to allow contracts having a wide variety of frequency-severity combinations, including 5%-20%, 10%-10% and 20%-5%, to meet the requirement for "significant" risk transfer. $ERD \geq 1\%$ is effectively a variable *TVaR* standard that defines "significant" as $TVaR_{1-Freq} \geq \frac{1\%}{Freq}$. One implication of this is that any contract that passes "10-10" will also pass a standard of $ERD \geq 1\%$.

Chart 6 shows the "significant" risk transfer frontiers for $ERD \geq 1\%$ and three *TVaR* standards ("10-10" as well as "5-20" and "20-5") plotted in terms of frequency and severity. Frequency-severity combinations above and to the right of the frontiers represent "significant" risk. We see that a fixed *TVaR* "10-10" standard would exclude contracts with loss frequencies less than 10% and severities less than 10% that the *ERD* standard would accept as "significant". As a generalized *TVaR* standard, a $ERD \geq 1\%$ standard would accept $TVaR_{95\%} \geq 20\%$ or $TVaR_{90\%} \geq 10\%$ or $TVaR_{80\%} \geq 5\%$, etc.

[23] Whether that is the proper threshold warrants further research.



To address the issue of contracts that have been engineered to remove most or all of the potential for a loss greater than 10% in the right tail, which some criticize as too small, we suggest consideration of a supplemental requirement that there be the potential for a reinsurer loss of some minimum threshold, say, 15% or 20% of premiums. That would eliminate very low loss ratio caps.

We are not advocating that every reinsurance contract be tested for significant risk transfer. It should be possible to conclude that some contracts have adequate risk transfer without formally testing them. In section 6 we will suggest some ways to do that. However, we *are* suggesting that the *ERD* test (possibly together with the supplemental test) could be applied to all contracts that are subject to the "significant" risk transfer requirement with the confidence that it would produce consistently reasonable results.

We believe the *ERD* test (with or without the supplemental component), if adopted, should only be applied prospectively and not to contracts already on the books.

5. ILLUSTRATION OF THE *ERD* TEST

In this section we apply the proposed test to the contracts used in the examples of Section 3 as well as several additional examples.

Example 5.1: Property Catastrophe Excess of Loss Reinsurance

If we apply the *ERD* test to the catastrophe reinsurance contract described in Example 3.1, that contract now easily passes muster for risk transfer. Again assuming normal reinstatement premium provisions, which call for an additional premium equal to the original premium times the proportion of the limit that has been exhausted, *Freq*=3%, *Sev*= $TVaR_{97\%}$ =800% and *ERD*=24%. Because of the large contribution from *Sev* to *ERD*, this contract now easily surpasses the standard of $ERD \geq 1\%$.

TABLE 7

ERD / Max Downside

For Standard Cat XL Contracts

By Rate on Line

Rate on Line	Poisson λ	*ERD**	Reinsurer Max Downside*
1.0%	0.5%	49.0%	19545%
2.0%	1.0%	48.0%	9678%
3.0%	1.5%	47.0%	6364%
4.0%	2.1%	46.0%	4651%
5.0%	2.6%	45.1%	3726%
7.5%	3.9%	42.6%	2373%
10.0%	5.3%	40.2%	1711%
12.5%	6.7%	37.9%	1315%
15.0%	8.1%	35.6%	1051%
20.0%	11.1%	31.0%	723%
25.0%	14.2%	26.6%	530%
30.0%	17.5%	22.3%	402%
40.0%	24.6%	14.2%	246%
50.0%	32.4%	6.6%	157%

* Ratio to expected premium

Assumptions.
- One reinstatement of limit for 100% A.P.
- Investment income effects ignored
- Poisson model with parameter λ
- Expected loss ratio 50%

In fact, using conservative assumptions, contracts having the same structure as the standard property catastrophe treaty[24] can be shown to exceed the $ERD \geq 1\%$ threshold (as well as a supplemental minimum potential downside threshold) if the upfront rate on line $ROL \leq 50\%$. Table 7 summarizes the *ERD* and potential downside values (ignoring investment income) for contracts having rates on line ranging from 1% to 50%, based on the simplifying assumptions that the expected loss ratio is 50%, all claims are total limit losses and that claims are Poisson distributed. On the basis that every rate on line in Table 7 easily passes the *ERD* test even without the supplemental downside requirement, we suggest that any reinsurance contract having this structure be deemed to meet the requirements for "significant" risk transfer. Clearly, such contracts are subject to the "significant" risk transfer requirement, but because we have, in effect, pre-qualified them as a class, the requirement to demonstrate significant risk transfer can be waived.

Example 5.2: Primary Quota Share Reinsurance

We applied the *ERD* test to the primary quota share contract described in Example 3.2. Again assuming a one-year net claim payment lag[25], a 5% interest rate and a lognormal σ of 15%, we calculated the frequency and severity, respectively, of present value underwriting loss to be 21.53% and 6.91%, which corresponds to an *ERD* of 1.49%[26.] This *ERD* value surpasses the $ERD \geq 1\%$ standard. Moreover, because there is no limit on the reinsurer downside potential, it would meet the suggested supplemental requirement. Therefore, this contract meets the "significant" risk transfer requirement.

Example 5.3: Primary Quota Share Reinsurance (Volatility of S&P 500)

In this example we test the same quota share that was the subject of Example 3.3. That quota share covered an insurance portfolio with the same loss ratio volatility as an S&P 500 index investment. The ceding commission is 25%. The frequency, severity and *ERD* characteristics of such a portfolio are summarized in Table 8 for the two volatility scenarios modeled in Example 3.3. For volatility of 13.85% the $ERD \geq 1\%$ standard is met. However, at the historically low volatility of 9%, a portfolio with S&P 500 volatility

[24] The standard property catastrophe treaty provides two loss limits, the second one paid for with a contingent "reinstatement" premium at the same rate on line as the first one.

[25] Using this simplifying assumption, we can focus on the present value of the losses only, measured at the time the premium is received, because the present value factor applicable to premiums and losses for the period up to the premium receipt date is the same. The ratio of discounted *ERD* to discounted premium using the full claim and premium payment lags is equal to the ratio of discounted *ERD*, using the net claim lag, to undiscounted premium.

[26] If the prospective loss ratio is lognormally distributed, $ERD = PV[E(x) \cdot N(d1) - FV(B) \cdot N(d2)]$, where N is the normal cdf, $d1 = [ln(E(x)/FV(B)) + 0.5\sigma^2]/\sigma$ and $d2 = d1 - \sigma$.

characteristics has an *ERD* of only 0.28% and thus fails the $ERD \geq 1\%$ standard by a wide margin. That creates a conundrum – is it ever reasonable to consider the S&P 500 to be without risk? If not, a 1% threshold for *ERD* is too high.

TABLE 8

ERD Risk Transfer Analysis for Quota Share in Example 5.3

Given Portfolio with Volatility of S&P 500

σ	*Freq*	*Sev*	*ERD*
9.00%	8.8%	3.2%	0.28%
13.85%	17.9%	6.0%	1.07%

Next, we will use the *ERD* test to assess quota share contracts with features such as loss ratio caps and corridors that reduce the loss exposure of the reinsurer. These features appear frequently in traditional reinsurance contracts as a means of making otherwise unattractive treaties acceptable to the reinsurance market.

Example 5.4: Reinsurance with 25% Ceding Commission and 5-Point Loss Ratio Corridor

Table 9 shows the downside risk measures *Freq*, *Sev* and *ERD* for a quota share or excess contract that provides a 25% ceding commission and requires the ceding company to retain any losses that fall within a five point loss ratio corridor from 75% to 80%. We assume the prospective loss ratio is lognormally distributed, with a mean of 70% and a range of values for σ. Claim payments are assumed to lag premium payments by one year.

Table 9 shows that for lower volatility business, represented here by lognormal σ values of 10% and 15%, a treaty with the 5 point loss ratio corridor removes enough risk from the deal that the *ERD* falls below 1%, indicating that the risk transfer is not significant. For the σ values of 25% and higher, the *ERD* significantly exceeds the 1% threshold. Clearly, the effect of a loss ratio corridor depends on the characteristics of the reinsured business, and in some circumstances such treaty feature is entirely appropriate.

TABLE 9
ERD Risk Transfer Analysis for Contract
With 25% Ceding Commission and
Loss Ratio Corridor from 75% to 80%

σ	*Freq*	*Sev*	*ERD*
10%	3.1%	3.2%	0.10%
15%	9.1%	6.0%	0.59%
20%	15.6%	9.2%	1.43%
25%	19.7%	12.6%	2.47%
30%	22.4%	16.2%	3.63%
40%	25.6%	23.9%	6.13%
50%	26.9%	32.4%	8.74%

Example 5.5: Reinsurance with 25% Ceding Commission and 95% Loss Ratio Cap

We now consider the effect of an aggregate loss ratio cap of 95% (instead of a loss ratio corridor) on the same subject matter business discussed in Example 5.4. Table 10 shows frequency, severity and *ERD* for σ values ranging from 10% to 50%. Except for the case of $\sigma = 10\%$ (where *ERD*=0.41%) the aggregate loss ratio cap is at a high enough level that the 1% threshold is exceeded, and for the higher values of σ by a wide margin.

Note that in the case of $\sigma = 10\%$, the *ERD* associated with a contract with no loss ratio cap is also 0.41%, indicating that the cap at 95% has no significant effect on the risk transferred to the reinsurer. On that basis, the contract with a 95% cap transfers "substantially all" the risk in the underlying portfolio, and even though it does not transfer "significant" risk, it meets the risk transfer requirements of FAS 113.

TABLE 10
ERD Risk Transfer Analysis for Contract
With 25% Ceding Commission and
Loss Ratio Cap of 95%

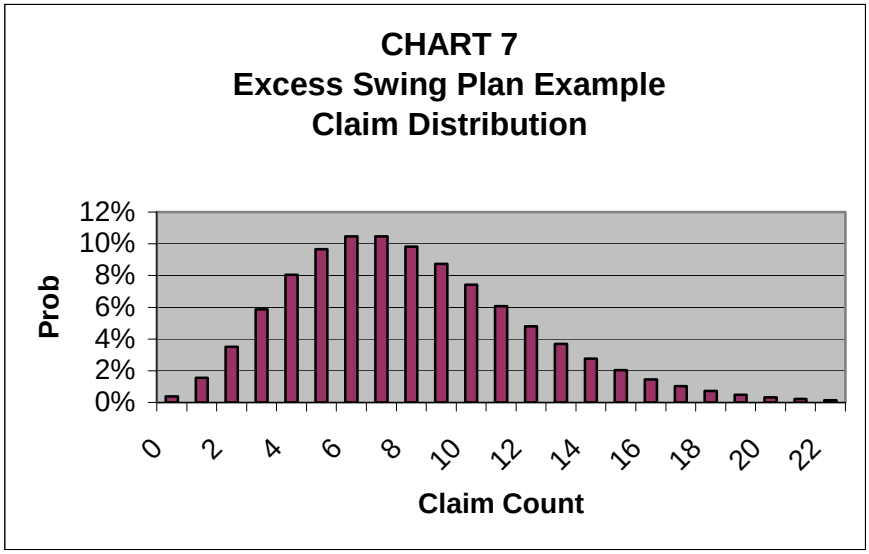
σ	*Freq*	*Sev*	*ERD*
10%	11.0%	3.8%	0.41%
15%	19.5%	6.5%	1.27%
20%	24.5%	8.9%	2.18%
25%	27.6%	10.7%	2.94%
30%	29.4%	12.0%	3.53%
40%	31.1%	13.8%	4.29%
50%	31.4%	14.9%	4.69%

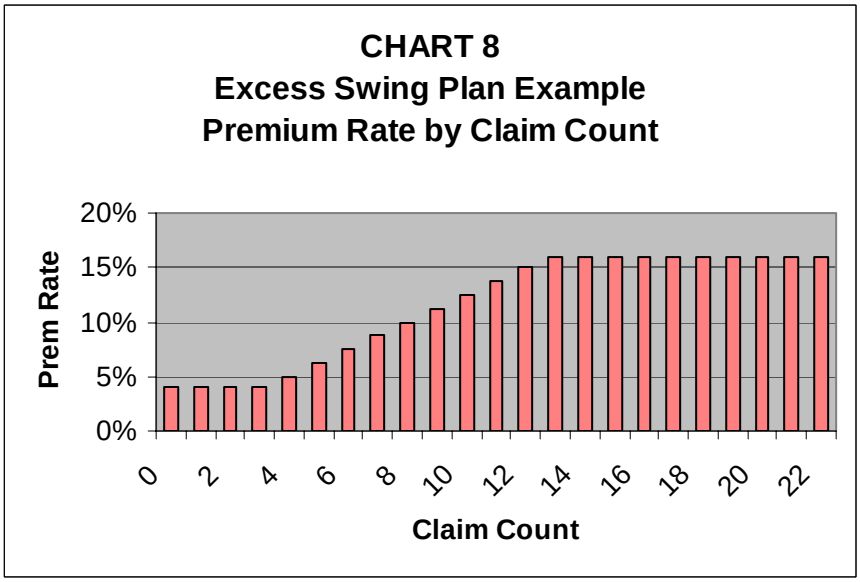
Example 5.6: Excess Swing-Rated Reinsurance

It is common for "working layer" excess of loss reinsurance to be structured on a "swing-rated" basis, which means the premium is based in part on the losses ceded to the treaty. Typically, the premium formula calls for ceded claims to be multiplied by a loading factor to reflect a margin for the reinsurer, subject to a minimum and maximum. In primary insurance this structure is known as a "retrospective experience rating plan". The purpose of such plans is to allow the ceding company to fund its own excess claims up to the point beyond which it would become too painful and to cede the excess claims beyond that point to the reinsurer. To the extent that the excess claims experience is good, the ceding company benefits from a lower rate. Reinsurers often like these plans because they provide strong incentives, both positive and negative, to the ceding company to minimize excess claims. Ceding companies often find these plans attractive because they believe their realized rate will be significantly less than under a flat-rated plan.

While minimizing risk transfer is not usually the driving force behind the structuring of a swing plan, such a structure typically does transfer less risk than a flat-rated excess of loss treaty covering the same business. To illustrate this, suppose the expected excess losses are

$4 million. If the total premiums on the subject portfolio are $50 million, this can be expressed as a loss cost of 8%. For the sake of discussion let's assume the excess claim count can be modeled using a negative binomial distribution with an mean of 8 claims[27] and that only total limit claims are possible. The claim distribution is shown graphically in Chart 7.





[27] Specifically, using the Microsoft Excel function for the negative binomial probability, Prob(COUNT)= NEGBINOMDIST(COUNT, 8, 0.5)

Suppose the swing plan calls for an excess reinsurance premium equal to excess claims times 100/80, subject to a minimum of 4% of subject premiums and a maximum of 16%. That results in the excess rate distribution shown in Chart 8. The expected value of the premium rate under this plan is 9.71%. The alternative is a contract with a flat rate of 11.43%.

Table 11 summarizes the *ERD* analysis for both the flat-rated and swing-rated plans, assuming that there is a negligible claim payment lag. It shows that the swing plan has an *ERD* of 0.97%, just under the 1% threshold for significant risk. With some minor restructuring this contract would be able to pass the *ERD* test. In contrast, the flat-rated plan has an *ERD* of 4.70%, which is well above the threshold. Note that the mean severity of loss faced by the reinsurer is greater in the case of the swing plan than in the flat-rated plan, but because the probability of loss is much lower, the swing plan *ERD* falls below the threshold for "significant" risk. This is a good illustration of why severity (*TVaR*) by itself is an unreliable indicator of risk.

TABLE 11
ERD Risk Transfer Analysis
Swing-Rated vs. Flat-Rated Excess

Plan	Rate	*Freq*	*Sev*	*ERD*
Swing	9.71%	3.2%	30.4%	0.97%
Flat	11.43%	18.0%	26.2%	4.70%

Example 5.7: Individual Risks

One of the well known drawbacks of the "10-10" test is that if it were applied to individual insurance contracts or facultative reinsurance contracts, it would in almost all cases indicate that they do not contain "significant" risk, which strikes virtually everyone as unreasonable. In this example, using simplifying but not unreasonable assumptions we will show that the *ERD* test correctly identifies individual risk contracts as containing significant risk.

We assume that a portion of the premium for every individual risk contract is attributable to the potential for a limit loss. Since it is very large losses rather than partial losses that are most likely to put the insurer or reinsurer into deficit, we will ignore the potential for small losses and focus on limit losses. Let's assume that the pure premium for total limit losses is 10% of the total premium. Since a limit loss can occur only once in a policy period, let's assume the probability of such a loss is Bernoulli distributed with a probability equal to this 10% times the total premium rate on line (i.e., the total premium divided by the limit). From that we can calculate the *ERD* and the maximum downside potential.

The results are shown in Table 12 for rates on line ranging from 0.5% up to 83.33%. We see that any individual risk paying a rate on line of less than 83.33% would exceed a $ERD \geq 1\%$ standard for "significant" risk. We display such a wide range of rates on line, because we want to show that virtually all individual risks, ranging from personal lines policies to large commercial policies with a high level of premium funding, can be shown to meet the "significant" risk requirement using the *ERD* test.

TABLE 12

ERD / Max Downside
For Individual Risk Contracts

By Rate on Line

Rate on Line	Limit Loss Prob	*ERD*	Reinsurer Max Downside
0.5%	0.05%	9.95%	19900%
1.0%	0.10%	9.90%	9900%
2.5%	0.25%	9.75%	3900%
5.0%	0.50%	9.50%	1900%
10.0%	1.00%	9.00%	900%
25.0%	2.50%	7.50%	300%
50.0%	5.00%	5.00%	100%
75.0%	7.50%	2.50%	33%
83.3%	8.33%	1.67%	20%

Assumptions.
- Investment income effects ignored
- Bernoulli probability of limit loss
- Total limit loss ratio 10%

Above a rate on line of 83.33%, the maximum downside falls below 20% of premium, which is a potential threshold for our proposed minimum downside requirement. Thus, individual risks with rates on line above 83.33% would fail to show "significant" risk. While this is a highly idealized example and further research would be appropriate to refine the methodology, we believe it is sufficiently realistic to "pre-qualify" virtually all individual risk contracts as containing significant risk and thus make it unnecessary to test them individually.

5.1 Section Summary

In this section we have shown that the *ERD* test produces mostly reasonable results when applied to a variety of reinsurance structures covering insurance portfolios having a wide range of risk characteristics. Using the $ERD \geq 1\%$ standard together with reasonable contract assumptions we have demonstrated that catastrophe excess of loss reinsurance and individual risk contracts generally contain significant risk, which is a common sense result that eludes the "10-10" test. We also showed that loss ratio corridors and loss ratio caps are acceptable under some circumstances but not under others, and similarly that swing-rated excess reinsurance must be structured with care to ensure that it transfers significant risk while still meeting the reinsurer's and ceding company's other goals. The only unreasonable result we produced was that a quota share contract with a ceding commission of 25% and the prospective volatility characteristics of the S&P 500 (as measured by VIX) does not always meet the "significant" risk requirement. VIX has ranged as low as 9% in the period since 1990. Volatility parameters below about 13% produce *ERD* results (in the quota share we tested) that suggest insignificant levels of risk. This is an anomalous result because it suggests that under some circumstances an investment related to the S&P 500 index should not be considered risky, a conclusion that does not seem reasonable.

In summary, given these results and the findings in Section 4, we conclude that:

1. The *ERD* methodology described here, with a 1% threshold for significant risk transfer, is numerically comparable to the "10-10" benchmark;

2. The *ERD* methodology is qualitatively superior to that benchmark; and

3. If the 1% *ERD* method were adopted as a de facto standard replacing the "10-10", we would consider that a significant improvement.

6. IDENTIFICATION OF CONTRACTS SUBJECT TO "SIGNIFICANT" RISK REQUIREMENT THAT DO NOT REQUIRE INDIVIDUAL TESTING

Apart from those contracts for which it can be demonstrated that they transfer "substantially all" the risk inherent in the underlying insurance policies, all purported reinsurance contracts are subject to the requirement that they transfer "significant" risk. Unless a contract is tested, it is impossible to know whether or not it meets the requirement. However, the implication that it is necessary to test every single reinsurance contract is daunting. For many ceding companies buying excess of loss reinsurance, it might even be impossible. Ceding companies often buy excess coverage not only to transfer risk but also to obtain pricing for excess exposure they themselves do not fully understand, which they can factor into their own insurance rates. Under such circumstances, to ask ceding companies to model such exposure to demonstrate compliance with FAS 113 seems unreasonable.

Ideally, we would like to find a way to partition the set of all reinsurance contracts subject to the "significant" risk requirement into the subset containing those that we can reasonably expect will pass if they were tested and the subset comprising all other contracts. The former subset would be exempt from individual testing, while the latter subset would have to be tested individually. The purpose of this section is to begin to identify elements of the first subset of contracts that do not require individual testing.

Example 6.1: Individual Risk and Catastrophe Excess of Loss Contracts

In Section 5 we showed that 1) standard catastrophe excess of loss contracts and 2) individual risk contracts, generally possess *ERD* characteristics that indicate these two classes of contracts meet the "significant" risk requirement, and that it is therefore unnecessary to test contracts within those classes individually.

Example 6.2: Other Excess of Loss Contracts

By virtue of analysis similar to that for individual risk and catastrophe excess of loss contracts, it is possible to add a further large subset of excess of loss contracts (treaty and facultative) to the category of contracts that do not require individual testing. Table 13 summarizes the *ERD* analysis for excess of loss contracts with no ceding commission and rates on line ranging from 1% to 500% and aggregate limits no less than one full limit or 200% of premiums, whichever is greater. The term "rate on line" is most frequently used in connection with catastrophe excess of loss treaties and other excess contracts where the

ratio of premium to limit[28] is far less than 100%, so a rate on line of 500% might be surprising. However, it is common for "working layer" excess of loss contracts to be priced with the expectation that there will be between several and many claims during the coverage period. Under typical pricing assumptions, a 500% rate on line implies the expectation that excess claims will be equivalent to about three total limits losses.

TABLE 13

Expected Reinsurer Deficit / Max Downside

For Long/Short Tail XL Contracts with
Aggregate Limit $\geq$ One Limit or 200% Loss Ratio

By Rate on Line

Rate on Line	Poisson λ	Expected Reinsurer Deficit*	Reinsurer Max P.V. Downside*
1.0%	0.7%	54.0%	7735%
2.5%	1.8%	52.6%	3034%
5.0%	3.5%	50.5%	1467%
10.0%	7.0%	46.2%	684%
15.0%	10.5%	42.1%	422%
25.0%	17.5%	34.3%	213%
50.0%	35.0%	16.7%	57%
75.0%	52.5%	6.9%	57%
100.0%	70.0%	8.8%	57%
200.0%	140.0%	5.0%	57%
300.0%	210.0%	2.9%	57%
400.0%	280.0%	1.8%	57%
500.0%	350.0%	1.3%	57%

* Ratio to premium

Assumptions.
- Loss cap of greater of one limit or 200% L/R
- No ceding commission
- Poisson model with parameter λ
- Claim payment lag 5 years
- Interest rate 5% per annum
- Expected loss ratio 70%

[28] Note that the limit used in the denominator is the risk or occurrence limit, depending on the coverage, not the aggregate limit except in the case of aggregate excess coverage.

Our analysis assumes a Poisson distribution for claim frequency and that all claims are limit losses. Theoretically, we should use a negative binomial, but because that makes the tail fatter and thus easier to pass the *ERD* test, the Poisson assumption is conservative. We assume an expected loss ratio of 70%, another conservative assumption. In a competitive market the expected loss ratio can be expected to be higher, especially for the higher rate on line business. We assume an interest rate of 5% and a 5-year claim payment lag (which makes this analysis suitable for reasonably long tail as well as short tail business).

On the basis that every rate on line in Table 13 from 1% to 500% passes the *ERD* test even without the supplemental downside requirement coming into play, we suggest that any excess of loss contract having this structure (and no loss sensitive or other features that might call the contract's status into question) be deemed to meet the requirements for "significant" risk transfer. Excess of loss contracts with no aggregate limit clearly fall into this category as well. All such contracts are subject to the "significant" risk transfer requirement. However, because we have, in effect, pre-qualified them as a class, the requirement to demonstrate significant risk transfer can be waived.

Example 6.3: Contracts with Expected Loss Ratios Above a Minimum Permissible Loss Ratio Threshold

There is a further general approach to expanding the set of contracts subject to "significant" risk testing that do not need to be tested individually. In Section 3 we noted that one unreasonable implication of the "10-10" test is a cap on reinsurance pricing at such a low level that, if it were enforced, would likely lead to a reduction of reinsurance capacity. The $ERD \geq 1\%$ standard we have proposed also implies a cap on reinsurer margins. Fortunately, the *ERD* standard we have illustrated implies a significantly higher maximum permissible present value margin for the reinsurer than the "10-10" test does.

Table 14 shows maximum permissible present value margins and corresponding minimum permissible loss ratios implied by $ERD \geq 1\%$ for claim lags of zero, one year, two years and three years with respect to contracts for which the prospective loss ratio can be modeled using a lognormal distribution[29]. The results are shown for σ values ranging from 9% to 100%. Note that for each value of σ, the permissible loss ratios increase in nominal terms with the claim lag, but the present values are all the same. The allowable margins for the σ values at the low end of the range might make reinsurance of such low risk portfolios impossible unless the reinsurance is structured to meet the "substantially all" risk transfer

[29] Where the lognormal assumption is not appropriate, similar tables could be constructed for other loss ratio models.

test. For example, the maximum permissible present value margin for $\sigma = 9\%$ of only 7.1%, while much higher than the 1.6% permitted under "10-10"[30], does not allow a reinsurer much, if any, upside potential, after deducting brokerage and internal expenses. That is one reason to consider the possibility that an *ERD* threshold of 1% might be too high. On the other hand, in light of our discussion in Section 3 about parameter uncertainty, it might turn out to be the case that realistic prospective estimates of σ will, in practice, generally exceed the low end of the range, making this concern irrelevant.

TABLE 14

Maximum Margins / Minimum Permissible Loss Ratios
Implied by $ERD \geq 1\%$

Contracts with No Ceding Commission
Interest at 5% per annum

Tabulated by σ and Claim Lag

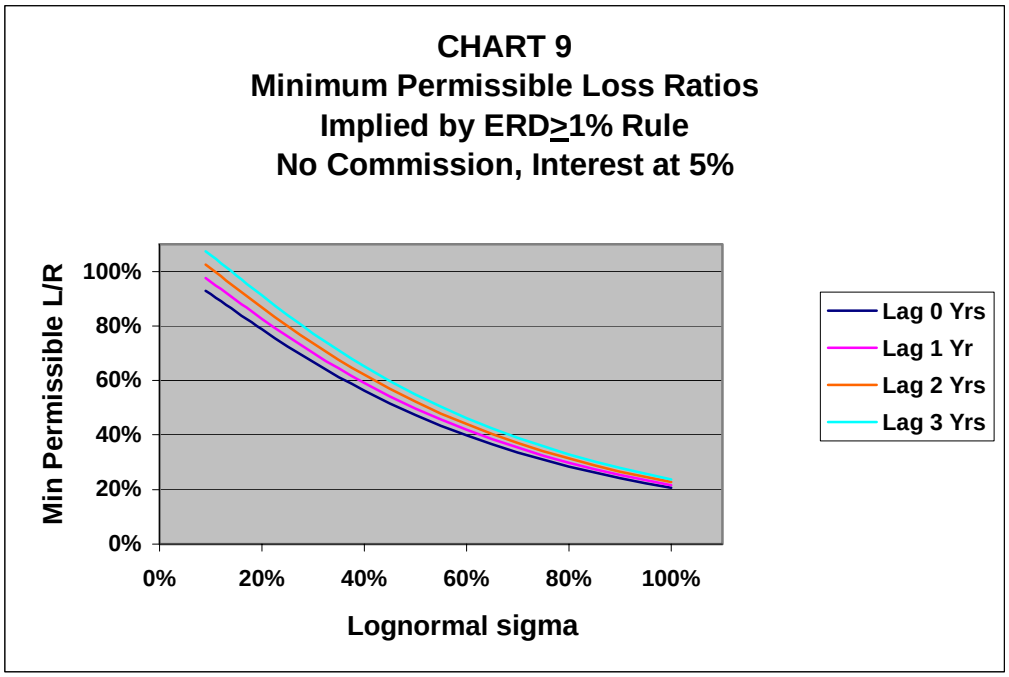
	Max	Minimum Permissible Loss Ratio			
	P.V.	Lag 0	Lag 1	Lag 2	Lag 3
σ	Margin	Yrs	Yr	Yrs	Yrs
9.0%	7.1%	92.9%	97.5%	102.4%	107.5%
10.0%	8.4%	91.6%	96.2%	101.0%	106.0%
11.0%	9.7%	90.3%	94.8%	99.6%	104.6%
12.0%	11.0%	89.0%	93.5%	98.2%	103.1%
13.0%	12.3%	87.7%	92.1%	96.7%	101.6%
14.0%	13.6%	86.4%	90.8%	95.3%	100.1%
15.0%	14.9%	85.1%	89.4%	93.9%	98.6%
20.0%	21.3%	78.7%	82.7%	86.8%	91.1%
25.0%	27.4%	72.6%	76.2%	80.0%	84.0%
30.0%	33.2%	66.8%	70.1%	73.6%	77.3%
40.0%	43.7%	56.3%	59.1%	62.1%	65.2%
50.0%	52.6%	47.4%	49.8%	52.2%	54.9%
60.0%	60.1%	39.9%	41.9%	44.0%	46.2%
75.0%	69.1%	30.9%	32.5%	34.1%	35.8%
100.0%	79.5%	20.5%	21.6%	22.6%	23.8%

[30] See Table 6. It is worth noting that the *ERD* $\geq$3% mentioned in the 2002 VFIC paper as a possible threshold would result in an even lower maximum permissible present value margin of 1.2%! A threshold of 3% is clearly too high.

The maximum margins implied by $ERD \geq 1\%$ for larger values of σ seem more reasonable. For example, for $\sigma = 30\%$, the allowable present value margin is 33.2%, which is a more reasonable ceiling[31].

The implication of this for our present discussion is that if a contract with no ceding commission is priced to an expected loss ratio that is greater than the minimum permissible loss ratio shown for the relevant σ and claim lag (and the other assumptions are reasonable), then the contract will meet the $ERD \geq 1\%$ standard that indicates significant risk transfer. We present this as an illustration of how the subset of contracts that do not require detailed testing for significant risk transfer could be expanded beyond the catastrophe excess of loss, individual risk and other excess of loss contracts we identified earlier. Any contract that is priced to an expected loss ratio that exceeds the minimum permissible loss ratio would be exempt from individual testing. Additional research is necessary to fully realize this approach.

Chart 9 shows the minimum permissible loss ratios in Table 14 graphically.



[31] In contrast, a threshold of $ERD \geq 3\%$ implies a maximum permissible present value margin of 22.0%, which is about the same as that implied by "10-10".

Example 6.4: Contracts with Immaterial Premiums

Contracts or programs that involve the cession of small amounts of premium should be exempt from individual testing, unless there is reason to suspect that they might materially distort either the ceding company's or reinsurer's financial statements. A reasonable definition of small might be the smaller of $1 million and 1% of total gross premiums. The rationale for this exception is that small premium cessions by definition have a very limited impact on either party's financial statements. Any distortion resulting from minimal risk transfer below the significance threshold would be immaterial.

7. POSSIBLE EVOLUTION OF RISK TRANSFER MEASUREMENT

The context of the paper is risk transfer testing. However, the notion of risk transfer is also integral to the pricing of insurance and reinsurance products. Risk transfer is what gives rise to risk premiums and the potential for profit. Many methods already exist for explicitly or implicitly adding a profit load to a reinsurance contract. It seems reasonable that a risk loading method used to determine needed profits could be turned into a risk transfer test as well. Although this paper does not address the issue directly, the *ERD* risk transfer test described in earlier sections of this paper measures tail value at risk (*TVaR*), which is a valid method for producing risk and profit loads. In fact, given the coherent nature of *TVaR*, it is considered a superior method for risk loading by many practitioners.

At least one major insurance company has used the *ERD* framework in pricing and enterprise risk management for several years, in the form of the *risk coverage ratio* (*RCR*) described by Ruhm [6]. In practice, that risk measure has produced results for the company that are reasonable and consistent across a broad variety of actual risks, due in large part to its good technical properties and its relative transparency.

As noted before, this working party is not endorsing any single specific method for risk transfer testing. Thus, rather than doing more work on our *ERD* example to show its full implications for risk loading, we will show another (much briefer) example here where risk loading and risk transfer testing are tightly linked.

The approach we examine here is based on the *right tail deviation* (*RTD*), a framework proposed by Wang and developed from concepts he has written about extensively [7] [8].

For a given aggregate distribution function $F(x)$ (derived from some convolution of frequency and severity distributions), we transform the distribution using the following formula:

$$F^*(x) = 1 - \sqrt{1 - F(x)} \tag{7.1}$$

Because $0 < F(x) < 1$ for all x, it is fairly easy to see that $F^*(x) < F(x)$ for all x, which implies the following expected value relationship:

$$E^*(x) \geq E(x) \tag{7.2}$$

The interpretation is that the transform has "loaded" the original distribution for risk. The difference between E^* and E is the risk load, for any layer of the distribution. Thus, we can use E^* instead of E to represent a fully risk loaded pure premium. The reason this approach is appealing is that the transformed distribution is itself another loss distribution, meaning that all the ordinary mathematics of loss distributions carry over. Relating this to financial mathematics, it is generally assumed that assets like equities are themselves transformed distributions, although this is not usually explicitly stated. The transform in the financial economic model is the so-called state price, which enforces no-arbitrage pricing [9].

If one wants to think about the risk load independently, it is easily captured as:

$$RTD(x) = E^*(x) - E(x) \tag{7.3}$$

Under this approach, the risk load *RTD* might be adjusted (i.e. multiplied) by some constant factor α to produce the final profit load. Note that Wang has generalized this model to consider other exponents of transformation (i.e. instead of just the power of 0.5, any power between 0 and 1 exclusive).

There are a couple of ways in which the *RTD* could be used to devise a risk transfer test. One way would be to treat αRTD as the maximum permissible reinsurer's margin consistent with "significant" risk transfer. That is essentially the same approach that was described in Example 6.3. The difference is that in that example, we derived the risk load consistent with a "significant" risk transfer threshold of $ERD \geq 1\%$, whereas here we would determine the risk load component αRTD first and then effectively determine the risk transfer threshold that is consistent with it.

A second way would be to devise a risk transfer test that compares the full premium (not just the margin) with a multiple of αRTD using the following procedure, which is similar to one outlined by Wang:

1. Compute expected loss of the contract under the untransformed distribution $F(x)$;
2. Note the premium for the deal (however computed—allows for market pricing);
3. Compute *RTD* for the deal using the transformed distribution and formula (7.3);
4. Define the *maximum qualified premium* as some multiple of *RTD* (Wang suggests 3-5x[32]);
5. The "significant" risk transfer threshold is defined as "*maximum qualified premium* $\geq$ *premium*"[33].

We will look at two examples of this approach. The first is the catastrophe excess of loss contract described in Examples 3.1 and 5.1. The second example addresses a questionable scheme for creating a reinsurance structure that apparently meets the "significant" risk transfer requirement by combining two unrelated coverages to produce just enough risk transfer to pass. This is an important example, because this method separates the reinsurance premium into higher risk and lower risk components and thus has potential to identify highly structured reinsurance contracts that satisfy other quantitative tests but do not meet the spirit of FAS 113[34].

Example 7.1: Property Catastrophe Excess of Loss Reinsurance

If we apply the *RTD* qualified premium approach to the property catastrophe excess of loss example discussed in Examples 3.1 and 5.1, we see that the contract easily meets this *RTD*-based risk transfer requirement. Table 15 shows the catastrophe loss distribution originally shown in Table 3 with an additional column for the "transformed" probability based on the $F^*(x)$ determined from formula 7.1. $E^*(x)$, expressed both in terms of premiums and limit, is shown at the bottom of the table as 203% and 20%, respectively.

[32] The issue of the appropriate multiplier of *RTD* warrants further research. A multiple of 4 appears to imply that traditional quota shares like those discussed in Examples 3.2 and 3.3 do not contain significant risk transfer, which suggests the effective threshold may be set too low.

[33] Wang has a suggested giving partial credit in cases where the maximum qualified premium is less than the actual reinsurance premium. However, we prefer to focus on the risk characteristics of the contract as a whole.

[34] This comes at the cost of some complexity. The subdivision into risky and less risky components depends on the values chosen for α, the multiplier for αRTD, and the exponent in formula (7.1), choices that are made more difficult by the fact that it is difficult to ascribe an intuitive meaning to these parameters.

TABLE 15 Catastrophe Loss Distribution Example 7.1			
Loss as % of Limit	Loss as % of Premiums	Actual Probability of Given Loss	Transformed Probability* of Given Loss
0%	0%	67%	43%
5%	50%	20%	21%
10%	100%	10%	19%
100%	1000%	3%	17%
5%	50%	100%	100%
20%*	203%*		

In terms of premium, *RTD*=203%-50%=153%. Using a multiplier of 4x, the "qualified" premium proportion is 612%, which is well in excess of the threshold of 100% required for significant risk transfer.

Example 7.2: "Highly Structured" Mix of Low Risk and High Risk Portfolios

We now move on to the example of potential manipulation. In this case, the deal structure consists of a base portfolio with very little risk mixed with a highly risky catastrophe layer. The overall structure is designed to barely pass risk transfer using the "10-10" criterion.

The low risk portfolio has expected losses of $8 million with lognormal σ value of only 1%. To maximize the low risk nature of this portfolio, its premium is $8 million—no load for expense or profit at all.

The catastrophic portfolio we add to this deal is a $1.6 million layer with a 12.5% chance of loss. For simplicity, if a loss occurs, it is a total loss. Thus, the expected loss for this piece is $200,000. Let's assume the premium is $500,000, for a 40% expected loss ratio.

First, let us consider the two pieces separately. The low risk portfolio has an untransformed expected loss of $8 million and a transformed expected loss of $8.1 million.

The maximum qualified premium is only $0.4 million, leaving $7.6 million unqualified. This piece falls far short of the "significant" risk standard.

The catastrophic portfolio has an untransformed expected loss of $200,000 and a transformed expected loss of $666,000. The maximum qualified premium is well in excess of the actual premium of $500,000, thus easily meeting the *RTD* -based "significant" risk standard.

Now consider the combined distribution. The combined contract has a premium of $8.5 million. A 10% loss over this would be an attachment of $9.35 million, and the probability of this occurring is 12.5% (very close to the cat loss alone, of course). Thus, this contract passes the "10-10" test. But Wang's method gets closer to the truth. The transformed expected losses are only $8.65 million vs. $8.2 million untransformed, producing maximum qualified premiums of only $1.8 million, leaving $6.7 million unqualified, well short of the 100% required for "significant" risk transfer.

Note that this method penalizes the combination even more than the sum of the components (the *RTD* of the combined deal is $450,000, whereas the sum of the *RTD*s of the two deals is about $570,000)[35]. It is not clear whether this phenomenon, i.e., the *RTD*-based approach of the highly contrived structure being less than sum of the *RTD* of the separate components, represents the general case. However, it does suggest the intriguing possibility that this approach could perhaps be developed into a quantitative test to detect reinsurance structures that appear to pass certain quantitative threshold, but which do not meet the spirit of FAS 113.

This is as far as we will pursue the *RTD* ideas here. The *RTD* approaches have some appeal and added properties that the *ERD* method does not, at the cost of increased complexity. As noted previously, the working party is not specifically advocating any particular method. This example shows that other methods could be used instead of the *ERD* example that we have examined in some detail. Ultimately, a combination of market and regulatory factors will determine what methods are actually deployed.

8. SUMMARY

The purpose of this paper has been to contribute constructively to the thinking about what should be understood by the term "risk transfer" in the context of FAS 113 by framing a comprehensive response to the four questions posed by COPLFR.

[35] This is due to the diversification of the combined deal, which is of course the correct treatment.

In particular, we have responded to the first two questions by describing two approaches for assessing the significance of risk transfer that are superior to the "10-10" test that is in common use. The first approach, which we have described and illustrated in detail, is based on the expected reinsurer deficit (*ERD*). The second approach, which we outline more briefly, is based on the concept of right tail deviation (*RTD*). We have responded to the third "safe harbor" question in two parts. First, we have described a framework for determining whether a purported reinsurance contract meets the FAS 113 risk transfer requirement by virtue of the cession of "substantially all" of the underlying insurance risk to the reinsurer. Second, we have begun to identify groups of contracts that are subject to the "significant" risk requirement of FAS 113, but which can be exempted from detailed individual testing, because we have established that contracts falling within the group can reasonably be expected to pass the "significance" test, if they were actually tested.

In particular, the following classes of contracts fall into the category of transferring "substantially all" of the original insurance risk, unless they include features that reduce the reinsurer's *expected underwriting deficit* (*EUD*) below that which the cedent would face on its unreinsured portfolio:

- Proportional facultative reinsurance with effective ceding commissions no less than cedent expenses;
- Proportional treaties with effective minimum ceding commissions no less than cedent expenses;
- Proportional facultative or treaty reinsurance for which it can be shown that the reinsurer's *EUD* is essentially the same as the cedent's *EUD* on the unreinsured subject portfolio, irrespective of whether the contract includes a loss ratio corridor, loss ratio cap or other risk mitigating feature;
- Excess of loss facultative or treaty reinsurance for which it can be shown that the reinsurer's *EUD* is essentially the same as the cedent's *EUD* on the portion of the original subject portfolio that is exposed to the same risks as the excess of loss contract;
- Whole account quota share contracts with loss ratio caps no lower than the point at which the ceding company would exhaust its surplus.

To address the question of how to measure "significant" risk transfer, we have proposed an *ERD* test as an improvement over the "10-10" test, which arose in the 1990s as a way to test "finite risk" reinsurance contracts for compliance with FAS 113. The "10-10" test was

not originally intended to be applied to traditional reinsurance contracts, and usually it was not. In the wake of recent real and alleged reinsurance accounting abuses, there is an increasing sentiment that a wider class of reinsurance contracts beyond those classified as "finite" need to be tested for significant risk transfer. Because it has come into widespread use, the "10-10" test has become the de facto standard for reinsurance risk transfer testing, despite the fact that it has never been endorsed by any professional body nor subjected to serious critical scrutiny.

We have also addressed COPLFR's fourth question. Throughout the paper we have discussed the advantages of our described approaches over the "10-10" test that is commonly used today. We have demonstrated that "10-10" is inadequate for use as a universal risk transfer test, because it cannot correctly identify contracts that are clearly risky. We have proposed an improved alternative test based on the concept of the *expected reinsurer deficit*, or *ERD*, which incorporates both frequency and severity of underwriting loss into a single measure. The embedded severity measure is the *TVaR* at the economic breakeven point. *TVaR* has the advantages over *VaR* of reflecting all the information in the right tail of the underwriting result distribution as well as being a coherent measure of risk.

We have shown that the proposed $ERD \geq 1\%$ threshold correctly classifies as "risky[36] a quota share treaty that has the loss ratio volatility characteristics of the S&P 500 stock index. This is important because the standard for assessing reinsurance risk should be consistent with those in other financial markets.

We have also shown that low frequency-high severity reinsurance contracts (such as catastrophe excess of loss treaties) and high frequency-low severity contracts (such as traditional primary quota share treaties) pass the *ERD* test, provided loss mitigating features such as loss ratio caps and/or corridors do not remove too much risk from the contracts (in which case a "failure" is entirely appropriate).

In summary, while we are not explicitly endorsing any single model or framework, because the *ERD* methodology described here (with a 1% risk transfer threshold) is numerically comparable to the current "10-10" benchmark and is superior in almost every way to that benchmark, if the 1% *ERD* method were adopted as a de facto standard replacing the "10-10", we would consider that a good outcome.

To address the concern in some quarters that the *ERD* test is not always stringent enough with respect to the potential for a large loss by the reinsurer, we have suggested

[36] Provided the risk characteristics of the treaty are not too distorted by a large ceding commission.

consideration of a supplemental requirement that the reinsurer face a minimum downside potential of 15% or 20% of premiums.

Among contracts that are subject to the "significant" risk transfer requirement, under the "significance" standard embodied in $ERD \geq 1\%$ the classes of contracts listed below would not be subject to individual testing, because they have already been found to meet the requirement under very general conditions. It is therefore possible to say about contracts falling into the categories on the list below that the significance of their risk transfer is "reasonably self-evident". This is a preliminary list. We believe it may be possible to expand it considerably.

- Individual risk contracts;
- Short tail excess of loss treaties in the standard catastrophe excess structure, i.e., one reinstatement of the limit for 100% additional premium, with rates on line of up to 50%;
- Other excess of loss contracts with aggregate limits of no less than the greater of one occurrence (or risk) limit and 200% of premiums, no ceding commissions, and rates on line less than 500%;
- Proportional and excess contracts having an expected loss ratio above the minimum permissible loss ratio implied by the $ERD \geq 1\%$ standard (or other standard as may be agreed);
- Contracts involving immaterial premiums.

Other contracts should be considered for significance testing, even if they appear to fall into one of the safe harbor categories, for the simple reason that they have greater potential to attract attention, and it is better to be prepared. This group includes, for example, 1) contracts involving large premium cessions, 2) those which, when accounted for as reinsurance, would substantially alter surplus or the ratio of premiums to surplus, and 3) contracts involving unusual structures, especially those that look contrived (e.g., a primary quota share combined with catastrophe protection on a different portfolio). Contracts in category 3 may be structured to narrowly meet the quantitative requirements for "significant" risk transfer, but they might still reasonably be disqualified on other grounds. Thus, a quantitative risk transfer test such as the *ERD* will not be adequate in all cases. However, we believe the *ERD* would do a good job of discriminating between contracts with significant risk and those without significant risk in all but cases involving contrived structures.

We have also pointed out that other risk transfer tests besides *ERD* can and should be considered, particularly in the context of reconciling risk transfer testing to the process of determining risk and profit loads. One such example, based on the *right tail deviation*, has certain desirable properties but comes at the cost of greater complexity. Other approaches could surely be used and should be the subject of future research.

It is important to remember that any risk transfer test requires a model of the prospective underwriting results and the related cash flows. In cases where there is relevant and credible loss experience, identifying a model is often straightforward, though it is always important to appropriately adjust the historical loss experience to prospective levels and to be conscious of the uncertainty in the model parameters. Where there is little or no relevant historical experience, the model must be chosen on the basis of the similarity of the subject portfolio to other ones with the same general characteristics. In such cases there will be greater uncertainty about the parameters, which should be reflected in the structure of the model.

9. Suggested Priorities for Further Research

The *ERD* test proposed in this paper should be seen as an example of a reasonable framework for assessing the significance of risk transfer in reinsurance contracts. We have demonstrated that it is a clear improvement over "10-10", but we do not claim that it is the only reasonable approach. Indeed, we briefly described another promising, albeit more complicated, method, namely, Wang's *RTD* framework. There may be others. We urge the CAS to encourage further research on this subject, perhaps through a call for papers.

We recommend the following research priorities in order to quickly arrive at a more effective assessment of risk transfer according to FAS 113 as well as to provide for continuing research in relation to future improvements.

9.1 Immediate "Level 1" Research – Consensus on Thresholds

1. Determination of an appropriate pass threshold for the comparison methodologies presented in Section 2 to determine whether or not "substantially all" of the insurance risk has been transferred. This may include determining a single applicable testing methodology (i.e., limiting the test to just one of the two methods presented);

2. Determination of an appropriate "pass" threshold framework for the *ERD* test presented in Section 4. In particular, is the 1% threshold illustrated in this paper appropriate, or would some other threshold be more appropriate? In addition, should there be a supplemental requirement that the reinsurer's potential loss be greater than or equal to

some minimum amount? (We considered a minimum underwriting loss of 20% in some of our examples.);

3. Determination of the contract categories and financial characteristics of contracts that will not be required to be individually tested for "significant" risk transfer (because they have previously been analyzed and found generally to pass the significance test). This depends on item 2. Given a standard of $ERD \geq 1\%$, we demonstrated that individual risks, short tail excess of loss contracts in the standard catastrophe excess of loss structure within a certain rate on line range, other excess treaties within a certain rate on line range that have aggregate limits that are not too large, and other contracts with expected loss ratios above a minimum permissible loss ratio threshold, should not be required to be individually tested because we have determined they will pass if they were tested. It may be possible to expand that set of contracts "pre-qualified" for "significant" risk in that same way. If an *ERD* threshold different from 1% is adopted, the set of contracts that can be pre-qualified for "significant" risk may change.

9.2 On-Going "Level 2" Research – Other Methods

1. Continued research on methodologies and thresholds for determining whether or not "substantially all" of the insurance risk has been transferred;

2. Continued research for methodologies that assess risk transfer within the "reasonably possible" chance of a "significant" loss. As stated earlier, the Wang transformation could be one example of such a method;

3. Continued research into appropriate methods for incorporation of parameter uncertainty into models used for risk transfer testing.

Appendix A

Definition of Downside Risk Measures

Suppose B represents the amount of (present value) claims corresponding to the reinsurer's economic "breakeven" point, before taking into account brokerage and internal expenses (the FAS 113 definition):

$$B = P - C \qquad \text{(A.1)}$$

where P represents the ceded premiums and C represents the ceding commissions payable on ceded premiums, if any. If $C = 0$, then the breakeven loss amount is equal to the premiums.

Let x denote the random variable for the prospective losses. (It may be more convenient in practice to work with loss ratios, but here we are using loss dollars.) Then the expected cost of FAS-113-defined present value loss scenarios PV(*Loss* > 0) (which ignore all reinsurer expenses other than ceding commissions), also known as the present value expected reinsurer deficit or *ERD*, expressed as a dollar amount, is:

$$ERD = E[(PV(Loss) > 0)] = PV\int_{FV(B)}^{\infty}(x - FV(B))\cdot f_x(x)dx \qquad \text{(A.2)}$$

As the pure premium cost of underwriting loss scenarios, *ERD* is a measure of the reinsurer's underwriting downside risk[37].

The probability or frequency of the insurer incurring a present value loss $PV(Loss) > 0)$ is:

$$Freq = \Pr ob[PV(Loss) > 0] = \int_{FV(B)}^{\infty} f_x(x)dx \qquad \text{(A.3)}$$

The expected severity of underwriting loss, given $PV(Loss) > 0)$, is

$$Sev = E[(PV(Loss) \mid PV(Loss > 0)]$$

$$= \frac{\int_{FV(B)}^{\infty}(x - FV(B))f_x(x)dx}{\int_{FV(B)}^{\infty} f_x(x)dx}$$

[37] Note that the *ERD* is the expected present value of the contingent capital calls described by Mango [5].

$$= \frac{ERD}{\Pr ob[PV(Loss > 0)]} \tag{A.4}$$

Note that *Sev* is the Tail Value at Risk (for present value underwriting loss) described by Meyers [4] as a coherent measure of risk and by the CAS Valuation, Finance, and Investments Committee [1] for potential use in risk transfer testing of finite reinsurance contracts. Meyers (p. 239) gives the following formula for $TVaR_\alpha$:

$$TVaR_\alpha = VaR_\alpha + \frac{EPD(VaR_\alpha)}{1-\alpha} \tag{A.5}$$

At the present value breakeven loss point *B*, $\alpha = F_x(B) = \int_0^{FV(B)} f_x(x)dx$. The present value loss at the breakeven loss is zero, implying $VaR_\alpha = 0$. That leaves only the second term. Because $EPD(VaR_{F_x(B)}) = ERD$ and $1-\alpha = 1-F_x(B) = \Pr ob[PV(loss > 0)]$, when the variable of interest is underwriting loss, (A.5) equates to formula (A.4).

For a quota share with no loss ratio caps or corridors, the reinsurer's loss ratio is identical to the ceding company's loss ratio on the subject portfolio and their distributions are identical[38]:

$$f_x(x) = f_y(y)$$

If there are no loss ratio caps or corridors, it is often still convenient to express the random variable x for the reinsurer's loss ratio in terms of the subject portfolio's loss ratio random variable y. For example, given a 5-point loss ratio corridor between 75% and 80% with respect to the subject portfolio, the reinsurer's loss ratio $x(y)$ is:

$$x(y) = \begin{cases} y & if\ \ y \le 75\% \\ 75\% & if\ \ 75\% < y < 80\% \end{cases}$$

[38] Because it is easier to compare the cedent and reinsurer positions if we use loss ratios rather than loss dollars, this part of the discussion is in terms ratios to premiums.

$$y - 5\% \quad if \;\; y \geq 80\%$$

In this case, given $B = 75\%$, formula (A.2) for *ERD* would be expressed in terms of y as follows:

$$ERD = PV \int_{FV(B_y)}^{\infty} (y - FV(B_y)) \cdot f_y(y) dy$$

$$ERD = PV \int_{FV(80\%)}^{\infty} (y - FV(80\%)) \cdot f_y(y) dy$$

where $B_y = B + 5\%$. Similarly, Formulas (A.3) for frequency and (A.4) and severity can be expressed in terms of y.

Appendix B

Discussion of Analogy to Stock Market Risk

In this appendix we compare S&P 500 equity risk[39] to the risk in a quota share reinsurance treaty. We begin by discussing the basis of the lognormal assumption. Then, in Example B.1, we show how the cash flows and economics of the quota share described in Example 3.3 can be replicated by an S&P 500 index transaction. That transaction takes the form of a short sale. In that scenario, the short seller loses money if the S&P 500 index closes higher than its level at the time of the short sale, just as the reinsurer loses money if the actual loss ratio exceeds the breakeven loss ratio. The appendix also includes Table B-1, which shows the data underlying Chart 4 and Table B-2, which shows the sensitivity of "10-10" test results for the quota share in Example 3.3 to the expected loss ratio.

Basis of Lognormal Assumption

It is possible, perhaps even likely, that stock prices are not lognormally distributed. However, stock price movements are commonly assumed by financial economists to follow Brownian motion through continuous time, which implies that stock returns over infinitesimal time intervals are normally distributed and stock prices are lognormally distributed after any finite time interval. For example, see Hull [10] Chapter 11 (p. 228)

[39] In order to simplify the discussion we ignore dividends, which could easily be incorporated in the example, but at the cost of complicating the comparison.

and Baxter-Rennie [11] Chapter 3 (p. 51). The latter says, "It is not the only model for stocks…but it is simple and not that bad." The Black-Scholes call option pricing formula was originally derived using a Brownian motion assumption. It has subsequently been shown that it can also be derived from the assumption that "asset prices are lognormally distributed under the martingale measure Q."[Ibid, p. 181].

At the same time there is some disagreement with the Brownian motion/lognormal assumption. See for example Peters [12], Chapter 3 (p. 27), who presented evidence that the distribution of actual stock market *returns* has a higher peak and fatter tails than predicted by a normal distribution and found, "The stock market's probability of a three-sigma event is roughly twice that of the Gaussian random numbers." [Ibid, p. 29]. He argues that because "capital market theory is, in general, dependent on normally distributed returns"[Ibid, p. 25], the Efficient Market Hypothesis, Capital Asset Pricing Model and Modern Portfolio Theory all rest on a shaky foundation. We don't take a position in that debate. However, we do wish to point out that our use of a lognormal distribution is consistent with the mainstream view.

The fact is that doubling the probability at the three-sigma level does not have a significant practical effect. We can adjust for Peter's finding of a fatter tail in the stock return distribution. A Student's *t* distribution with 30 degrees of freedom has twice the probability of a three-sigma event as the corresponding normal. It has a higher peak and fatter tails.

If we replace the lognormal stock price model with a "log t" model, "10-10" test values for the Example 3.3 quota share with $\sigma = 9\%$ and $\sigma = 13.85\%$ still fall far short of the significance threshold. For $\sigma = 9\%$, the 90th percentile result is still a small profit of 0.29% and the probability of a 10% loss rises to just 0.51%. For $\sigma = 13.85\%$, we find a 90th percentile loss of 4.17% and a probability of a 10% loss of 3.91%. These values are only slightly higher than those arising from the lognormal model. There is no practical effect of the non-normality observed by Peters.

Example B.1: Replicating a Quota Share with 25% Ceding Commission

Suppose the quota share in Example 3.3 involves ceded premiums of $10 million. Given a ceding commission of 25%, the net proceeds to the reinsurer total $7.5 million. Similarly, if S&P 500 "spiders" (symbol SPY) are trading at $117 a share (as they were in early May 2005), a short sale of 64,103 shares also yields net proceeds to the seller of $7.5 million. The expected loss ratio on the quota share is 70%, implying expected losses of $7 million. Claim payments are expected to lag premiums by one year. This is equivalent to the short seller

estimating the expected value of SPY in one year's time as $109.20, or $7 million in total for the short position. (A short seller would generally not short the stock if he did not expect it to decline.) In order for the reinsurer to suffer a $1 million present value loss (10% of the ceded premiums), given a risk free interest rate of 5%, the loss ratio would need to reach 85% times 1.05, or 89.25%. In order for the short seller to incur a $1 million present value loss, the stock price would have to reach $139.23[40]. These are the threshold levels for "passing" the "10-10" test.

As discussed in Example 3.3, in order for either the loss ratio to exceed 89.25% or the stock price to exceed $139.23 with a probability of 10% (these being fundamentally identical scenarios), the lognormal σ parameter must be at least 20.6%.

If we remove the 25% ceding commission from the quota share terms and instead provide for a premium cession net of a 25% expense allowance, then the "10-10" threshold for a 10% / $750,000 present value loss to the reinsurer is 82.5% times 1.05, or 86.63%. The comparable "10-10" threshold for the short seller is a stock price of $135.14. Exceeding these thresholds requires a σ value of at least 17.9%.

[40] $1 million loss amounts to $15.60 per share, implying a present value share price of $132.60 and a future value share price of $139.23.

Data Underlying Chart 4

Table B-1 shows the data underlying Chart 4, which plots the probability of a 10% present value loss on the quota share defined in Example 3.2, given a 70% expected loss ratio, 25% ceding commission and σ values equal to VIX as of the last trading day of each year from 1990 through 2004 plus May 4, 2005.

TABLE B-1
"10-10" Risk Transfer Analysis
for Quota Share in Example 2.3
Given Portfolio with Volatility of S&P 500 VIX
Data Underlying Chart 4

VIX Date	VIX	(a) 90th Percentile P.V. Underwriting Loss	(b) Probability of ≥10% P.V. Underwriting Loss
Dec 1990	26.4%	15.3%	14.6%
Dec 1991	19.3%	8.8%	8.8%
Dec 1992	12.6%	2.7%	2.3%
Dec 1993	11.7%	1.9%	1.6%
Dec 1994	13.2%	3.3%	2.8%
Dec 1995	12.5%	2.7%	2.3%
Dec 1996	20.9%	10.3%	10.3%
Dec 1997	24.0%	13.1%	12.9%
Dec 1998	24.4%	13.5%	13.2%
Dec 1999	23.4%	12.6%	12.4%
Dec 2000	26.9%	15.7%	14.9%
Dec 2001	23.8%	12.9%	12.7%
Dec 2002	28.6%	17.3%	16.1%
Dec 2003	18.3%	7.9%	7.8%
Dec 2004	13.3%	3.4%	2.9%
May 2005	13.9%	3.9%	3.4%

Sensitivity of "10-10" Test Values to Expected Loss Ratio Assumption

Table B-2 shows the sensitivity of the values shown in Table 5 to changes in the expected loss ratio. It shows that our conclusions with respect to the "10-10" test apply even with high assumed levels for the expected loss ratio. For example, even in the case of no expected profit and the higher May 2005 implied volatility levels, the "10-10" rule is not met.

TABLE 5
"10-10" Risk Transfer Analysis
for Quota Share in Example 2.3
Given Portfolio with Volatility of S&P 500
Sensitivity to Expected Loss Ratio

VIX	σ	Expected Loss Ratio	(a) 90th Percentile P.V. Underwriting Loss/(Profit)	(b) Prob of $\geq 10\%$ P.V. Underwriting Loss/(Profit)
Low	9.00%	65%	(5.81%)	0.02%
Low	9.00%	67.5%	(3.15%)	0.08%
Low	9.00%	70%	(0.49%)	0.30%
Low	9.00%	62.5%	2.18%	0.93%
Low	9.00%	75%	4.84%	2.40%
May 2005	13.85%	65%	(1.78%)	0.92%
May 2005	13.85%	67.5%	1.04%	1.85%
May 2005	13.85%	70%	3.85%	3.41%
May 2005	13.85%	62.5%	6.67%	5.82%
May 2005	13.85%	75%	9.49%	9.25%

10. References

[1] CAS Valuation, Finance, and Investments Committee "Accounting Rule Guidance Statement of Financial Accounting Standards No. l l 3--Considerations in Risk Transfer Testing", *Casualty Actuarial Society Forum*, Volume: Fall, 2002, pp. 305-338.

[2] Kreps, Rodney E., "Parameter Uncertainty in (Log)Normal Distributions", PCAS LXXXIV, 1997, p. 553-580, http://www.casact.org/pubs/proceed/proceed97/97553.pdf

[3] Van Kampen, Charles E., "Estimating the Parameter Risk of a Loss Ratio Distribution", Casualty Actuarial Society Forum, Volume: Spring, 2003, p. 177-213, http://www.casact.org/pubs/forum/03spforum/03spf177.pdf

[4] Meyers, Glenn G., "The Cost of Financing Insurance", *Casualty Actuarial Society Forum*, Volume: Spring, 2001, pp. 221-264, http://www.casact.org/pubs/forum/01spforum/01spf221.pdf.

[5] Mango, Donald F., "Capital Consumption: An Alternative Methodology for Pricing Reinsurance", *Casualty Actuarial Society Forum*, Volume: Winter, 2003, pp. 351-379, http://www.casact.org/pubs/forum/03wforum/03wf351.pdf

[6] Ruhm, David L., "Risk Coverage Ratio: A Leverage-Independent Method of Pricing based on Distribution of Return," ASTIN Colloquium, July 2001, http://www.actuaries.org/ASTIN/Colloquia/Washington/Ruhm.pdf

[7] Wang, Shaun S., "Premium Calculation by Transforming the Layer Premium Density", *ASTIN Bulletin*, Volume: 26:1 (1996), pp. 71-92, http://www.casact.org/library/astin/vol26no1/71.pdf

[8] Wang, Shaun S., "A Universal Framework for Pricing Financial and Insurance Risks", *ASTIN Bulletin*, Volume: 32:2 (2002), pp. 213-234, http://www.casact.org/library/astin/vol32no2/213.pdf

[9] Panjer, Harry H., et al, Financial Economics, Schaumburg, IL, The Actuarial Foundation, 1998.

[10] Hull, John, *Options, Futures and Other Derivatives*, Third (International) Edition, London, Prentice Hall International, Inc., 1997.

[11] Baxter, Martin and Andrew Rennie, *Financial Calculus*,, London, Cambridge University Press, 1996.

[12] Peters, Edgar E., *Chaos and Order in the Capital Markets*, New York, John Wiley & Sons, Inc., 1991

Abbreviations and notations

10-10, 10% chance of 10% loss benchmark
CAS, Casualty Actuarial Society
COPLFR, Committee on Property and Liability Financial Reporting
$E(x)$, expected value of x
$E^*(x)$, expected value of transformed x
ERD, expected reinsurer deficit
EUD, expected underwriting deficit
$F(x)$, aggregate distribution function
$F^*(x)$, transformed aggregate distribution function
FAS 113, Financial Accounting Standard No. 113
Freq, probability of present value loss
Freq(UL), probability of underwriting loss
FV, future value operator
$N(z)$, standard normal distribution function
$N^{-1}(\text{prob})$, standard normal inverse dist function
PV, present value operator
RTD, right tail deviation
S&P 500, Standard & Poor's 500 stock index
Sev, severity of present value loss
Sev(UL), severity of underwriting loss
SSAP, Statement of Statutory Accounting Principles
TVaR, tail value at risk
$TvaR_\alpha$, tail value at risk at α probability level
VaR, value at risk
VaR_α, value at risk at α probability level

Biographies of Working Party Members

Michael Wacek (Working Party Chair) is President of Odyssey America Reinsurance Corporation based in Stamford, CT. Over the course of 20 years in the industry, including nine years in the London Market, Mike has seen the business from the vantage point of a primary insurer, reinsurance broker and reinsurer. He has a BA from Macalester College (Math, Economics), is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. He has authored several papers.

John Aquino is Executive Vice President of Benfield, Inc. in Chicago. He has over twenty years of experience in the reinsurance industry and actuarial consulting. John has also been a frequent speaker at industry meetings. He has served as President of the Midwest Actuarial Forum and also on various committees of the CAS. He holds a bachelor's degree in Math and a MBA in Finance from the University of Chicago and is a Fellow member of the CAS and a Member of the American Academy of Actuaries.

Todd Bault is Senior Research Analyst covering non-life insurance equities for Sanford C. Bernstein & Co., LLC, a New York-based research firm. In 2004, Todd was ranked the #1 non-life insurance analyst by Institutional Investor's annual poll. Risk measurement and quantification is a favorite research topic. Todd is a Fellow of the CAS and a Member of the American Academy of Actuaries.

Paul Brehm is Senior Vice President and Instrat Manager for Guy Carpenter. Paul spent 22 years at St Paul Travelers, most recently as the Chief Actuary. He holds a BS degree in Economics from the University of Minnesota. He is a Fellow of the CAS and a Member of the American Academy of Actuaries. Paul is a former chair of the CAS Valuation, Finance, and Investment Committee and has authored several papers.

Elizabeth Hansen is a Managing Director at Guy Carpenter, based in Minneapolis, MN. She is responsible for all quantitative resources in the Mid-America region as a regional manager of Instrat. Elizabeth holds a bachelor's degree in Mathematics from Luther College in Decorah, Iowa. She is a Fellow of the Casualty Actuarial Society, a member of the American Academy of Actuaries and a frequent presenter at industry conferences.

Pierre Laurin is Senior Vice President and Director of Reinsurance with Zurich in North America. He is responsible for the corporate reinsurance treaties and has underwriting oversight over all business unit related treaties. He has a degree in actuarial science from the University of Laval in addition to a Master of Science from Western University. He is a Fellow of the CAS, of the CIA and a Member of the American Academy of Actuaries. He has participated on the CAS examination committee, and is a frequent presenter at industry symposia on reinsurance topics.

Mark Littmann is a principal with PricewaterhouseCoopers LLP, based in the firm's Hartford, CT, office. His practice areas have included reserving, financial modeling, valuations, benchmarking claims and actuarial practices, financial reporting, and actuarial software systems. He has been the actuarial group's thought-leader for evaluating the internal control implications for actuaries arising from Section 404 of the Sarbanes-Oxley Act. He co-authored the firm's paper on the practical implications of implementing fair value accounting for property/casualty loss reserves. He earned a BA degree in Mathematics and Economics from Valparaiso University. He is a Fellow of the CAS and a Member of the American Academy of Actuaries.

Karen Pachyn is Senior Vice President and Chief Pricing Actuary for the North American Broker segment of GE Insurance Solutions. In this role, she leads a team of actuaries pricing treaty reinsurance in the U.S. and Canada. She is an FCAS, MAAA and CPCU, and is currently involved in the CAS Committee on Special Interest Seminars. She has previously participated on a number of other CAS Committees and is a past President of the Midwestern Actuarial Forum. She has a BA from Illinois Wesleyan University.

Deborah Rosenberg is the Deputy Chief Casualty Actuary for the New York State Insurance Department. She is a Fellow of the CAS and a Member of the American Academy of Actuaries. Deborah is the current Vice President of Administration for the CAS and also a member of the Task Force on Publications and the Task Force on Reserving Principles.

David Ruhm is Assistant Vice President at Hartford Investment Management Company in Hartford, CT. His areas of responsibility include portfolio risk management, financial modeling and enterprise risk management. He has a bachelor's degree in Mathematics from the University of California, San Diego and is a Fellow of the CAS. David has published several papers on risk theory and capital management. He participates on the CAS Theory of Risk Committee, and is a frequent presenter at industry conferences.

Mark van Zanden is a structured risk underwriter with Catlin Insurance Company Ltd. in Bermuda. He is responsible for originating, structuring, analyzing and underwriting highly tailored (re)insurance transactions. He has a degree in Mathematics and Statistics from the University of Western Ontario in London, Canada. He is a Fellow of the CAS and of the Canadian Institute of Actuaries. He is a CFA charterholder. He has over ten years of experience designing and analyzing alternative risk transfer (re)insurance transactions.

Robert A. Bear, FCAS, MAAA, CPCU

This letter is written in response to the request for suggestions on risk transfer analysis. I would not suggest changing the current test for risk transfer, but do suggest broadening the test criteria. I believe that the test should be performed at several points and that a contract should be required to pass the test at two or more points with associated probabilities that differ by at least 3%. The contract would pass at a point if it could be shown to have a NPV loss of at least 20-P percent of premium, where P is the probability of loss tested and P is between 1% and 15%.

For example, a contract would pass if one could demonstrate that there is a 15% chance of loosing at least 5% of premium and a 12% chance of loosing at least 8% of premium. It would also pass if there is a 10% chance of loosing at least 10% of premium and a 5% chance of loosing at least 15% of premium. It would also pass if there is a 4% chance of loosing at least 16% of premium and a 1% chance of loosing at least 19% of premium. Note that in each of these examples, the two P's at which the test is performed are at least 3% apart.

I believe that this test is consistent with the criteria established by the CAS Risk Transfer Testing Working Party, would be easy to implement and would allow sufficient flexibility to permit legitimate reinsurance contracts to pass risk transfer. Thanks you for considering this proposal.

Michael J. Belfatti, FCAS, MAAA

1) My suggestions regarding effective risk transfer tests begin with some reminders as to general principles:

- Since we are referring to "risk," it makes sense to define it. Many definitions are possible. For the sake of discussion, I'll use the following: Risk is the potential for adverse changes in the amount or timing of the payment or receipt of cash, due to the occurrence of future contingent events.

- My definition here has a number of implications:
  i. Although better than expected outcomes also reflect uncertainty, I don't think that is what people mean when they say "risk." Thus, I will require adverse changes.
  ii. Also, requiring adverse impacts correctly treats a situation where something bad could happen but it doesn't hurt someone. For example, on a contract where the agg limit has been exhausted, there is no further risk - even though a future contingent event could still occur, there is no potential for adverse impact.
  iii. I'll emphasize amount and timing because this allows several situations to all be considered risk:
    1. fixed amount/unknown timing
    2. unknown amount/fixed timing
    3. fixed present value/unknown timing (think liquidity risk)
  iv. I'll stick with cash effects and ignore accounting risk for now.
  v. I'll define the events in question as inherently future. Note, though, the definition of "future" in this context is broad – if a claim already occurred, for example, you could still define the ultimate payment or even the manifestation of the claim as occurring in the future.
  vi. The emphasis on potential for adverse changes will ensure that it remains clear that not having a loss does not mean risk was not borne

- The sine qua non of a risk transfer test is its ability to reflect a greater or lesser degree of risk. Using the definition above, it makes sense to consider some principles regarding what "more risk" even means. To attempt to define this, we need to consider several parts:

  i. Holding likelihood of event constant, we can say that future contingent events that have a larger potential adverse impact on the amount or timing of the payment or receipt of cash contain more risk (and vice versa).

ii. Holding potential adverse impact constant, we can say that future contingent events that are more likely to occur contain more risk.

We'll return to the issues of amount, timing, and likelihood below. At this stage, however, we note that this definition of "more risky" calls to mind a fundamental property of risk. Risk lies on a relative continuum from "zero risk" (a tricky idea but roughly meaning no potential for adverse impact) to "infinite risk" (itself practically limited by enterprise value and other real world constraints). Something can be more risky or less risky but, practically speaking, there is not a "cutoff" between "risky" and "not risky."

The "cutoff" between "significantly risky" and "not significantly risky," in turn, is a fundamental problem with current risk transfer tests. The cutoff is fundamentally at odds with the reality of risk, and thus itself creates much of the interpretation and implementation problems we see today. Put most directly, if small changes in the underlying "risk" always produced small changes in the reflection of or accounting for that risk, a new system would not be needed.

It may be that such simplifications and cutoffs are required by the considerations of practicality. Nonetheless, we must not forget that the cutoff is a simplification and, in fact, is fundamentally at odds with reality. Indeed, I would argue that the more "cutoffs" that a risk transfer test includes, the more at odds with reality it will be, and thus the more problematic it will be to implement.

- Another area that has been misunderstood in current (ineffective) risk transfer tests is the mixing of likelihood and amount. This misunderstanding even exists in some of the conceptual literature available (for example, see the criticism by Dr. Ali Samad-Khan regarding the problems with the COSO Enterprise Risk Management framework, which emphasizes as the key risk metric an event's marginal contribution to expected value, i.e. probability times amount). As we all know, it is patently absurd to suggest that an event that has a 2% probability of causing a $1B loss is not significant risk, just because the probability is low. Thus, whatever effective framework is adopted must intelligently combine the issues of likelihood and amount into a unified framework.

- One further area that has been misunderstood in practice is the issue of lack of data. Very often, the data surrounding a risk is simply not sufficient to permit a reliable stochastic model from being developed. Lack of

data, other things equal, suggests that it's more likely you've missed the mark widely in your estimates. Since we only count downside deviations in my definition of risk, lack of data should be thought to uniformly increase risk (by increasing the variance of the estimators and therefore stretching downside deviations).

In practice, our thirst for "modeled probabilities" forces a counterintuitive and sometimes absurd result in the case of little data. We either must admit that we can't show the risk because we can't model it, or we must use some flimsy and inapplicable data source to "demonstrate" the risk in a modeled sense. One of the main risks is the lack of data itself, and this raises a question that one should consider well: Does it make any pragmatic or common sense to use a model to demonstrate the risk associated by lack of data?

- Keeping in mind all of the above, an effective test for risk transfer must have all of the following:
  - It must react to increases/decreases in risk in a smooth fashion
  - It must correctly reflect that a low likelihood but high severity event is nonetheless risky
  - It must allow some reflection of the lack of data as part of the consideration of the risk

Based on all of these principles, I would recommend the following test:

- The test will be a Risk Transfer Factor (RTF) which in turn will be based on a Risk Transfer Score (RTS)
- The Factor will be 0-100 as calculated below. A Factor calculation near 0 suggests little risk has been transferred and the contract should be accounted for largely as a deposit. Vice versa, a Factor near 100 suggests full insurance accounting is appropriate.
- Not all contracts would be modeled – see safe harbors under 3. In fact, ideally very few would need to be modeled, so that the additional administrative weight is minimal.

Calculation of RTS:

- First, a Risk Transfer Score (RTS) is calculated for each of several metrics. At this point, I'd suggest:
  - Modeled conditional expected downside (over loss scenarios)
  - Modeled TVAR at 90^{th} percentile worst
  - Modeled TVAR at 99^{th} percentile worst

  [Of course, others can be developed based on input.]

- For each metric selected, the RTS is calculated for the transferring company as simply the retained risk over the gross risk. For 90 TVAR, for example, it would be:

  1-(Modeled TVAR at 90th retained / Modeled TVAR at 90th gross)
- For the final RTS, some combination of the various metrics should be used. Although additional testing and input is required, possible rules include:
  - Average of each RTS
  - Max RTS
  - Min RTS
- After the metrics are combined, the final RTS would be rounded, so the only permissible scores are 0, 10, 20, etc.

Calculation of RTF:

- Once the final (rounded RTS) is available, a translation mechanism is required to determine the Risk Transfer Factor. The translation mechanism is needed to convert the RTS into the desired proportional accounting treatment (which the RTF will depict). As an example of why the RTS can't be used directly, something that reduces conditional expected downside by 60% should certainly get 100% insurance accounting, not 60%. The translation should accomplish this.

- Although many translation mechanisms are possible, a very simple one derives the RTF by multiplying the RTS by a fixed factor and then capping the result at 100. The factor can be experimented with to roughly match the desired point where full risk transfer accounting could be realized.

			translation factor					
cev loss retained	cev loss gross	RTS	1 RTF	1.5 RTF	2 RTF	2.5 RTF	3 RTF	5 RTF
0	100	100	100	100	100	100	100	100
10	100	90	90	100	100	100	100	100
20	100	80	80	100	100	100	100	100
30	100	70	70	100	100	100	100	100
40	100	60	60	90	100	100	100	100
50	100	50	50	75	100	100	100	100
60	100	40	40	60	80	100	100	100
70	100	30	30	45	60	75	90	100
80	100	20	20	30	40	50	60	100
90	100	10	10	15	20	25	30	50
100	100	0	0	0	0	0	0	0

Note, a more refined formula may well be desirable to minimize the width of the "steps" in the function (the wider the RTF bands are, the closer to a cutoff system like today).

In any event, these formulas can be defined with the input of various professionals, to ensure that the formula is as free from problems as possible.

2) As mentioned above, any "all or nothing" test of risk prevents effective differentiation of risk and thus reflection of reality. Not surprisingly, therefore, the RTF is not designed to be a "yes or no" indicator.

   Rather, we recommend a system whereby contracts that require this testing procedure are split for booking purposes into an insurance piece and a deposit piece using the RTF. So, if the RTF is 70, the transaction is split 70/30. 70% is booked in usual insurance accounting fashion and 30% is booked as a deposit. The entries for each piece are maintained throughout the life of the deal as if that share were the only share the company owned. The only difference is they now own two "shares" of the deal, one of which gets full risk transfer accounting and the other of which gets full deposit accounting.

   Most other elements could follow current form accordingly. There are still some of the same implementation issues that exist today (e.g. related contracts, how to handle interest rates, incorporation of non cash flow items like fund balances, etc.) – those will continue to be challenges.

   Another area that will be a challenge, as highlighted above, is areas where data is sparse. Currently, the requirement to support sparse data situations with models is counterproductive. A better solution needs to be offered.

3) The issue of safe harbors becomes particular important if this methodology is followed, since a key risk of the method is creating undue administrative burden through the doubling of transaction entries. To avoid this, the procedure will only be used where "necessary." Contracts passing the safe harbor requirements will automatically get a RTF of 100.

   To define contracts that do not need this split accounting, input should be sought from various professions. Some safe harbors should include:

   - Contracts where the ceding and assuming company are in the same economic "shoes" (full quota shares).
   - Contracts that have no loss sensitive provisions and no aggregate limits of liability.

- Contracts that have no loss sensitive provisions and that feature a rate on line below a certain threshold (e.g. if a contract is $10 premium for $100 potential loss with no other provisions affecting the possible payout, it should not need to be tested).
    - This will likely encompass all plain vanilla catastrophe contracts.
- Possibly contracts for which it can be readily demonstrated that there is a material, or at least non-quantifiable probability of a highly significant loss. For example, if you receive $200 of premium and there's even a non-absurd possibility of losing $1,000, it passes.
- Etc.

4) Many of the advantages and disadvantages of the approach have already been mentioned. To reiterate and expand, they include:

Advantages

1. Eliminates crucial "cutoff" element of current system and potential related incentive problems.
2. In the process of eliminating cutoffs, better reflects the underlying risk profile of a contract and therefore better aligns the substance of the contract with the depiction of it in financial statements.
3. Provides significant safe harbors to avoid additional administrative complexity.
4. Allows a great deal of flexibility in selection of metrics to be used in RTS
5. Allows a great deal of flexibility in selection of the translation method for the RTF (i.e. translation to the "full risk" standard).
6. Still uses stochastic modeling to reflect actual deal terms.
7. Still focuses on amount, timing, and probability of uncertainty. However, the metrics can be chosen to better reflect the risk reduction of, say, a contract with a 2% chance of a 500% loss.
8. Additional administrative hassle of booking (twice the entries) could be viewed as a deterrent for doing these transactions. Of course, also the translation mechanism itself could be modified to be more or less on the punitive side, again reflecting a priori beliefs as to the value of structured transactions.

Disadvantages

1. Doubles the accounting entries for any transaction that must be tested.
2. Doesn't address (yet) the issue of little data and how the RTS/RTF could be adjusted for those situations.
3. Still allows RT results that are very "model dependent."

4. Still has same implementation issues as today surrounding things like:
    a. Related contracts
    b. Interest rates to use
    c. Reflection of non-cash flow aspects (e.g. FWB)
5. Translation may produce counterintuitive results and/or some “cutoff” issues if not developed carefully
6. Still may allow for significant argument regarding which metrics should be used.
7. Method may be open to a theoretical criticism that our true sense of “risk” is not a linear function of the reduction in the risk metric. (of course, this criticism can be partially addressed by thoughtful selection of metric).

Joseph Boor, FCAS, MAAA

Re: Tests for Risk Transfer – Suggestions

Although I am not a member of the AAA, I am an FCAS, and happen to be closely following the reinsurance risk transfer issue. I have a couple of suggestions to offer in the hopes that industry financials can become more transparent. They are enumerated below:

1. Instead of evaluating the probability that the reinsurer incurs a loss of a specific size in all circumstances, evaluate the probability that the reinsurer incurs a loss of a specific size over only those circumstances where an underlying loss occurs at all. This would eliminate the problem with catastrophe and high excess treaties, wherein the probability of any loss at all occurring is less than 10%, yet risk is clearly transferred.
2. Insist that the limit of coverage be high enough to generate a risk standard deviation that is at least as high as that of the subject business at first dollar levels. This would help reduce the use of risk transfer solely for 'financing-type' purposes.

Thank you in advance for passing this on. I appreciate the opportunity to contribute.

Gregory A. Cuzzi, ACAS, MAAA

Response to the American Academy of Actuaries' Request for Suggestions on Risk Transfer Analysis

I write this in response to the request by the American Academy of Actuaries' (AAA) Committee on Property and Liability Financial Reporting (COPLFR) for suggestions on risk transfer analysis. I should point out that the opinions expressed herein are my own and do not necessarily represent those of my employer in any way.

By way of introduction, I am Senior Vice President and Chief Actuarial Officer of Berkley Risk Solutions (BRS), a company that specializes in structured property and casualty insurance and reinsurance transactions. My experience in structuring such transactions and modeling their cash flows dates back to 1990, both at BRS and at previous employers.

My initial focus in cash flow analysis had originally been to assess both the profitability of a transaction under varying assumptions, whether internal (ultimate loss result, speed of payout) or external (interest rate), and how sensitive that profitability would be to changes in contract terms. Over time, and in response to the issuances of SFAS 113 and SSAP 62, I have increased the scope of my analysis to examine risk transfer, primarily as one determinant in recommending to my company (the assuming reinsurer) the appropriate accounting treatment. I do not share my risk transfer analysis with ceding companies, as it is my view that this action could be seen as self-serving, possibly enticing a cedant to enter into a deal based on one accounting treatment or the other, in a situation where our view is not shared by the client's auditors. BRS does not offer accounting advice. We do recommend that cedants seek the advice of their own actuaries and auditors, and make their own decision in the determination of risk transfer and accounting treatment. As a rule, we require that our clients provide full disclosure to all relevant parties, including regulators.

Cash flow analysis only makes sense when one can reasonably estimate cash flows based on generally accepted actuarial methods prudently applied to relevant data from the risk being reinsured, to the extent that it is credible, or, to the extent it is not, from an appropriate industry proxy source. In all cases it is necessary to adhere to relevant Actuarial Standards of Practice, including, but not limited to, ASOP 7 (Analysis of Life, Health, or Property/Casualty Insurer Cash Flows), ASOP 23 (Data Quality), and ASOP 25 (Credibility Procedures Applicable to Accident and Health, Group Term Life, and Property/Casualty Coverages).

In the absence of appropriate, credible data from any source, the argument in favor of risk transfer is often strengthened. Risk transfer in this case is not assured, however, as risk limiting features of the reinsurance contract must be considered.

The model I use is a proprietary one; however I can say that it is based on a selected distribution of gross ultimate loss outcomes for the risk being evaluated, a selected payout pattern, and the ability to superimpose any of several typical contract features on the modeled gross cash flows to determine ceded cash flows. Net present value is

determined based on a single interest rate assumption, selected based on the current interest rate environment and the expected duration of the ceded cash flows, which the model also determines.

The model produces two sets of outputs, one using the selected payout pattern (expected), and one using the selected payout pattern advanced by six months (fast). The model outputs are 1) average profitability across the entire distribution, both in dollars and as a percent of premium and 2) two measures of risk transfer – the probability of a loss greater than or equal to 10% of premium (10-10), and the average result, as a percent of premium, in the worst 10% of outcomes ($TVaR_{0.10}$). This latter statistic was addressed in *Accounting Rule Guidance Statement of Financial Accounting Standards No. 113 – Considerations in Risk Transfer Testing* by the CAS Valuation, Finance, and Investments Committee (VFIC).

Responses

1) **What is an effective test of risk transfer?** The 10-10 test has gained wide acceptance in the industry, and is adequate as a simple rule-of-thumb. It assigns a value of 10% (chance of happening) to the expression "reasonably possibly", and 10% (of premium) to the expression "significant loss". It fails, however, in low frequency, high severity type covers, e.g. catastrophe covers, in which the possibility of loss is much lower than 10%, but the size of the loss can be multiples of the premium. The TVaR is a substantial improvement over the 10-10 test, as it examines results not just at the 90^{th} percentile, but across the continuum of outcomes beyond that point.

2) **What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer?** I believe that a reinsurance arrangement having a $TVaR_{0.10}$ showing a loss in excess of 15% of premium demonstrates sufficient risk transfer. The VFIC paper suggests a higher threshold, 20% to 25%, however, I have selected 15% because I consider it to be more consistent with the 10-10 test under the loss distribution/reinsurer margin combinations that I am typically faced with.

   Assuming that a TVaR type concept is believed to be beyond the capacity of most non-actuaries (a belief that I do not share), there may be an appeal to preserve a 10-10 type test. In that case, the next set of discussions would relate to establishing an appropriate threshold. Is it 10-10? Is 15-15 more acceptable? Recent studies of the dynamic effects on capital of exposure to loss demonstrate that a threshold above 10-10 would provide both an inadequate return across the portfolio and an increased risk of ruin.

3) **What safe harbors, if any, should be established so that a full cash flow analysis does not have to be completed in every instance?** It is legitimate to write specialized or customized insurance and reinsurance transactions which assume measured and limited amounts of risk. As such, we risk test virtually

every transaction that we enter into. It seems that once one has developed a model to risk test some contracts, it would not be too onerous to apply it to all contracts, saving perhaps those that fall under the SFAS 113, paragraph 11 exemption.

4) **What are the advantages and disadvantages of the suggested approach vs. other approaches commonly used?** See response to #1.

Rod Davis, ACAS, MAAA

General Provisions of Contract
The retroactive reinsurance contract provides for a $500,000,000 premium of which $25,000,000 is paid to the assuming insurance company, while the remaining $475,000,000 is held by the ceding company in a Funds Withheld Account. Losses are to be paid out of the Funds Withheld Account until exhausted and them reimbursement is sought from the assuming company. The ceding company agrees to pays 7% interest on the funds withheld balance based on the prior years ending fund balance. The ceding company can commute the contract at any time with 90 days notice, and receive any positive amount remaining in the Funds Withheld Account. The assuming company can only commute upon non-payment of the premium, or other specific provisions related to the insolvency or rehabilitation of the ceding company, change of control of the ceding company, etc.

Three methods are presented below to measure risk transfer under SSAP 62. Because three methods were considered, we believe SSAP 62 should provide more specifics as to "Funds Withheld" contracts should be treated when evaluating risk transfer. We would appreciate your input as to the appropriate method to use on this type of reinsurance contract to measure risk transfer.

For purposes of simplicity, we have presented only one representative Scenario for purposes of determining the appropriate method to use. We are aware that all three methods used below do not produce a "significant risk of loss", but we are more interested in the computation methods verses the actual outcome of the numbers. We have attached one Excel file of two worksheets with the cash flow examples of the three methods.

Computation 1
The first computation offsets the premium of $500,000,000 with the net present value (NPV) of the deemed interest paid into the Funds Withheld Account, and the NPV of the projected loss payments.

NPV of interest	$236,443,734
NPV Premium	500,000,000
Total NPV	$736,443,734
NPV loss payments	(585,101.959)
Total-no risk	$151,341,775

SSAP 62 requires the measurement of underwriting risk and timing risk, where investment risk is not an element of insurance risk. Specifically, based upon paragraphs 14 and 15 of SSAP 62, the NPV of the cash flows between the parties, without regard to how the individual cash flows are describe or characterized, are compared to the NPV of the amounts paid or deemed to have been paid to the reinsurer. Under this method, the $500,000,000 is deemed paid to the reinsurer at the inception of the contract. Likewise, the interest payments on the Funds Withheld account are deemed to be paid to the reinsurer with an income stream that has a NPV.

Computation 3
In this computation, the $475,000,000 portion of the premium deposited into the Funds Withheld account is deemed paid to the reinsurer only when actually used to pay losses.

NPV of interest	$236,443,734
NPV of loss pymts	(585,101,959)
Total NPV	(348,658,225)
NPV of Funds W/H	$306,111,619
Margin	25,000,000
Total NPV of Premium	$331,111,619
Total-some risk	(17,546,606)

Computation 2
This computation generates the same NPV result as in Computation 3, but the approach is different. In this computation an imputed premium was generated representing the difference between the 5% NPV discount rate and the actual 7% interest rate. This occurs when the ceding company agrees to pay interest at a rate greater than the prevailing rate. Thus, in this computation only 2% of the interest paid into the Funds W/H was consider in the NPV computation, the remaining 5% of the interest paid was excluded.

NPV of imputed premium	$ 67,555,352
NPV of losses	(585,101,959)
Total NPV	(517,546,606)
Premium	500,000,000
Total-some risk	(17,546,606)

Evaluation
Since computation 2 and 3 generate the same NPV of $17,546,606, it would appear that the inherent difference in the computational methods is the inclusion of the interest earned at the discounted rate of 5% on $475,000,000 Funds Withheld portion of the premium in computation 1, which is excluded from computations 2 & 3.

SSAP 62 proposes to measure underwriting risk and timing risk whereas actual or imputed investment returns are not an element of insurance risk. In a contract not containing a Funds Withheld provision, the assuming company receives the premium and bears the investment risk of investing the premium to cover potential losses, as such the investment income earned by the assuming company is excluded from the computation. It would generally appear that the interest excluded from Computations 2 & 3 would be considered investment income and should be excluded from the computation. This would be true if the contract was not a Funds Withheld contract.

The inherent problem for a Funds Withheld contract is evaluating risk transfer regarding the assuming company. In our example, the assuming company bears no investment risk regarding the $475,000,000 Funds Withheld portion of the premium, since the interest

earned is a 7% fixed rate per contractual provisions. The only variables affecting the amount of interest received by the assuming company on the $475,000,000 of premium is that of insurance risk; the amount and timing of the loss payments out of the Funds Withheld account. In addition, the full 7% of interest is used to offset the loss payments. Thus, it appears inappropriate to exclude the NPV of the 5% of interest earned from the NPV computation as Computations 2 & 3 would do for the purposes of evaluating whether the assuming company has assumed insurance risk.

In contrast, from the prospective of the ceding company, they bear the investment risk since they invest the $475,000,000 to provide for the interest payments and loss payments made out of the funds withheld account. Perhaps from this perspective when evaluating whether the ceding company has transferred risk, Computation 2 and 3 would be more appropriate.

We do not believe that SSAP 62 provides enough guidance to address "Funds Withheld" contractual provisions. Your consideration of clarifying this shortcoming would be most appreciated.

Example Provided to NAIC
Internal Revenue Service
Determination of NPV Computation
Example of Two Methods

Example provided to NAIC

	Total Premium	Margin	Beginning Funds Withheld	Interest Paid by Cedant 7%	Losses Paid Assuming Co	Ending Funds Withheld	(NPV Rate) * Interest 5%	* Imputed Premium Interest 2%	Actual Interest Paid 7%
1/1/2004	500,000,000	25,000,000	475,000,000	33,250,000	(60,000,000)	448,250,000	23,750,000	9,500,000	33,250,000
1/1/2005			448,250,000	31,377,500	(58,000,000)	421,627,500	22,412,500	8,965,000	31,377,500
1/1/2006			421,627,500	29,513,925	(56,000,000)	395,141,425	21,081,375	8,432,550	29,513,925
1/1/2007			395,141,425	27,659,900	(54,000,000)	368,801,325	19,757,071	7,902,829	27,659,900
1/1/2008			368,801,325	25,816,093	(52,000,000)	342,617,417	18,440,066	7,376,026	25,816,093
1/1/2009			342,617,417	23,983,219	(50,000,000)	316,600,637	17,130,871	6,852,348	23,983,219
1/1/2010			316,600,637	22,162,045	(48,000,000)	290,762,681	15,830,032	6,332,013	22,162,045
1/1/2011			290,762,681	20,353,388	(46,000,000)	265,116,069	14,538,134	5,815,254	20,353,388
1/1/2012			265,116,069	18,558,125	(44,000,000)	239,674,194	13,255,803	5,302,321	18,558,125
1/1/2013			239,674,194	16,777,194	(42,000,000)	214,451,387	11,983,710	4,793,484	16,777,194
1/1/2014			214,451,387	15,011,597	(40,000,000)	189,462,984	10,722,569	4,289,028	15,011,597
1/1/2015			189,462,984	13,262,409	(38,000,000)	164,725,393	9,473,149	3,789,260	13,262,409
1/1/2016			164,725,393	11,530,778	(36,000,000)	140,256,171	8,236,270	3,294,508	11,530,778
1/1/2017			140,256,171	9,817,932	(34,000,000)	116,074,103	7,012,809	2,805,123	9,817,932
1/1/2018			116,074,103	8,125,187	(32,000,000)	92,199,290	5,803,705	2,321,482	8,125,187
1/1/2019			92,199,290	6,453,950	(30,000,000)	68,653,240	4,609,965	1,843,986	6,453,950
1/1/2020			68,653,240	4,805,727	(28,000,000)	45,458,967	3,432,662	1,373,065	4,805,727
1/1/2021			45,458,967	3,182,128	(26,000,000)	22,641,095	2,272,948	909,179	3,182,128
1/1/2022			22,641,095	1,584,877	(24,000,000)	225,972	1,132,055	452,822	1,584,877
1/1/2023			225,972	15,818	(22,000,000)	(21,758,210)	11,299	4,519	15,818
1/1/2024			(21,758,210)	0	(20,000,000)	(41,758,210)			
1/1/2025			(41,758,210)	0	(18,000,000)	(59,758,210)			
1/1/2026			(59,758,210)	0	(16,000,000)	(75,758,210)			
1/1/2027			(75,758,210)	0	(14,000,000)	(89,758,210)			
1/1/2028			(89,758,210)	0	(12,000,000)	(101,758,210)			
1/1/2029			(101,758,210)	0	(10,000,000)	(111,758,210)			
1/1/2030			(111,758,210)	0	(8,000,000)	(119,758,210)			
1/1/2031			(119,758,210)	0	(6,000,000)	(125,758,210)			
1/1/2032			(125,758,210)	0	(4,000,000)	(129,758,210)			
1/1/2033			(129,758,210)	0	(2,000,000)	(131,758,210)			
Total	500,000,000	25,000,000		323,241,790	(930,000,000)		230,886,993	92,354,797	323,241,790
NPV at 5%	500,000,000			236,443,734	(585,101,959)			$67,555,352	

Computation 1-Include full Interest Payment

NPV Interest	236,443,734
NPV Premium	500,000,000
Total NPV	736,443,734
NPV Losses	(585,101,959)
Difference	151,341,775

No risk

Computation 2-Imput Premium

NPV of Imputed Premium	67,555,352
NPV Premium	500,000,000
Total NPV	567,555,352
NPV Losses	(585,101,959)
Difference	(17,546,606)

Now some risk

Cedant pays 7% into the Funds W/H acct for the benefit of reinsurer, per contract provisions, computed based on the prior year-end fund balance

* Actual Interest paid by cedant	7%
NPV interest rate	5%
Imputed Premium	2%

Example Provided to NAIC
Internal Revenue Service
Determination of NPV Computation
Example of Third Method

	Total Premium	Margin	Beginning Funds Withheld	Interest Paid by Cedant 7%	Losses Paid Assuming Co	Ending Funds Withheld	* Cash Flow Funds W/H Used to Pay Losses
1/1/2004	500,000,000	25,000,000	475,000,000	33,250,000	(60,000,000)	448,250,000	26,750,000
1/1/2005			448,250,000	31,377,500	(58,000,000)	421,627,500	26,622,500
1/1/2006			421,627,500	29,513,925	(56,000,000)	395,141,425	26,486,075
1/1/2007			395,141,425	27,659,900	(54,000,000)	368,801,325	26,340,100
1/1/2008			368,801,325	25,816,093	(52,000,000)	342,617,417	26,183,907
1/1/2009			342,617,417	23,983,219	(50,000,000)	316,600,637	26,016,781
1/1/2010			316,600,637	22,162,045	(48,000,000)	290,762,681	25,837,955
1/1/2011			290,762,681	20,353,388	(46,000,000)	265,116,069	25,646,612
1/1/2012			265,116,069	18,558,125	(44,000,000)	239,674,194	25,441,875
1/1/2013			239,674,194	16,777,194	(42,000,000)	214,451,387	25,222,806
1/1/2014			214,451,387	15,011,597	(40,000,000)	189,462,984	24,988,403
1/1/2015			189,462,984	13,262,409	(38,000,000)	164,725,393	24,737,591
1/1/2016			164,725,393	11,530,778	(36,000,000)	140,256,171	24,469,222
1/1/2017			140,256,171	9,817,932	(34,000,000)	116,074,103	24,182,068
1/1/2018			116,074,103	8,125,187	(32,000,000)	92,199,290	23,874,813
1/1/2019			92,199,290	6,453,950	(30,000,000)	68,653,240	23,546,050
1/1/2020			68,653,240	4,805,727	(28,000,000)	45,458,967	23,194,273
1/1/2021			45,458,967	3,182,128	(26,000,000)	22,641,095	22,817,872
1/1/2022			22,641,095	1,584,877	(24,000,000)	225,972	22,415,123
1/1/2023			225,972	15,818	(22,000,000)	(21,758,210)	225,972
1/1/2024			(21,758,210)	0	(20,000,000)	(41,758,210)	0
1/1/2025			(41,758,210)	0	(18,000,000)	(59,758,210)	0
1/1/2026			(59,758,210)	0	(16,000,000)	(75,758,210)	0
1/1/2027			(75,758,210)	0	(14,000,000)	(89,758,210)	0
1/1/2028			(89,758,210)	0	(12,000,000)	(101,758,210)	0
1/1/2029			(101,758,210)	0	(10,000,000)	(111,758,210)	0
1/1/2030			(111,758,210)	0	(8,000,000)	(119,758,210)	0
1/1/2031			(119,758,210)	0	(6,000,000)	(125,758,210)	0
1/1/2032			(125,758,210)	0	(4,000,000)	(129,758,210)	0
1/1/2033			(129,758,210)	0	(2,000,000)	(131,758,210)	0
Total	500,000,000	25,000,000		323,241,790	(930,000,000)		475,000,000
NPV at 5%	500,000,000			236,443,734	(585,101,959)		306,111,619

Computation

NPV Interest	236,443,734	NPV Funds W/H	306,111,619	*	Difference
NPV Losses	(585,101,959)	Margin	25,000,000		
Total NPV	(348,658,225)	Total NPV Prem	331,111,619		(17,546,606)

Cedant retains Funds W/H acct for the benefit of reinsurer, per contract provisions, and pays 7%. interest into the account. Cedant deducts the $500M premium, and assuming co reports $500M premium. Cedant retains $475M as funds W/H.

*Since assuming co. can only use Funds W/H to pay losses, the premium cash flow used to pay losses is NPV as the funds are used.

Bob Eramo, ACAS, MAAA

I have attached an XL spreadsheet which results from an analysis of a medical professional book of business. The losses analyzed are prospective one year losses, not loss reserves.

On the summary page you will see output on covariances and confidence loss levels at 95, 90, 75 and expected losses. There is also a ratio of those loss levels to expected. These ratios can provide an idea, along with the covariances the degree of uncertainty there is associated with these distribution of losses. You will notice that the covariances and ratios are higher for the layer strictly looking at losses $ 1 Million xs $ 1 Million. And this is generally what we would expect.

Measures such as these could be part of a disclosure regarding level of risk or uncertainty. Such an approach can be expanded to cope with the issue of risk transfer.

On the XL spreadsheet you will see a second tab that is an example of a confidence interval array for the $1 Million layer.

Comparison of Future Year's Risk Profiles - $1 Million Layer vs $1M xs $1 M vs $ 2 Million Layer

Layer	CV	95% Confidence Level	90% Confidence Level	75% Confidence Level	Expected Losses
			In Millions		
$1 Million	0.305344	206	183	153	131
$1 M xs $ 1M	0.463768	128	109	83	69
$ 2 Million	0.380734	374	324	258	216
			Ratio to 50% Level		
$1 Million		1.5725	1.3969	1.1679	
$1 M xs $ 1M		1.8551	1.5797	1.2029	
$ 2 Million		1.7315	1.5000	1.1944	

All 1:PL (I):PTF[1]:Future PALD Summary Quantile Statistics and Value at Risk (Acc. Year: Total)
Mean = 131.256, S.D. = 40.618, Provision = 131.256, 1 Unit = $1,000,000

%	Sample			Kernel			LogNormal			Gamma		
	Quantile	# S.D.'s	V-a-R	Quantile	# S.D.'s	V-a-R	Quantile	# S.D.'s	V-a-R	Quantile	# S.D.'s	V-a-R
50	125.147	-0.15	-6.109	125.228	-0.148	-6.028	125.389	-0.144	-5.867	127.091	-0.103	-4.165
51	126.063	-0.128	-5.193	126.188	-0.125	-5.068	126.341	-0.121	-4.915	128.092	-0.078	-3.163
52	127.205	-0.1	-4.051	127.155	-0.101	-4.1	127.3	-0.097	-3.955	129.1	-0.053	-2.156
53	128.162	-0.076	-3.094	128.13	-0.077	-3.126	128.269	-0.074	-2.987	130.114	-0.028	-1.141
54	129.139	-0.052	-2.117	129.114	-0.053	-2.142	129.247	-0.049	-2.009	131.136	-0.003	-0.12
55	130.07	-0.029	-1.186	130.108	-0.028	-1.148	130.235	-0.025	-1.021	132.165	0.022	0.91
56	131.056	-0.005	-0.2	131.109	-0.004	-0.147	131.234	-0.001	-0.022	133.204	0.048	1.948
57	132.097	0.021	0.841	132.117	0.021	0.861	132.245	0.024	0.989	134.251	0.074	2.995
58	133.244	0.049	1.988	133.137	0.046	1.881	133.268	0.05	2.012	135.309	0.1	4.053
59	134.282	0.075	3.027	134.167	0.072	2.911	134.305	0.075	3.049	136.378	0.126	5.122
60	135.146	0.096	3.89	135.206	0.097	3.95	135.357	0.101	4.101	137.458	0.153	6.203
61	136.177	0.121	4.922	136.255	0.123	4.999	136.423	0.127	5.167	138.552	0.18	7.296
62	137.288	0.149	6.032	137.319	0.149	6.063	137.507	0.154	6.251	139.659	0.207	8.404
63	138.297	0.173	7.042	138.399	0.176	7.143	138.607	0.181	7.351	140.782	0.235	9.526
64	139.349	0.199	8.094	139.493	0.203	8.237	139.727	0.209	8.471	141.92	0.263	10.664
65	140.484	0.227	9.228	140.605	0.23	9.349	140.867	0.237	9.611	143.075	0.291	11.819
66	141.607	0.255	10.351	141.738	0.258	10.482	142.028	0.265	10.772	144.249	0.32	12.993
67	142.426	0.275	11.17	142.898	0.287	11.642	143.212	0.294	11.956	145.443	0.349	14.187
68	143.518	0.302	12.262	144.085	0.316	12.829	144.421	0.324	13.165	146.657	0.379	15.401
69	144.671	0.33	13.415	145.3	0.346	14.044	145.656	0.355	14.4	147.895	0.41	16.639
70	145.871	0.36	14.615	146.548	0.376	15.292	146.92	0.386	15.664	149.157	0.441	17.901
71	147.361	0.397	16.105	147.833	0.408	16.577	148.214	0.417	16.958	150.445	0.472	19.189
72	148.724	0.43	17.468	149.165	0.441	17.909	149.541	0.45	18.285	151.762	0.505	20.506
73	149.879	0.458	18.623	150.544	0.475	19.289	150.903	0.484	19.647	153.11	0.538	21.854
74	151.415	0.496	20.159	151.973	0.51	20.717	152.304	0.518	21.048	154.491	0.572	23.235
75	152.66	0.527	21.404	153.456	0.547	22.2	153.746	0.554	22.49	155.908	0.607	24.652
76	154.23	0.566	22.974	154.995	0.584	23.739	155.234	0.59	23.978	157.365	0.643	26.109
77	155.843	0.605	24.588	156.596	0.624	25.34	156.77	0.628	25.514	158.864	0.68	27.608
78	157.775	0.653	26.519	158.26	0.665	27.005	158.361	0.667	27.105	160.41	0.718	29.154
79	159.732	0.701	28.477	159.991	0.707	28.735	160.01	0.708	28.754	162.006	0.757	30.75
80	161.494	0.744	30.238	161.792	0.752	30.536	161.723	0.75	30.468	163.659	0.798	32.403
81	163.226	0.787	31.97	163.665	0.798	32.409	163.509	0.794	32.253	165.374	0.84	34.118
82	164.891	0.828	33.636	165.622	0.846	34.366	165.374	0.84	34.118	167.158	0.884	35.902
83	166.973	0.879	35.717	167.672	0.897	36.416	167.327	0.888	36.071	169.018	0.93	37.762
84	169.169	0.933	37.913	169.82	0.949	38.564	169.38	0.939	38.124	170.964	0.978	39.709
85	171.352	0.987	40.096	172.077	1.005	40.821	171.546	0.992	40.29	173.007	1.028	41.751
86	173.387	1.037	42.131	174.467	1.064	43.211	173.839	1.048	42.583	175.16	1.081	43.904
87	175.874	1.098	44.618	177.016	1.127	45.76	176.28	1.108	45.024	177.439	1.137	46.183
88	178.702	1.168	47.446	179.723	1.193	48.468	178.892	1.173	47.636	179.863	1.197	48.607
89	182.327	1.257	51.072	182.649	1.265	51.393	181.704	1.242	50.448	182.458	1.261	51.202
90	184.836	1.319	53.58	185.794	1.343	54.538	184.755	1.317	53.499	185.254	1.329	53.998
91	188.243	1.403	56.987	189.21	1.427	57.954	188.095	1.399	56.839	188.294	1.404	57.038
92	191.65	1.487	60.394	192.981	1.52	61.725	191.791	1.49	60.535	191.633	1.486	60.377
93	195.643	1.585	64.387	197.214	1.624	65.958	195.939	1.592	64.683	195.348	1.578	64.092
94	200.593	1.707	69.337	202.091	1.744	70.835	200.677	1.709	69.422	199.552	1.681	68.296
95	206.173	1.844	74.917	207.854	1.886	76.598	206.221	1.846	74.966	204.416	1.801	73.161
96	213.297	2.02	82.041	214.976	2.061	83.72	212.93	2.011	81.674	210.228	1.944	78.973
97	222.539	2.247	91.283	224.268	2.29	93.012	221.477	2.221	90.221	217.517	2.124	86.262
98	235.445	2.565	104.189	237.763	2.622	106.507	233.371	2.514	102.115	227.454	2.368	96.198
99	258.5	3.133	127.244	260.633	3.185	129.377	253.424	3.008	122.168	243.693	2.768	112.437
99.1	261.005	3.194	129.749	264.003	3.268	132.747	256.452	3.082	125.196	246.091	2.827	114.836
99.2	263.726	3.261	132.47	267.768	3.361	136.512	259.831	3.165	128.575	248.753	2.893	117.497
99.3	267.235	3.348	135.979	272.141	3.469	140.885	263.658	3.26	132.402	251.746	2.966	120.49
99.4	272.295	3.472	141.039	277.306	3.596	146.051	268.069	3.368	136.813	255.171	3.051	123.915
99.5	280.706	3.679	149.45	283.619	3.751	152.363	273.281	3.497	142.025	259.182	3.149	127.926
99.6	289.879	3.905	158.623	291.368	3.942	160.112	279.654	3.654	148.398	264.036	3.269	132.78
99.7	298.496	4.117	167.24	300.987	4.179	169.732	287.865	3.856	156.609	270.21	3.421	138.954
99.8	310.042	4.402	178.786	313.605	4.489	182.349	299.439	4.141	168.183	278.765	3.632	147.509
99.9	330.38	4.902	199.124	334.586	5.006	203.331	319.266	4.629	188.011	293.039	3.983	161.783

Bruce D. Fell, FCAS, MAAA, CFA

I appreciate the opportunity to respond to the American Academy of Actuaries' (AAA) Request for Suggestions related to the Risk Transfer Subcommittee's evaluation of appropriate risk transfer guidelines. Please note that the opinions expressed below are my own personal and professional opinions and do not represent the views of my employer, Towers Perrin or any clients of Towers Perrin.

I am glad to see that the AAA is getting involved in the risk transfer issue. Before I respond directly to the questions raised in the Request, I would like to address three broader issues that the RTS should raise to the National Association of Insurance Commissioners (NAIC) for consideration.

The Role of the Actuary

First, it is most important to define the roles and responsibilities of the various professions involved in the industry: in particular, the role of actuaries and accountants. As a result of FAS 113 and SSAP62, the accounting profession has been charged with ensuring that reinsurance contracts are accounted for properly. Whether intended or not, these accounting pronouncements have put the accounting profession in the driver's seat of not only ensuring that the accounting is correct but of evaluating whether significant risk exists in a contract. However, evaluating risk is the business of the actuary.

We as a profession claim to be the experts at analyzing and quantifying risk and yet we are at the mercy of the accounting profession to decide whether to involve our expertise in determining whether risk transfer exists. Therefore, I would advocate that, the NAIC (and FASB) should clearly define the role of the actuary as the experts at determining whether risk has been transferred, while the role of the accountant would be to determine that the accounting treatment is proper. This could follow in a similar vane as loss reserve adequacy where the actuary determines if the carried reserve value is appropriate while the accountants determine that the accounting is proper.

Disclosure Requirements

Second, it is important to define what disclosure requirements should exist. Many of the recent problems have been caused not by whether the reinsurance transferred risk but by company's wanting to hide something from either policyholders, shareholders, regulators or other constituents. If one considers that under SEC reporting, a company must disclose significant details of the debt covenant to the public while that same company that uses reinsurance discloses almost no information other that the presence of the contract. There are many legitimate uses of finite reinsurance and a company using it legitimately will not have an issue disclosing the structure. On the other hand, if a company is uncomfortable disclosing the details then it is more likely they are trying to manipulate the truth. Therefore, I would advocate increasing the disclosure requirements of reinsurance buyers to make sure that they provide the details of their reinsurance.

Existing Regulatory Constraints

Third, I believe that arbitrary regulations have helped to fuel the use of finite reinsurance and correcting these regulations would lessen the need for some finite transactions. Most importantly, the NAIC developed the Risk Based Capital calculation to establish minimum capital requirements. It seemed at the time that this would lessen the reliance on the IRIS leverage tests, namely the premium to surplus ratio, to determine whether a company is writing too much business for their level of surplus. However, it seems that everyone still focuses on a 3-to-1 premium to surplus ratio regardless of the riskiness of the business written. For example, should a non-standard automobile company be required to carry the same level of surplus relative to its premium volume as a company writing excess reinsurance? With all of the progress we as a profession have made regarding risk-return measures and risk based capital adequacy, why hasn't the actuarial profession urged the NAIC to abandon the premium to surplus ratio and rely more on the RBC requirement? This would allow companies that write low risk business to leverage their balance sheet by writing at higher premium to surplus ratios and not have to rely on finite quota share reinsurance to reduce their net premiums to a level required by the IRIS test.

Question 1

Regarding question 1, there is no one correct test for risk transfer. Just as it would be inappropriate to "legislate" that one type of average should be used over another in selecting loss development factors, requiring one specific test for risk transfer would be inappropriate. There are some common items that should be included and considered when testing risk transfer. But these should be presented as considerations in the same way that our professional standards of practice identify important considerations in ratemaking and reserving, but don't dictate what you must do with each of the consideration items.

The current NAIC requirements dictate consideration of all cash flows and a reasonable discount rate but are silent regarding the use of simulation, process risk variability, parameter risk, the reinsurer's capital requirements, payout pattern variability, credit risk, etc. These are all critical considerations when evaluating risk transfer and should be contemplated by the competent actuary.

Considering it another way, evaluating risk transfer requires the combination of many other actuarial tasks put together. First, an estimate of losses, loss variability and an appropriate payout pattern must be determined. These are standard actuarial pricing tasks. Next, a stochastic financial model must be constructed with all cash flows and appropriate variability in order to evaluate the transaction. This is financial modeling and Dynamic Financial Analysis (DFA). Finally, the results must be interpreted and a decision made regarding whether significant risk transfer exists. As this is Question 2, I will address it below.

If we as a profession would wrestle control of the risk transfer testing from the arms of the accounting profession, then we can establish actuarial guidelines and

standards of practice that provide the appropriate considerations in evaluating risk transfer.

Question 2

I do not believe that a single criterion should be established to determine whether a significant amount of risk has been transferred to reinsurers. As mentioned above, the financial modeling requires significant actuarial judgment and expertise and the results must be interpreted using appropriate actuarial judgment based on experience. After all this good actuarial work has been done, is it appropriate to replace sound judgment with a simplistic bright line test like the 10/10 rule? In my opinion that would be the same as requiring actuaries to calculate all the various reserve estimation methods as loss development, Bornhuetter-Ferguson, frequency-severity, etc. and then instead of using judgment to decide upon the best answer, an algorithm is used that always requires certain methods get certain weights regardless of the appropriateness of the method.

As mentioned above, if the actuary were viewed as the expert in the industry at evaluating risk transfer rather than thinking of it as an accounting requirement under the accountant's responsibility, then we as a profession can responsibly address the appropriate criteria.

For example, while the 10/10 rule contemplates both frequency and severity, it does not consider the entire distribution of reinsurer profits and losses. This is similar to the Value-at-Risk concept of how much can I lose at some probability. Instead, why not look at the entire distribution of reinsurer results. Are reinsurer profits important? Obviously the magnitude of losses at various probabilities is important. Can the Expected Policyholder Deficit concept that underlies the RBC calculation be used? This method at least considers the reinsurer loss at all probabilities.

It is possible that different methods are more appropriate depending upon the situation at hand or the type of contract. For example, different methods might be appropriate for a finite quota share contract where there tends to be a very low expected profit to the reinsurer and a capped downside so that the reinsurer can't lose too much. Compare this to a funded catastrophe cover where the idea is to provide protection for a low probability event spread over multiple years and where the reinsurers may initially have a big probability of a big loss but then when viewed over multiple years, they make back the loss in future years when the loss doesn't occur.

Question 3

With regard to safe harbors, I believe it is very important to consider that any loophole presents opportunity for abuse. While I am not advocating that a cash flow analysis must be performed on every contract, I do believe that here again professional actuarial judgment must prevail. Obviously single year catastrophe covers have significant risk (even though they would never pass the 10/10 rule). Secondly, straight quota share contracts with no caps, corridors or slides of any sort, should qualify. Third, straight excess of loss contracts with no additional or

reinstatement premiums or aggregate caps would contain significant risk. Given the customized approach to reinsurance contract structuring and negotiation, it is very difficult to provide broader safe harbor guidelines without the risk of creating loopholes.

Question 4

Advantages and disadvantages are addressed within Questions 1-3 above.

* * * * *

I appreciate your consideration of these viewpoints.

Spencer M. Gluck, FCAS, MAAA

I've attached a paper (unpublished) I've written on the subject of accounting for risk transfer and risk transfer testing. It's still labeled as draft but fairly completely edited.

A summary:

1. Defining Risk Transfer: With fairly little analysis, it's clear that the assumption underlying reinsurance accounting is that all (100%) of the risk associated with losses that are ceded has been eliminated. Deposit accounting assumes that 0% has been transferred. If our only choices are one or the other, we need to be looking at how much of the risk, i.e., what percentage of the risk, has been transferred.

2. Absolute vs. Relative Tests: The FAS 113 definition implies an absolute test, "How much risk?", whereas I am proposing a relative test, "What portion of the risk?" i.e. a before/after test. The 10/10 rule can be replaced with far superior risk measures, but absolute tests will still never work. Absolute tests of riskiness will always penalize underlying cash flows that are relatively stable, often "failing" contracts that transfer 100% or nearly 100% of the risk. But the bigger problem is that when the underlying cash flows are more volatile, then the absolute tests will "pass" contracts that transfer 20 – 30% of the risk, as long as they're "risky enough." Transferring 20% of the risk and accounting for it like you've transferred 100% is a big accounting distortion. That's how finite works and that's why FAS 113 doesn't succeed in regulating it, and still won't even with better risk measures.

3. Measuring "percent of risk transferred is no harder than the risk modeling already required to test for the 10/10 rule or any of the better risk measures that have been proposed. The paper describes the procedure and contains a number of examples that apply the method along with the 10/10 rule and several alternatives, demonstrating the point that I've made above.

4. Defining 100% Risk Transfer: Standard reinsurance contract provisions that don't limit risk transfer are named "Natural Provisions". Any contract having only Natural Provisions is defined as 100% risk transfer. This provides a substantial "safe harbor." Provisions that may limit risk transfer are named "Structural Provisions." To measure risk transfer, you compare the ceded risk when only Natural Provisions apply with the ceded risk when all provisions, Natural and Structural, apply.

5. The Need for Continuous Accounting: Having accounting for only 100% risk transfer or 0% risk transfer is still not satisfactory. Obviously, partial risk transfer exists, and picking one or the other, even if you make the better pick, will still lead to accounting distortions. Using the "percentage of risk transferred" you can specifically account for partial risk transfer contracts.

Reinsurance Involving Partial Risk Transfer
Addressing the Accounting Difficulties
(Draft #6)

Spencer M. Gluck, FCAS, MAAA

Introduction and Summary

Reinsurance contracts frequently contain any number of risk limiting provisions, which may call into question the validity of reducing net losses and premiums by showing them as having been ceded to the reinsurance, i.e. "reinsurance accounting". Many or most such contracts cede some, but not all of the relevant risk, which the author describes as partial risk transfer.[1]

There are concerns that some partial risk transfer contracts have been used to manipulate financial statements. Yet there are many legitimate uses of partial risk transfer, and more that may develop in the future as sophisticated tools for risk management. The author's view is that opportunities for financial statement manipulation arise from inaccurate accounting. The author's proposal for more accurate accounting would substantially eliminate opportunities for manipulation while allowing the legitimate use and further development of structured risk transfer techniques.

Currently, the accounting choice is whether or not the contract in question has enough risk transfer to qualify as reinsurance, and therefore be eligible for reinsurance accounting. FAS 113 and other relevant documents provide guidance for making this choice.

The author's central thesis is that the degree of risk transfer in a reinsurance contract can be described by a relatively simple and intuitive measure called "the percentage of risk transferred" or "***PRT***", which should be the basis for the above decision. The central provisions for defining risk transfer in FAS 113 are found to be fundamentally flawed.

Section I:

- develops the underlying basis for the central thesis,
- contrasts the approach with FAS 113,
- defines the approach specifically, and
- applies the approach, along with several others, to a range of hypothetical cash flow models and hypothetical reinsurance contracts.

[1] More common terms are "structured risk" and "finite risk". The author prefers partial risk transfer, which corresponds more directly with the basis of the approach. Partial risk transfer includes many traditional risk sharing techniques that are not always associated with structured risk. The term finite risk has no well-defined meaning and has developed a negative connotation by being associated with financial statement manipulation.

The second aspect of the central thesis is that the two available accounting choices are appropriate for 100% risk transfer and 0% risk transfer, but that neither is truly appropriate for partial risk transfer. Section II illustrates how the principle developed in Section I can be used to develop appropriate accounting for partial risk transfer contracts.

Outline

Section I - Defining and Measuring Risk Transfer in Reinsurance Contracts

1.1 Risk Transfer and Accounting
- 1.1.1 Risk and Balance Sheets/Income Statements
- 1.1.2 Risk and Net Premiums and Losses
- 1.1.3 Reinsurance Accounting vs. Deposit Accounting
- 1.1.4 The Relevant Risk
- 1.1.5 Partial Risk Transfer

1.2 The FAS 113 Definition of Risk Transfer – Discussion and Critique
- 1.2.1 Measuring Risk Rather than Risk Transfer
- 1.2.2 Re-Pricing the Reinsurance

1.3 The Percentage of Risk Transfer ("*PRT*") Approach
- 1.3.1 Defining 100% Risk Transfer: Natural vs. Structural Contract Provisions
- 1.3.2 The Applicable Cash Flows
- 1.3.3 The Risk Model
- 1.3.4 Adverse Deviation from Accounting Values
- 1.3.5 Risk Measures and Co-Measures I
- 1.3.6 The Percentage of Risk Transferred ("*PRT*")
- 1.3.7 Some Advantages of the *PRT* Approach

1.4 Risk Measures and Co-Measures II
- 1.4.1 Definitions and Examples
- 1.4.2 Measures and Co-Measures Applied

1.5 Examples Comparing Risk Transfer Measures: *PRT* vs. "Absolute" Risk Measures
- 1.5.1 The Risk Transfer Measures
- 1.5.2 The Subject Business Models
- 1.5.3 The Reinsurance Contracts
- 1.5.4 Risk Transfer Measures Applied to Subject Business
- 1.5.5 Risk Transfer Measures Applied to Quota-Share Contracts
- 1.5.6 Risk Transfer Measures Applied to Structured Aggregate Excess Contracts
- 1.5.7 Conclusion

1.6 Examples Using *PRT* with Various Risk Measures and Co-Measures

Section II – Accounting for Partial Risk Transfer Reinsurance

Section I - Defining and Measuring Risk Transfer in Reinsurance Contracts

1.1 Risk Transfer and Accounting

The effects of risk transfer accounting are subdivided into two basic categories:

- Effects on overall reported equity and income; and
- Effects on reported net premiums and losses.

1.1.1 Risk and Balance Sheets/Income Statements

Effects on overall reported equity and income arise from the accounting for loss reserves.

Loss reserves for most P/C liabilities are recorded at estimated nominal (undiscounted) value, i.e., an estimate of the sum of future outgoing cash flows. It is important to distinguish the reserve from the liability itself. The liability is more complex, the sum total of the insurer's obligations under the relevant policies. The reserve is simply a valuation of the liability, possibly a surrogate for a market value.

If the same future cash flows were not estimates, but simply future payment obligations that were fixed in amount and timing, then it is clear that the value of those obligations would be the discounted value of the future payments, and the liability would be accounted for as such. The accounting difference between an at-risk insurance liability and the corresponding no-risk liability is precisely the discount. The (unrecognized) discount then is the risk load. It exists precisely because the liabilities are subject to insurance risk and would not exist if they were not.

Under an "economic value" accounting concept (not currently applicable under U.S. GAAP or SAP), the implicit risk margin in the unrecognized discount may be replaced by an explicitly discounted reserve and an explicit risk margin. The issues to be discussed subsequently regarding ceding the reserve and its associated risk margin would be equally applicable if the risk margin were converted from implicit to explicit.

The cession of loss reserves and their implicit risk load may have a direct effect on equity (or surplus). The effect on income in any period will be the difference between the effects on the beginning and ending balance sheets, and thus will be controlled by the cession of loss reserves as well.

1.1.2 Risk and Net Premiums and Losses

For shorter tail business, where loss reserves and their implicit risk margin are small, the choice of accounting will have little impact on overall equity or income. However, the characterization of premiums and losses as having been ceded (or not) affects the reported net premiums, losses, and loss reserves. Various measures of capital adequacy used by rating

agencies, regulators, and other publics use net premiums, net losses, net loss reserves, etc. as measures of the risk to which a company is exposed.[2] Accounting for premiums and losses as ceded when the corresponding risk has not been ceded, or has been partially ceded, distorts these measures.

1.1.3 Reinsurance Accounting vs. Deposit Accounting

When accounting for a ceded reinsurance contract (perhaps we should say a purported reinsurance contract), we currently have two options: reinsurance accounting or deposit accounting.

Under reinsurance accounting, reserves are ceded on the same basis that they are established: in most cases at undiscounted, and therefore implicitly risk-loaded, value. As the net recorded liability for the ceded cash flows is reduced to zero, the underlying assumption is clear – that the liability itself has been ceded, both at the recorded estimate and at all other possible outcomes. The risk load has been 100% eliminated, which is appropriate only if 100% of the risk has been ceded. Similarly, since premiums and losses have been 100% ceded, capital adequacy measures, regulatory ratios, etc. also assume a 100% cession of the related risk.

Under deposit accounting, it is assumed that no reinsurance transaction has occurred, in other words, that 0% of the risk has been ceded.

1.1.4 The Relevant Risk

For equity and income, the choice between reinsurance accounting and deposit accounting hinges on whether it is appropriate to eliminate (by cession) the risk load imbedded in the carried loss reserves. To discuss whether this risk has been ceded, we must define the relevant risk more precisely. What risk does this risk load provide for?

The author believes that it is fairly clear that the relevant risk is the risk of inaccuracy in the estimate that is on the balance sheet. If we consider only downside risk to be important, then it is the risk of inadequacy of the estimate. If we view the balance sheet value as a surrogate for market value, the risk load is the amount in addition to the discounted value required to fund the mean losses that an assumer of the liability would require to compensate for the risk of inadequacy in the mean estimate.

This description of risk is consistent with a concept of risk as related to economic or financial losses. The risk as defined above is the risk of the insurer realizing losses subsequent to the statement date related to the loss reserves to be ceded.

[2] This paper does not necessarily endorse the validity of any particular capital adequacy measure. For example, capital adequacy measures that use net premiums as a surrogate for underwriting risk have a number of imperfections and potential distortions that shall not be discussed further.

While the previous paragraphs refer to loss reserves, we will normally view risk prospectively, i.e. at the inception of the reinsurance contract, before statement values are established. How do we define the risk of future losses? If the expected losses create an underwriting loss, then actual losses worse than expected create a future loss. If the expected losses create an underwriting profit, then actual losses worse than breakeven create a future loss.

All further analysis herein will be based on a definition of risk as adverse deviation from actual or expected statement values. For prospective losses, adverse deviation is measured relative to expected losses or underwriting breakeven losses, whichever is higher.

Note that fixed amounts, which create no accounting uncertainty as to their value, are not relevant. In particular, ceded premiums, to the extent that they are not contingent on losses, will be accounted for in their normal straightforward manner with no risk of accounting inaccuracy. The size of those fixed premiums, and therefore of the reinsurer's profit margin, does not affect the question of whether the insurer has retained or ceded the risk for its losses, only the question of at what cost. Whatever the cost, that cost will be expensed under normal accounting procedures, and therefore creates no additional risk for the insurer.

1.1.5 Partial Risk Transfer

Many reinsurance contracts have risk-sharing provisions (e.g., retrospective rating, adjustable commissions, profit sharing, refundable experience accounts), and/or risk limiting provisions (e.g., aggregate limits, sub-limits, additional premiums). These provisions may reduce, but not necessarily eliminate, the transfer of risk. In such cases, neither of the assumptions underlying the available accounting options – 100% risk transfer or 0% risk transfer – is precisely accurate.

The question before us is stated narrowly: Given that we have only these two options, which shall we use? A likely answer is: The one that is more nearly accurate. In other words, does the contract more nearly transfer 100% of the risk or 0% of the risk?

In order to answer this question, we need to estimate, for any reinsurance contract, the portion, or percentage, of the risk that has been transferred ("***PRT***"). In fact, a reasonable definition of ***PRT*** is fairly simple, and the modeling required to estimate the value is no more complex or difficult than the modeling required to perform risk transfer testing under FAS 113 as currently written. Both require the same risk model of the underlying cash flows.

Once the ***PRT*** has been estimated, the choice of accounting treatment can be decided by comparing the ***PRT*** to a critical value. A critical value of 50% would seem to best answer the question of which accounting treatment is more nearly accurate, though other critical values might be chosen.

The above test will provide a practical, intuitive answer to the narrow question which will, in the author's opinion, represent a significant improvement to current practice. It will

minimize the degree of accounting inaccuracy to the extent possible under the constraint that we have only the two accounting treatments to choose from. Nonetheless, it must be recognized that neither of the available accounting treatments is in fact designed for partial risk transfer, and both will be inaccurate to some degree. The definition and estimation of the ***PRT*** can also provide the basis for practical accounting for partial risk transfer. While this is a larger change to current accounting practice, the difficulties that arise from inaccurate accounting for partial risk transfer cannot be eliminated until partial risk transfer reinsurance is formally recognized and appropriate accounting is promulgated.

A previous reference to measuring risk transferred by comparing "before" and "after" distributions is noted in the report of the CAS Valuations, Finance and Investment Committee ("VFIC") [1]. The reference is to an approach described for testing the basis risk in catastrophe derivatives [2].

1.2 The FAS 113 Definition of Risk Transfer – Discussion and Critique

The well known FAS 113 definition of adequate risk transfer is that it must be "*reasonably possible that the reinsurer may realize a significant loss from the transaction*" [3]. The determination must be based on a probabilistic model of all cash flows to the reinsurance contract, whether characterized as losses, premiums, expenses, etc., but transactional expenses and the reinsurer's expenses are not included.[3] The terms "*reasonably possible*" and "*significant loss*" are not specifically defined, but some guidance is given and the well known "10/10" rule is frequently applied to test whether a contract meets the FAS 113 definition.

The 10/10 rule has frequently been discussed and criticized and a number of potentially superior risk measures have been suggested. The author's critique is more fundamental: The FAS 113 definition of risk transfer is fundamentally flawed, not just because of problems with the risk measures, but because the wrong risk is being measured.

The two fundamental defects:

1. The definition of risk transfer does not contain the concept of risk transfer. Rather, the FAS 113 definition sets an absolute standard of the required level of assumed risk. A test of risk transfer requires a comparison of "before" and "after" risk. No single absolute standard can produce results that are meaningful regardless of the riskiness of the underlying cash flows.

2. The definition is influenced by fixed profit margins paid to the reinsurer. As discussed in the previous section, in determining proper accounting from the cedant's perspective, the relevant risk is the risk that the amounts carried in the cedant's

[3] While the definition is stated from the reinsurer's perspective, the exclusion of transactional and reinsurer's expenses actually convert it to the cedant's perspective. A more accurate expression would be "reasonably possible that the *cedant* may realize a significant *gain* from the transaction."

financial statements are inadequate. Fixed profit margins are irrelevant. Furthermore, it is inappropriate for the risk transfer analysis to be influenced by the analyst's implicit second-guessing of the reinsurance pricing, which is unavoidably the case when applying the FAS 113 definition.

Each of these defects is further explored below:

1.2.1 Measuring Risk Rather than Risk Transfer

A problem that may arise from the FAS 113 definition that has been frequently discussed by others is that obvious risk transfers of low risk portfolios may not pass. FAS 113 provides that obvious 100% risk transfer contracts need not be tested. The specific language is that the previous test would not apply if "*the reinsurer has assumed substantially all of the insurance risk relating to the reinsured portion of the underlying insurance contracts*" [3]. Unstructured quota-share contracts are generally accepted to fall within this "safe harbor". While such contracts need not be tested, it would nevertheless be desirable if such contracts would pass the test.

A number of practitioners have explored risk measures that should be superior to the 10/10 rule. Whatever the risk measure, a critical value must be selected, and "obviously risky enough" contracts should pass. Even with a fairly low threshold, unstructured quota-shares of stable, profitable business may still fail – the solution will still be imperfect and the exception will still be required.

But the corresponding problems at the other end of the risk spectrum, which have rarely been explored, may be even more significant. Imagine that the underlying ceded cash flows are extremely risky long-tailed payments. Because of the long tail, the distinction between discounted and undiscounted reserves (the implicit risk margin) is large and the choice of accounting treatment is highly material. Let us further assume that the reinsurance contract is highly structured so that only 20% of the risk is transferred. If we have set the critical value of the risk measure low enough so that a modestly risky quota-share will pass (as we must), then 20% of the risk on these extremely risky cash flows will also pass. If so, the cedant will be eligible for reinsurance accounting and will record on its books a 100% cession of the relevant reserves including a 100% elimination of the risk margin, even though in fact 80% of the risk has been retained -- a material accounting inaccuracy. This example is hardly purely hypothetical.

The example demonstrates that there is no absolute standard of riskiness, no matter how good the risk measure, that can apply equally to all incoming cash flows which themselves contain various degrees of risk. We are doing our best to answer the question that has been posed, but it's the wrong question.

1.2.2 Re-Pricing the Reinsurance

The author has already presented a first principles case that the relevant risk is the risk in the cedant's financial statements, and that fixed premium amounts are irrelevant to the issue of whether the cedant's risk has been transferred. Risk relates only to uncertainty.

A significant problem with the FAS 113 definition is that the risk analysis in this approach inherently includes an opinion on the appropriateness of the reinsurance pricing. There should be no better measurement of value than the actual price agreed to by a willing buyer and a willing seller in a free market. Furthermore, there may be any number of valid reasons, in volatile and cyclical markets, for a buyer to agree to pay a more conservative price at any given time. Accounting should be concerned with properly recording the actual price paid, not passing judgment on it, and any inherent "re-pricing" of the reinsurance is undesirable.

For example, in the past year, we have seen several cases where risk transfer has been questioned by auditors for straightforward casualty excess-of-loss contracts without adjustable provisions. Assuming that the FAS 113 "safe harbor" does not clearly apply in this case, the auditors were simply diligently applying the provisions of FAS 113. In these cases, the FAS 113 test failed simply because the analyst's risk model implied that the reinsurance was overpriced. Apparently, the consensus of the assuming and ceding companies was otherwise.

1.3 The Percentage of Risk Transfer ("*PRT*") Approach

To define ***PRT's*** between 0% and 100%, we first require a definition of 100% risk transfer. The author presumes that the meaning of 0% risk transfer is self-evident, and no more discussion is necessary.

1.3.1 Defining 100% Risk Transfer: Natural vs. Structural Contract Provisions

Practitioners have a fairly good idea regarding the meaning of 100% risk transfer as well. The safe harbor provision of FAS 113 provides a starting point. Recalling that language, the reinsurer must have "*assumed substantially all of the insurance risk relating to the reinsured portion of the underlying insurance contracts.*" The definition may be adequate, but could be clarified. For example, it should be clear that a traditional per-claim excess-of-loss reinsurance contract is covered, even though the per-claim retentions and limits in the reinsurance contract do not necessarily correspond to provisions in the underlying insurance contract, and might not be considered as defining the "*reinsured portion.*" Yet per-claim retentions and limits are not generally believed to be risk-limiting structures.

To more specifically define 100% risk transfer, we introduce the concept of "natural provisions" of a reinsurance contract. These would be generally defined as provisions that do not limit the losses ceded to the contract in a way that the cedant's own liability, as it relates to premiums and losses that would be ceded to such contract, is not similarly limited.

We introduce the term "structural provisions" to refer to provisions that involve risk-limiting or risk sharing. Any reinsurance contract containing only natural provisions would be deemed to contain 100% risk transfer.

The author's suggested list of natural provisions:

- Percentage multipliers (e.g. quota-share, surplus share);
- Deductibles, retentions, limits, on a per claim, per claimant, or per risk or per basis;
- Deductibles, retentions, limits, on a per occurrence basis in some cases;
- Exclusions applied on a policy or coverage basis;
- Deductibles or retentions in the aggregate for all or subsets of the subject losses.

We describe the losses that would be ceded to a contract applying only the natural provisions as being in their "natural form".

Structural provisions are those that limit the ceded losses in ways that the cedant's own liability for such losses is not similarly limited or that create additional cash flows contingent upon the natural form losses. Common provisions of this type include:

- Aggregate limits, applied to the total of natural form losses or sub-limits applying to a subset of the natural form losses;
- Corridors, whether applying to the total natural form losses or a subset;
- Limits on an occurrence basis in some cases;
- Exclusions on a type of claim basis;
- Additional premiums;
- Experience accounts and profit sharing provisions;
- Retrospective rating;
- Sliding scale commissions;
- Limited reinstatements;
- Reinstatement premiums.

Neither list is necessarily exhaustive, and new types of provisions may be developed. Ultimately, the determination of whether a provision is considered natural or structural will have to be made by applying the basic principles. Hopefully, it will usually be a fairly straightforward matter.

Note, for example, that per occurrence limits have been included in both lists. In the context of catastrophe reinsurance, occurrence limits are natural. There is no cession of premiums or losses that implies that a risk has been eliminated when in fact it has not. On the other hand, in the context of quota-share reinsurance, a catastrophe occurrence limit or exclusion is structural. Ceding premiums and losses under the quota-share implies that the risks associated with those premiums and losses are also ceded, and the provision limits the risk that is transferred.

Note that for the most part, aggregate provisions are considered structural. An exception has been suggested for aggregate deductibles or retentions as these are not viewed as risk-limiting.

The reader may notice that the list of structural provisions includes a number of risk-sharing and risk-limiting provisions that are common features of traditional reinsurance. In particular, limited reinstatements and reinstatement premiums are universal in catastrophe reinsurance and common in some other high risk reinsurance; nevertheless, they are technically structural as they limit ceded risk in a way that the cedant's own risk is not limited. However, as commonly practiced, the exhaustion of available reinstatements occurs only at very remote probabilities and reinstatement premiums are not typically a large percentage of ceded losses; therefore, the risk limiting effect of these provisions is not likely to be substantial.

Having now defined 100% risk transfer, we are ready to measure partial risk transfer, for contracts containing structural provisions.

1.3.2 The Applicable Cash Flows

Given that natural provisions are not risk-limiting, the analysis of risk transfer is an analysis of the impact of structural provisions. For ease of expression, we will use the familiar terms "gross", "ceded", and "net", relative to the structural provisions, with all values reflecting the natural provisions.

Let ***L*** be a random vector (i.e. a string of values) representing the cash flows for losses subject to a reinsurance contract.

Let: ***g(L)*** = the net present value of the losses that would be ceded to that contract applying only natural provisions, gross of structural provisions.

For convenience, we have combined the processes of applying the natural provisions and taking the net present value into a single function.

Let: ***c(L)*** = the net present value of the cash flows ceded to the contract, applying all provisions, both natural and structural.

Then: ***n(L)*** = ***g(L) – c(L)*** is the net present value of the decrease in net cash flows to the cedant due to the structural provisions.[4]

[4] Sign convention: Ceded losses under ***g(L)*** and ***c(L)*** have positive values reflecting positive cash flows to the cedant. Positive values of ***n(L)*** reflect decreased cash flows to the cedant due to the structural provisions. For example, if the structural provision is a loss limitation, then ***c(L)*** will sometimes be smaller than ***g(L)***. The resulting positive value of ***n(L)*** indicates an unfavorable cash flow effect. If the structural provision is a premium refund, then ***c(L)*** may sometimes exceed ***g(L)***. The resulting negative value of ***n(L)*** indicates a favorable cash flow effect.

FAS 113 requires that all cash flows, no matter how characterized, be included in the analysis. In the above, all such cash flows would be included in ***c(L)***, and consequently in ***n(L)***. That approach can be used here as well; however, fixed cash flows will have no impact. Only contingent cash flows, i.e. cash flows that can vary based on the value of ***L***, are essential.

1.3.3 The Risk Model

As with FAS 113, we require a risk model giving the probability distribution of ***L*** and the resulting probability distributions of ***g(L)***, ***c(L)***, and ***n(L).***

Given the book of business that the insurer expects to write and intends to cede, and the reinsurer intends to reinsure, the goal of the risk model is to reflect all of the uncertainty in ***L***, including the uncertainty in both the amount and timing of the payments.

Risk is often sub-divided into "process" and "parameter" risk.

Process Risk: Given that ***L*** is the result of a random process, the process risk refers to the risk arising from the randomness of that process. Typically, the random process will be described by a mathematical model which allows the analyst to calculate (often by simulation) the effects of the random process.

Parameter Risk: The remaining risk relates to the uncertainty about the model of the random process. The term "parameter risk" is often used to broadly describe this remaining risk. More generally, the risk relates to the uncertainty in both the parameters and the form of the risk model. For example, if the total of the payments in ***L*** is modeled as a lognormal distribution with a certain mean and variance, there will be uncertainty as to whether the parameters (i.e. mean and variance) are correct as well as whether the lognormal is the correct form for the distribution. The portion of the risk model relating to uncertainty in payment timing may be more complex and more uncertain in its parameters and form.

Underlying types of risk that contribute to parameter risk may include:

- Data Risks: The amount, stability, and applicability of available data.
- Market Risks: Uncertain market impact on pricing, underwriting, risk selection.
- Economic Risks: The impact of uncertain future inflation, employment, etc.

Actual risk model structures and estimation are beyond the scope of this paper.

An important exception is that it would be inappropriate to include the risk that the company will write a different from expected book of business, e.g., a different mix of classes, coverages, policy limits, etc. This is not a risk that reinsurance is necessarily expected to absorb. Reinsurers may include provisions, some of which may be structural in form, to protect them against the cedant altering its book of business. For example, a sub-limit on a hazardous class of business may be set at a level that is remote relative to the intended book,

but would be significantly risk-limiting if that class were to grow dramatically. The impact of the provision is appropriately measured against the intended book only.

1.3.4 Adverse Deviation from Accounting Values

Adverse deviation is defined relative to a base cash flow scenario, corresponding to the expected losses or the underwriting breakeven losses, whichever is higher. Let $\boldsymbol{a}$ be the vector representing the base cash flow stream.

Base Values:

Define the base value for $\boldsymbol{g(L)}$ as $\boldsymbol{b_g = g(a)}$. Again, frequently $\boldsymbol{b_g}$ = $\mathbf{E[}\boldsymbol{g(L)}\mathbf{]}$, but not necessarily in all cases.

Define the base value for $\boldsymbol{n(L)}$ as $\boldsymbol{b_n}$ = the accounting value for the structural provisions under cash flow scenario $\boldsymbol{a}$ (assuming reinsurance accounting).

Note that $\boldsymbol{b_n}$ will often be neither $\boldsymbol{n(a)}$ nor $\mathbf{E[}\boldsymbol{n(L)}\mathbf{]}$, and may frequently be zero. Two examples for illustration:

1. The structural feature is an aggregate limit larger than $\sum\boldsymbol{a}$. $\boldsymbol{n(L)}$ is zero for $\sum\boldsymbol{L} \leq$ the limit, and positive for $\sum\boldsymbol{L}$ > the limit. $\mathbf{E[}\boldsymbol{n(L)}\mathbf{]}$ is therefore positive, but at scenario $\boldsymbol{a}$, the accounting value recorded for $\boldsymbol{n(L)}$ is zero, and thus $\boldsymbol{b_n} = 0$.

2. The structural feature is a premium refund based on an experience account that accrues interest. At scenario $\boldsymbol{a}$, a refund would be due, given accrual of interest, meaning that $\boldsymbol{n(a)}$ would be negative. Further assume that no refund would be due at scenario $\boldsymbol{a}$ if accrual of interest were ignored. Under these circumstances, normally no asset is carried for the premium refund, and therefore $\boldsymbol{b_n} = 0$. If a refund were due at scenario $\boldsymbol{a}$ without accrual of interest, that amount would normally be carried as an asset. If so, that asset would be a negative value of $\boldsymbol{b_n}$.

Adverse Deviation:

The adverse deviations for $\boldsymbol{g(L)}$, $\boldsymbol{n(L)}$, and $\boldsymbol{c(L)}$ are defined as:

$\boldsymbol{d_g = g(L) - b_g}$, if positive, and zero otherwise;
$\boldsymbol{d_n = n(L) - b_n}$, if positive, and zero otherwise; and
$\boldsymbol{d_c = d_g - d_n}$.

Negative values are eliminated for $\boldsymbol{d_g}$ to reflect the basic principal that risk is defined by adverse scenarios. A negative value for $\boldsymbol{d_n}$ indicates that the effect of structural provisions is more favorable than is reflected in the accounting values (typically a premium refund larger than the asset – if any – carried for it), which does not increase the cedant's downside risk.

Negative values for d_n are eliminated so that favorable effects of structural provisions cannot decrease the risk transfer measure.

Note that:

$$g(L) = n(L) + c(L); \text{ and}$$
$$d_g = d_n + d_c.$$

Note also that if fixed cash flows have been included in $c(L)$ and therefore in $n(L)$, they will be identical in the base values and all other values and will not affect the adverse deviations.

In keeping with previously stated principles, these adverse deviations represent the relevant risk we intend to measure.

1.3.5 Risk Measures and Co-Measures I

Given a random variable, X, a risk measure, $r(X)$, is a function applied to the distribution of X that returns a single value.

Next assume that X is itself the sum of a number of random variables, i.e.:

$$X = \sum X_i.$$

For a broad class of risk measures, there are corresponding co-measures that can be applied to the sub-variables X_i.[5] The most common example of a risk measure and co-measure is variance and covariance. Co-measures provide a mathematically sound basis for allocating risk among sub-variables that may be dependant.

For risk measure $r(X)$, denote the corresponding co-measure applied to the sub-variable X_i as $r_i(X_i)$.

The essential property of co-measures is additivity, i.e.:

$$r(X) = \sum r_i(X_i) ,$$

regardless of the nature of any dependencies among the X_i's.

In our specific case, $r(d_g) = r_n(d_n) + r_c(d_c)$. Thus, co-measures provide a basis for allocating the risk in the losses gross of structural provisions to the net and ceded losses after the application of structural provisions.

Another useful property of co-measures is that, for any constant k,

[5] See Kreps [4].

If $X_i = kX$, then $r_i(X_i)/r(X) = k$.

Thus, a co-measure applied to an x% quota-share is x% of the risk measure applied to a 100% share.

A more complete definition of co-measures along with examples of actual risk measures and co-measures follows the next section.

1.3.6 The Percentage of Risk Transferred ("*PRT*")

Simply stated, the ***PRT*** is the portion of the risk associated with the natural losses, gross of the structural provisions, which is still ceded after the application of the structural provisions. Specifically:

Let r be a risk measure with corresponding co-measure.

The percentage of risk transferred is then defined as:

$$PRT = 1.0 - \frac{r_n(d_n)}{r(d_g)}$$

or equivalently,

$$PRT = \frac{r_c(d_c)}{r(d_g)}$$

With ***PRT*** defined, adequate risk transfer to qualify as reinsurance would be defined as a value of ***PRT*** in excess of a selected critical value. A natural choice for the critical value may be 50%, as previously discussed.

1.3.7 Some Advantages of the *PRT* Approach

1. Risk transfer is reduced to a simple single number with an intuitive meaning.

2. Safe harbors for obvious risk transfer contracts are an integral part of the risk transfer definition, rather than exceptions.

3. The approach is equally valid regardless of the relative riskiness of the subject losses.

4. The approach is unaffected by profit margins and expenses. The approach avoids the second-guessing of the reinsurance pricing that is implicit in the FAS 113 definition.

1.4 Risk Measures and Co-Measures II

1.4.1 Definitions and Examples:

Define a risk measure r applied to a random variable X as:

$$r(X) = \mathbf{E}[\, w(X) \cdot l(X) \mid \text{Condition } (X) \,],$$

where l is a linear function and w is a weighting function. Note that the weights, w, may be a function of X and are unrestricted as to form. The condition may also be functionally dependant on X.

For a sub-variable X_i, the corresponding co-measure is:

$$r_i(X_i) = \mathbf{E}[\, w(X) \cdot X_i \mid \text{Condition } (X) \,].^{6}$$

Note that the weights and the condition depend only on X, not X_i, and are identical to the weights and condition in $r(X)$.

As an example, consider variance:

$$\text{Variance}(X) = \mathbf{E}[(X - \mathbf{E}(X))^2] = \mathbf{E}[(X - \mathbf{E}(X)) \cdot (X - \mathbf{E}(X))]$$

In this form, the first occurrence of $(X - \mathbf{E}(X))$ can be considered the weight and the second occurrence the linear function. There is no condition.

Next, consider covariance:

$$\text{Covariance}(X_i, X) = \text{Variance}_i(X_i) = \mathbf{E}[(X - \mathbf{E}(X)) \cdot (X_i - \mathbf{E}(X_i))]$$

Note that the weight is dependant only on X and is identical to the weight used in variance, and the linear function is applied to X_i. Thus, covariance satisfies the definition of a co-measure relative to variance.

By adding a condition, we define the semi-variance:

$$\text{Semi-variance}(X) = \mathbf{E}[\, (X - \mathbf{E}(X))^2 \mid (X > \mathbf{E}(X) \,],$$

with the average restricted to the values greater than the mean. The corresponding co-measure is:

---

[6] This is one formulation consistent with the framework presented in [4]. The separate condition is convenient for our use, but could have been subsumed in the weights.

$$\textbf{\textit{Semi-variance}}_i(X_i) = \mathbf{E}[\,(X - \mathbf{E}(X)) \cdot (X_i - \mathbf{E}(X_i)) \;\big|\; (X > \mathbf{E}(X)\,]$$

Again, the condition is based on X, not X_i.

1.4.2 Measures and Co-Measures Applied

We next consider actual applications, applied to the problem at hand.

Mean Square Adverse Deviation ("MSAD")

Define:

$$MSAD(d_g) = \mathbf{E}[\, d_g^{\,2} \;\big|\; d_g > 0\,].$$

Recall that $d_g = g(L) - b_g$ for positive values. Often, $b_g = \mathbf{E}[g(L)]$, in which case,

$$MSAD(d_g) = Semi\text{-}variance(g(L)).$$

The corresponding co-measure applied to d_n is:

$$MSAD_n\,(d_n) = \mathbf{E}[\, d_n \cdot d_g \;\big|\; d_g > 0\,]$$

The condition is again based on d_g rather than d_n. Therefore, the average may (and often will) include values of $d_n = 0$.

Expected Adverse Deviation ("EAD")

Eliminating the quadratic weight from ***MSAD*** leaves us with the simpler Expected Adverse Deviation:

$$EAD(d_g) = \mathbf{E}[\, d_g \;\big|\; d_g > 0\,],$$

with the corresponding co-measure:

$$EAD_n(d_n) = \mathbf{E}[\, d_n \;\big|\; d_g > 0\,].$$

Tail Value at Risk ("TVaR")

TVaR is a popular risk measure for capital adequacy. It is similar to ***EAD***, except the borderline condition is a percentile of the distribution. Normally, relatively high percentiles are used, reflecting a belief that the most significant risk is exposure to extreme events.

Define ***VaR-p*** (d_g), the "Value at Risk," as the p^{th} percentile of the distribution of d_g.

Then,

$$\textbf{\textit{TVaR-p}}(d_g) = \mathbf{E}[\, d_g \mid d_g > \textbf{\textit{VaR-p}}(d_g) \,]$$

with the corresponding co-measure:

$$\textbf{\textit{TVaR-p}}_n(d_n) = \mathbf{E}[\, d_n \mid d_g > \textbf{\textit{VaR-p}}(d_g) \,]$$

Of the above three choices, the author's preference is for ***MSAD***.

TVaR and other tail-oriented measures are often used for measuring capital needs. In the context of measuring risk transfer, the measures have several drawbacks. One is that the selected percentile is arbitrary, which may not be desirable for a single measure to be widely applied. Another is that these measures, when used with relatively high percentiles, are responsive only to a small portion of the distribution, and many structural risk-limiting provisions may be ignored.

EAD is at the other end of the spectrum, considering the entire downside of the distribution without any greater weight to values in the tail. Most models for pricing risk assume that more extreme values have greater impact.

MSAD, like ***EAD***, includes the entire downside of the distribution, and will therefore be responsive to any risk limiting provisions. ***MSAD*** is quadratically weighted, so that values toward the tail of the distribution have more impact. It is a relatively conventional risk measure, closely related to semi-variance, with the difference that deviations are measured from an accounting value which may differ from the mean.

Some practitioners believe that the quadratic weighting of ***MSAD*** does not give sufficient weight to the tail. The structure of co-measures can accommodate more complex weighting schemes, including tail-heavier weights, as well as risk loading methods based on transformations of the probability distribution, such as the Wang Transform [].

1.5 Examples Comparing Risk Transfer Measures: *PRT* vs. "Absolute" Risk Measures

The following examples use four measures to evaluate risk transfer: ***PRT*** and three different "absolute" risk measures. The absolute measures in this case refer to risk measures applied to the distribution of reinsurer's profit, as defined by FAS 113. They are described as absolute measures since they apply to the riskiness of a single distribution, as contrasted with ***PRT*** which is based on a comparison of riskiness in "before" and "after" distributions.

The measures are applied to four different illustrative models of underlying subject losses with different degrees of volatility, and up to five different reinsurance contract structures.

1.5.1 The Risk Transfer Measures

In all cases below, the reinsurer's result is calculated according to the FAS 113 rules, i.e., the net present value of all cash flows to the reinsurer, however characterized, but without deducting transaction costs and without allowance for the reinsurer's internal expenses. All present values are at 4%. We will characterize a net loss to the reinsurer as a negative result.

1. **VaR-90**: The reinsurer's result as a percentage of ceded premium at the 90th percentile (adverse) of the distribution (given the above sign convention, this is actually the 10th percentile). Applying a critical value of -10% yields the "10/10" rule.

2. **TVaR-90**: The expected value of the reinsurer's result as a percentage of ceded premium, given reinsurer's result less than VaR-90.

   There is no standard critical value. 10% of the ceded premium has been suggested as a "more correct" 10/10 rule; however this is invariably less strict than the 10/10 rule. The VFIC paper suggests -25%, though this seems unusually high.[7] A range of -10% to -15% appears more in line with other measures.

3. **Expected Reinsurer's Deficit ("ERD")**: The expected value of the reinsurer's result as a percentage of ceded premium, given a reinsurer's result less than zero, multiplied by the probability that the reinsurer's losses are greater than zero. Equivalently:

$$ERD = \int_{x<0} xf(x)dx \Big/ NPV(Cededpremium)$$

   Again, there is no standard critical value. In subsequent discussion we will use a range of -1.0% to -2.0%.

4. ***PRT***, using ***MSAD*** as the risk measure.

1.5.2 The Subject Business Models

In all cases, the aggregate loss distribution is presumed to be lognormal. Payment patterns are at fixed percentages for all scenarios.

M1: Low volatility, short payment pattern.

[7] The VFIC paper calculates a TVaR-90 of 42% for a quota-share with 10% volatility, similar to one of the examples used herein. However, that quota-share may be under priced. A graph appears to indicate that the reinsurer's median discounted profit is zero, meaning that the reinsurer's mean profit will be less than zero, even before consideration of transaction costs or the reinsurer's internal expenses. This illustrates the difficulties with using risk transfer measures sensitive to the reinsurance pricing.

M2: Modest volatility, modest payment pattern.

M3: Higher volatility, longer payment pattern (e.g., primary casualty).

M4: High risk, long payment pattern (e.g., excess casualty).

Table 1 below summarizes the assumptions for the various models:

Table 1
Summary of Subject Business Models

		Model			
		M1	M2	M3	M4
Premium		$100	$100	$100	$100
Expenses		$30	$30	$30	$30
Expected Losses		$68	$69	$73	$83
CV		5%	10%	20%	40%
Underwriting Profit		2.0%	1.0%	-3.0%	-13.0%
Profit Including Discount		3.6%	4.3%	6.0%	11.3%
Payout	1	90%	50%	20%	1%
	2	10%	30%	20%	3%
	3		15%	10%	5%
	4		5%	10%	7%
	5			10%	7%
	6			10%	7%
	7			8%	7%
	8			6%	7%
	9			4%	7%
	10			2%	6%
	11				6%
	12				6%
	13				6%
	14				5%
	15				5%
	16				5%
	17				4%
	18				3%
	19				2%
	20				1%

The assumptions are illustrative, not based on any specific source. In the author's opinion, none of the subject business is assumed to be unusually profitable.

1.5.3 The Reinsurance Contracts

Quota-Share Contracts:

C1: With aggregate limit 35% over expected losses.
C2: With aggregate limit 10% over expected losses.
C3: With "corridor" (losses not covered) from 5% to 15% over expected losses and aggregate limit 35% over expected losses.

Table 2
Quota-Share Contracts

Contract		Model M1	M2	M3	M4
C1	Ceded Premium	$100	$100	$100	$97
	Ceding Commission	30%	30%	30%	30%
	Loss Ratio at Limit	103%	104%	108%	118%
C2	Ceded Premium	$100	$100	$97	$92
	Ceding Commission	30%	30%	30%	30%
	Loss Ratio at Limit	78%	79%	83%	93%
C3	Ceded Premium	$100	$99	$97	$94
	Ceding Commission	30%	30%	30%	30%
	Loss Ratio at Limit	103%	104%	108%	118%
	Loss Ratio at Corridor Bottom	73%	74%	78%	88%
	Loss Ratio at Corridor Top	83%	84%	88%	98%

Note that the ceding commission rate has been set equal to the expense ratio on the subject business. Ceded premiums have been reduced from $100 proportional to the reduction in expected losses from limits and corridors.

Structured Aggregate Excess of Loss Contracts:

C4: Aggregate retention and limit;
Attaches within expected losses;
Upfront premium plus additional premiums as a percentage of ceded losses;
Fixed margin is deducted from upfront premium;
Refundable experience account accrues interest at 4%.

C5: Same as C4, plus another layer of additional premiums on subject losses extending beyond the policy limit.

Table 3 Structured Aggregate Excess of Loss Contracts			
		Model	
Contract		M3	M4
C4	Upfront Premium	$9.00	$5.50
	Margin	$3.00	$4.00
	Retention	63.0%	76.0%
	Loss Ratio at Limit	98.0%	136.0%
	A.P.Rate	59.0%	47.5%
	AP Attachment L/R	73.0%	83.0%
	AP Exhaustion L/R	98.0%	136.0%
C5	2nd A.P.Rate	12.5%	12.5%
	2nd AP Attachment L/R	93.0%	126.0%
	2nd AP Exhaustion L/R	113.0%	146.0%

These contracts have no ceding commission.

1.5.4 Risk Transfer Measures Applied to Subject Business

Before applying the risk transfer measures to the reinsurance contracts, it is interesting to first apply these measures to the subject business to be ceded (excluding ***PRT***, which is not defined in this case)

Table 4 Summary of Risk Transfer Measures Applied to Subject Business				
	Model			
	M1	M2	M3	M4
Loss Probability	14.15%	24.91%	28.97%	25.50%
VaR-90	-0.73%	-4.35%	-10.85%	-19.13%
TVaR-90	-2.46%	-7.98%	-19.54%	-38.73%
ERD	-0.26%	-1.09%	-2.85%	-5.13%

The difficulties with the absolute risk transfer measures can be anticipated. All measures produce values well below any likely threshold for M1A. 10% volatility without unusual profitability seems like a level of risk that should "pass", but the 10/10 rule and **TVaR-90** fail for M2A as well, while the **ERD** passes only marginally at the low end of the range.

1.5.5 Risk Transfer Measures Applied to Quota-Share Contracts

We next apply the various measures to the three quota-share reinsurance contracts.

Table 5
Summary of Risk Transfer Measures
Quota-Share Contracts

Contract		Model M1	M2	M3	M4
C1	Loss Probability	13.83%	24.78%	29.27%	29.19%
	PRT-MSAD	100.00%	100.00%	94.85%	63.86%
	VaR-90	-0.71%	-4.17%	-10.88%	-17.77%
	TVaR-90	-2.43%	-7.94%	-17.78%	-21.60%
	ERD	-0.26%	-1.06%	-2.65%	-3.82%
C2	Loss Probability	13.83%	24.78%	34.86%	34.27%
	PRT-MSAD	98.98%	78.65%	51.44%	31.72%
	VaR-90	-0.70%	-4.35%	-6.49%	-7.24%
	TVaR-90	-2.33%	-5.40%	-7.48%	-9.95%
	ERD	-0.25%	-0.83%	-1.77%	-1.91%
C3	Loss Probability	13.83%	27.69%	34.86%	25.12%
	PRT-MSAD	67.99%	52.21%	62.16%	48.82%
	VaR-90	-0.68%	-1.53%	-5.65%	-14.22%
	TVaR-90	-1.26%	-2.38%	-12.60%	-17.72%
	ERD	-0.14%	-0.43%	-1.66%	-2.88%

The contract C1 aggregate limit 35% over the mean has no discernable impact when applied to the lower volatility M1 and M2 models. As the volatility increases with M3 and M4, the risk limiting impact of the aggregate limit increases. This effect can be seen as the percentage of risk transferred decreases to 95% for M3 and down to 64% for the volatile M4 model.

The C1 contract applied to M1 fails the risk transfer test for all of the absolute risk measures, even though substantially all the risk is transferred. For M2, most still fail or marginally pass. As the underlying business gets riskier in the M3 and M4 models, results on these risk transfer tests improve significantly, even as the aggregate limit becomes less remote and has more risk limiting impact. The tests based on absolute risk measures are more sensitive to the level of risk in the underlying business than to the degree of risk transfer.

The same pattern persists as we move to more significant risk limiting features. In each case, the risk limiting impact of the features becomes more significant when applied to the higher volatility cash flows, as is reflected in the declining ***PRT***. In each case, the absolute risk measures increase due to the increased underlying risk, even though a smaller percentage of that risk is being transferred.

1.5.6 Risk Transfer Measures Applied to Structured Aggregate Excess Contracts

While risk transfer measures based on absolute risk levels may often "fail" a contract which transfers nearly all the risk when it is applied to relatively stable business, the effect is just the opposite when applied to higher volatility business. In these cases, contracts with features that eliminate most of the risk can still pass. Consider the application of the highly structured reinsurance contracts C4 and C5 to the riskier cash flows of models M3 and M4.

Table 6
Summary of Risk Transfer Measures
Structured Aggregate Excess Contracts

		Model	
Contract		**M3**	**M4**
C4	**Loss Probability**	**24.80%**	**21.16%**
	PRT-MSAD	**22.89%**	**18.35%**
	VaR-90	**-10.51%**	**-10.91%**
	TVaR-90	**-15.76%**	**-21.00%**
	ERD	**-2.53%**	**-3.09%**
C5	**Loss Probability**	**24.80%**	**21.16%**
	PRT-MSAD	**19.36%**	**13.19%**
	VaR-90	**-10.74%**	**-10.73%**
	TVaR-90	**-11.56%**	**-11.91%**
	ERD	**-2.17%**	**-1.94%**

In the case of C4, only 23% and 18% of the risk is transferred for M3 and M4, respectively. Yet the 10/10 test is a marginal pass and the other tests would also appear to pass at likely critical values

Even though less than 25% of the risk is transferred, the C4 contracts are fairly risky for the reinsurer, especially relative to their small margins. The accounting distortion is that the losses accounted for as ceded are oversized relative to the risk absorbed by the reinsurer.

The C4 contract leaves the reinsurer with substantial tail risk, which is addressed in C5. Another layer of additional premium attaches just above the 90th percentile and extends

beyond the policy limit, protecting the reinsurer from the acceleration risk caused by worsening loss ratios beyond the policy limit. The technique succeeds in further risk reduction, now bringing the ***PRT***'s to 19% and 13%. Yet the 10/10 rule is unaffected (as intended in the design of the feature). The more sophisticated **TVaR** and **ERD** tests respond to the additional risk reduction, with the more tail-oriented **TVaR** showing the greater effect. Despite the additional risk limitations, the **ERD** still produces a passing score and the **TVaR** may as well, depending on choice of critical value.

1.5.7 Conclusion

In conclusion, the ***PRT*** test appears to logically and consistently identify the impact of structural features that limit risk transfer. The measures based on absolute standards invariably underestimate risk transfer for more stable subject business and overestimate risk transfer for more volatile subject business.

1.6 Examples Using *PRT* with Various Risk Measures and Co-Measures

The following tables present the results of ***PRT,*** applied to the same models and contracts as the previous section**,** with one exception. We have removed the aggregate limit from the 3rd contract (the corridor). We use the following risk measures (with their corresponding co-measures):

- ***MSAD***
- ***EAD***
- ***TVaR-90***
- $\boldsymbol{TVaR_{95}}$
- $\boldsymbol{TVaR_{99}}$

The results are presented without a great deal of additional comment. With each risk measure, the pattern of ***PRT'***s as the risk models and contracts change conform to a reasonable pattern of decreasing risk transfer as the risk-limiting provisions become more significant.

Table 7
PRT's -- Comparison of Risk Measures
Quota-Share Contracts

Contract		Model M1	M2	M3	M4
C1	MSAD	100.00%	100.00%	94.85%	63.86%
	EAD	100.00%	100.00%	97.92%	78.14%
	TVaR-90	100.00%	100.00%	95.84%	61.56%
	TVaR95	100.00%	100.00%	93.13%	52.25%
	TVaR98	100.00%	100.00%	85.94%	43.72%
C2	MSAD	98.98%	78.65%	51.44%	31.72%
	EAD	99.63%	87.82%	64.46%	43.90%
	TVaR-90	99.47%	76.45%	44.00%	29.53%
	TVaR95	99.16%	64.80%	38.16%	25.37%
	TVaR98	98.31%	54.41%	32.65%	21.27%
C3	MSAD	67.51%	40.25%	61.89%	83.62%
	EAD	79.97%	46.61%	55.05%	71.67%
	TVaR-90	71.55%	34.37%	64.16%	84.14%
	TVaR95	58.01%	34.00%	70.58%	87.42%
	TVaR98	46.51%	41.60%	75.93%	90.01%

Table 8
PRT's -- Comparison of Risk Measures
Structured Aggregate Excess Contracts

Contract		Model M3	M4
C4	MSAD	22.89%	18.35%
	EAD	23.84%	17.93%
	TVaR-90	23.23%	19.27%
	TVaR95	21.76%	18.85%
	TVaR98	19.53%	17.50%
C5	MSAD	19.36%	13.19%
	EAD	21.71%	14.52%
	TVaR-90	18.97%	13.31%
	TVaR95	15.85%	11.35%
	TVaR98	12.82%	10.41%

The results are not identical, however. The measures respond to the "heart" and the "tail" of the distribution to different degrees, consistent with their design. Some observations:

- In most cases ***MSAD*** produces results similar to ***TVaR-90***.

- Aggregate limits affect only the tail of the distribution, and are most penalized by the more tail-oriented ***TVaR*** measures, for example the low aggregate limit of the C2 contract applied to the moderately high risk M3 model.

- The combination of low corridor and no limit (C3), when applied to high risk models M3 and M4, decreases risk more in the heart of the distribution than the tail. In this case, the least tail-oriented measure, ***EAD***, indicates the greatest reduction in risk transfer.

- The first highly structured contract, C4, dramatically reduces risk in the heart and the tail of the distribution and all measures are similar.

- The second highly structured contract, C5, has an additional feature that mitigates the tail risk. Especially for risk model M4, risk transfer is significantly lowered. The effect of the tail-protecting feature is the smallest for the EAD and the largest for the more tail-oriented measures.

In conclusion, ***PRT*** is demonstrated to work acceptably well with a variety of risk measures. Assuming that it is desirable to have a single measure to be used universally, the author's preference continues to be for ***MSAD***, which works consistently and appears to strike the best compromise between responsiveness to the whole downside of the distribution and emphasis on the significance of the tail.

Section II – Accounting for Partial Risk Transfer Reinsurance

2.1 The Need for Continuous Accounting --The Unresolved Problem

The problem addressed so far is to find the best possible solution given the significant accounting constraint that there are two types of accounting available – one that is appropriate for 100% risk transfer and another for 0% risk transfer – and that our only option is to choose one or the other. The difference between these approaches can sometimes be very large – and for large enough contracts it can be material to the company's financial statements.

If the difference between the two accounting treatments is material, then it is likely that half that difference is material as well. Regardless of which accounting treatment is used, the accounting for a contract with 50% risk transfer will be materially inaccurate, one way or another. The author's suggestion of a critical value of 50% to define adequate risk transfer is simply to cut the worst case inaccuracy to the lowest possible number.

Using the 50% critical value, there could continue to be motivation to design 51% risk transfer contracts to take advantage of the 100% risk transfer accounting. 49% risk transfer contracts are no less problematic. The cedant may get no credit in its financial statements or solvency tests for a significant reduction in risk. And a reinsurer that assumes a 49% risk transfer contract that is ineligible for reinsurance accounting will be assuming significant risk while its financial statements reflect that it has assumed none.

Another significant problem is the point of discontinuity itself. If the difference in accounting treatment has a large impact, and the estimated ***PRT*** is close to the critical value, then a large material difference will turn on a decision requiring a precision of estimation that simply doesn't exist.

There is no adequate solution within the constraints of currently available accounting. What is required is appropriate accounting for partial risk transfer contracts. The availability of ***PRT*** can provide a basis for accounting for partial risk transfer reinsurance.

2.2 Goals of Partial Risk Transfer Accounting

In order of priority, the author has considered the following two goals of appropriate accounting for partial risk transfer:

- Income statements and balance sheets that are undistorted in total, i.e., accurate total income and equity; and
- Proper characterization of ceded premiums and ceded losses.

2.3 Proportional Bifurcation

Insurance risk arises from losses, and ***PRT*** has been calculated as the portion of the risk from losses that has been transferred. Appropriate accounting would be to record this same proportion of the losses as ceded. As noted much earlier, the effect of reinsurance accounting on income and equity is entirely related to the cession of loss reserves. Given an estimate of ***PRT***, the most accurate total effect on income and equity would be ***PRT*** multiplied by the effect that would have occurred under 100% reinsurance accounting.

The simplest approach, which would require no new development of basic accounting rules, is to apply a weighted average of the two accounting procedures already available, i.e. proportional bifurcation. The approach would be to simply divide all 100% values proportional to ***PRT*** and ***1-PRT***, with the amounts proportional to ***PRT*** accounted for as reinsurance and the amounts proportional to ***1-PRT*** accounted for using deposit accounting.

This approach will satisfy the objective of undistorted equity and income for partial risk transfer accounting. Net losses will be proportional to the net loss risk retained as well, so the objective will be satisfied for net and ceded losses as well.

Net premiums resulting from the proportional subdivision of premiums will not be perfectly reflective of net underwriting risk retained. However, the approximation will probably be adequate. If required, a more complex procedure could be developed to determine proper ceded premium more accurately. If this were done, any required adjustments to the premium accounts as determined under proportional bifurcation, would have to be accomplished with no impact on net income.

2.3.1 What Contracts Should Be Bifurcated?

While proportional bifurcation is probably the most easily implemented approach to continuous accounting, it would nevertheless increase accounting workloads and it makes sense to limit its application. Many reinsurance contracts have structural features that have modest risk-limiting effects. At the other extreme, there may be some contracts determined to have minimal risk transfer. In order to avoid unnecessary bifurcation, the author suggests that contracts with ***PRT*** > 80% or ***PRT*** < 20% be accounted for with reinsurance accounting or deposit accounting, respectively, with bifurcation limited to 20%<***PRT***<80%.

Such a threshold would also reduce the need for unnecessary testing. It will be fairly obvious in some cases that structural provisions will not reduce risk transfer by more than the threshold value, and minimal testing may be required.

2.3.2 Should Risk Transfer Be Reevaluated?

For the theoretical perfection of the concept, it should. In practice, this would certainly appear to be an idea to be avoided.

Nevertheless, the amount of remaining risk transferred for ceded loss reserves can change as the contract progresses over time. The theoretically indicated reevaluation would not be from inception, but only prospectively relating to remaining loss reserves. To the extent the ***PRT*** changed, that change would affect only the remaining loss reserves, not the any previously accounted for amounts, such as premiums or loss payments.

The theoretical change in the remaining risk transferred can be illustrated with a simple aggregate limit example. Suppose that an aggregate limit set above the expected loss ratio is originally estimated to have a 40% risk-limiting effect (i.e. 60% ***PRT***). Two years later, the ultimate losses are known with much more accuracy and have developed to below expected. The aggregate limit now appears quite remote and 95% of the remaining risk is transferred. Or conversely, losses have been much worse than expected and ultimate losses are now estimated to be at the aggregate limit, leaving no more coverage available. To the extent that there are still ceded reserves, almost none of the risk related to the remaining reserves is transferred. While these situations may be realistic, it would be hard to imagine that the increase in accounting accuracy would warrant reevaluating risk transfer on all contracts.

But perhaps it should be considered in a few special cases. An obvious candidate is a multi-line contract combining long and short tail business. For example, assume that such a contract, mixing property and casualty but not readily bifurcated in the more traditional sense, is estimated at its inception to transfer 50% of the risk and is accounted for with a 50% proportional bifurcation. Let us further assume that almost all the risk comes from exposure to property catastrophes, and that at the end of the year there has been no such catastrophe. There may be a significant cession of casualty reserves at a discount, but little or no risk transfer remaining. Conversely, if property catastrophe losses have occurred, a much larger degree of risk may be ceded on the remaining casualty reserves.

2.4 Comments on Related Topics

2.4.1 Over-Funding

A common technique for reducing risk to the reinsurer is over-funding, i.e., charging a conservative premium with refund provisions. The refund may be based on an "experience account" which includes interest credited on ceded funds. This technique may allow a reinsurer and cedant to come to terms without resolving differences of opinion on likely losses, or may simply be used to lower the risk premium charged.

Over-funding may be accomplished by charging a large upfront premium, through a contingent additional premium feature, or a combination of the two. To the extent that contingent additional premiums are charged, the outgoing cash flows will be included in the calculation of percentage of risk transferred and the value of ***PRT*** will be reduced.

To the extent that over-funding is accomplished through an increase in upfront premiums, it will probably have no effect on the risk transfer calculation, as only downside risks are

measured, and premium refunds usually have no impact This may appear counterintuitive, as over-funding clearly reduces the risk to the reinsurer.

Nevertheless, contingent refunds cannot cause a future loss for the cedant. To the extent that the risk related to ceded losses is covered by the reinsurance, it is appropriate to cede the losses and their associated risk margin, i.e. to apply reinsurance accounting. Whether the risk related to the ceded losses is covered from funds provided by the cedant or risk taken by the reinsurer is immaterial. As long as the cedant has expensed the premiums ceded, there is no increased risk of inadequacy in the financial statement values.

Under current accounting, the cedant records an asset for future refunds only to the extent that the current ceded loss estimate indicates that a refund will be due *without including future investment income credited to an experience account*. This asset, when applicable, prevents over-funding from causing a deferral of income. The exclusion of future investment income is also necessary – including it in the calculation of the asset would have a similar effect to discounting the loss reserve while retaining the risk.

In conclusion, premium refunds are not important when determining ***PRT*** since they do not affect downside risk. When reinsurance accounting is applied to reinsurance that includes over-funding, the net effects on balance sheets, income statements, and ceded losses are undistorted.[8]

2.4.2 Accounting for Retroactive Reinsurance

There are substantial restrictions in GAAP and Statutory accounting when the liabilities ceded are related to losses incurred in the past, e.g., loss portfolio transfers ("LPT's"). In fact, GAAP essentially applies deposit accounting to all retroactive reinsurance, as if no risk transfer is possible. This punitive accounting undoubtedly has its historical roots in past abuses, but otherwise appears to have no sound basis.

LPT's are often legitimate risk transfer motivated reinsurance contracts. There are any number of valid motivations, such as moving risky liabilities to better diversified and capitalized companies. LPT's are still done despite punitive accounting. But it would be hard to imagine that the accounting is not suppressing the market for legitimate retroactive reinsurance.

As we have demonstrated in the examples, FAS 113 is not effective in preventing financial engineering for prospective reinsurance, nor would it be for retroactive reinsurance if the present restrictions were eliminated. The improved accounting recommended herein would

[8] Overall equity and income will be undistorted, as will ceded losses and loss reserves. Conceivably, ceded premiums may be overstated to some degree. Methodology could probably be developed to estimate the overstatement of ceded premiums and then classify a portion of the ceded premium as some other type of expense. As with other imperfections on the premium side, it is doubtful that this problem is significant enough to warrant such a special procedure.

effectively prevent the type of abuses that were committed long ago, and the punitive accounting, which is itself highly inaccurate, could be eliminated.

2.4.3 Policing and Questionnaires

Punitive accounting for retroactive reinsurance under GAAP might be considered an example of policing by accounting – the idea is not to account accurately, but to prevent abuse.

Regulators have more direct police powers. Insurance executives may have to increasingly describe the intent of reinsurance transactions. While improved disclosure by financial executives is beneficial, the author is not entirely comfortable with police powers to regulate intent.

With more accurate accounting, regulation of intent would be less necessary. Bad behavior will still be possible; policing will still be needed. But with better accounting rules, policing can be about following the rules.

References

[1] CAS Valuation, Finance, and Investments Committee, "Accounting Rule Guidance Statement of FAS No. 113 – Considerations in Risk Transfer Testing", Casualty Actuarial Society Forum, Volume: Fall, 2002, pp. 305-338

[2] AAA Index Securitization Task Force, "Evaluating the Effectiveness of Index-Based Insurance Derivatives in Hedging Property/Casualty Insurance Transactions", October 4, 1999

[3] FAS 113

[4] Kreps, Rodney J., "Riskiness Leverage Models", Details to come.

Steven B. Goldberg, ACAS, MAAA

Request for Suggestions on
Risk Transfer Analysis

This is in response to your request on the above captioned. The comments that follow are personal and do not necessarily reflect the opinions of AXA Liabilities Managers, the AXA Group, or affiliated companies.

I am responding to your question #3, *"What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract (i.e. in what instances is risk transfer "reasonably self-evident" and therefore cash flow testing is not necessary to demonstrate risk transfer)?"*

At AXA Reinsurance Company in 1999, we designed a filtering system to designate contracts that did or did not require a full risk transfer analysis.

The following types of contracts were designated for actuarial review:

- Any contract containing a retrospective element (covering events already occurred)
- Any contract where amount and timing risk were not obviously present
- Multiple-year retrospectively rated treaties (EITF 93-6)

Remaining contracts above the materiality threshold were subjected to the following questions to determine reasonable possibility of significant loss:

- Is there a historical year that produced a significant loss to the treaty?
- For Property treaties could a $15 billion industry loss produce a significant loss to the treaty?
- What scenario would cause a significant loss to the treaty, and is this scenario reasonably possible?

A "yes" answer to any of the three questions above were considered "safe harbors" so that a full risk transfer analysis was not necessary.

Please let me know if you have any questions or comments. Thanks for your efforts on this important subject.

Todd J. Hess, FCAS, MAAA

In response to the request from COPLFR for views on risk transfer, I want to share some thoughts. This is my personal view and is not a position of Swiss Re.

The biggest source of difficulty in assessing risk has been the definition of "a reasonable possibility of significant loss". That assessment should be based on a reasonable amount of risk being transferred such as could be measured using some of the risk measures identified in actuarial literature such as value at risk, or tail value at risk, etc. The current role of judgment (from management on to the auditors) is an important part of the risk transfer rules. Applying an actuarially based measure of risk can be applied within the existing SSAP 62 and FAS 113 guidance. On this basis, the current risk transfer rules are sufficient.

Risk transfer analysis generally includes a review of the full spectrum of present value results and their associated probabilities. Risk transfer should be possible for various relationships between size and probability of loss--not only when there is a 10% chance of a 10% loss. The 10/10 criteria or any other “bright line” test has never been included in any accounting guidance, nor should it be. While it has proven a reasonable measure, it frequently leads to inappropriate conclusions. In particular, any policy or underlying portfolio of policies that has less than a 10% chance of loss would not meet a 10/10 test. In most states, obvious exceptions such as catastrophe covers and facultative certificates are already exempt from proving risk transfer, largely due to the paragraph 11 exception.

There are other cases where there is clearly risk because the size of loss transferred makes the likelihood of such loss unimportant. In cases where there is clear risk as measured by alternative measures, such as value at risk, the transaction should pass risk transfer even if there is less than a 10% chance of loss. Analysis of risk reduction to the cedant can help evaluate other transactions where the appropriateness of reinsurance accounting requires closer scrutiny.

Three scenarios describe the relationship that I think should be considered to determine "a reasonable possibility of significant loss":

1. A low probability, low severity transaction should pass risk transfer if the underlying book were similarly stable.

2. A very unstable book could be insured by a reinsurance transaction that was low probability but high severity.

3. Deposit accounting should be used for large variability underlying business protected by a low probability, low severity "reinsurance" transaction.

If the committee would like to discuss these views further, please call me.

Lawrence Katz, FCAS, MAAA

In response to the request from COPLFER for views on risk transfer, I want to share my views which are shared by some of my colleagues, but as you can appreciate, is not an opinion of Swiss Re.

The general guidance for risk transfer currently in SSAP 62 and FAS 113 is principle based guidance which is appropriate in most situations. However, those individuals who are interpreting the guidance and performing the risk transfer analyses must be knowledgeable and fully informed of all the relevant facts and circumstances relating to the agreement being tested. Proper application of the guidance requires professional judgment with consideration of all the facts and an appreciation of the complete output of the cash flow modeling including the full spectrum of the risk/probability curve. No "bright line" test (10/10 or otherwise) should be used. Keying in on one number (i.e. the 10^{th} percentile loss) is not proper in any analysis nor is it sufficient to access the amount of risk transfer in a transaction. All loss scenarios with their respective probabilities should be reviewed and all information should used to make an informed judgment in the risk transfer testing.

In addition, I believe that making specific rules would only lead to the design of products to circumvent those rules. Providing general guidance leaves the assessment of risk transfer to the judgment of the company's actuary, underwriter, and auditor on a case by case basis, which is completely appropriate as no two reinsurance contracts are the same and no specific rule could possible apply to all contracts all of the time.

Furthermore, the current guidance does not specify what methodology should be used in measuring the risk in a transaction (besides stating that all cash flows should be taken into account), and I do not believe that the specific methods should be outlined in the guidance. Different situations call for different methods and the selection of the method and measure used should be left to the judgment of the company's actuary, underwriter, and external auditor.

We must keep in mind that measuring the risk transfer in a transaction is not an exact science, and we should not try or assume we can make it one. The analysis and selection of loss reserves and potential variability of these selections can never be known with certainty at the outset and so, the assessment of the transfer of risk in a reinsurance contract cannot be required to pass an absolute and numerically defined standard.

Also keep in mind that the proposed additional disclosure by the NAIC related to so called "finite" business should improve the transparency of the effect of these transactions in the financial statements.

If the committee would like to discuss these views further, please call me.

David Koegel, ACAS, MAAA

Re: Request for Suggestions on Risk Transfer Analysis

"The most important questions of life are, for the most part, really only problems of probability." (Pierre Simon Marquis de Laplace, "Théorie Analytique des Probabilités", 1812)

This letter is in response to the June 13, 2005 memorandum from the American Academy of Actuaries requesting suggestions from P/C actuaries regarding analysis of risk transfer in reinsurance agreements. It addresses (1) probability of loss and (2) question #3 of the memorandum relating to exemption from a full risk transfer analysis in certain instances.

Probability of Loss in Insurance and Reinsurance

Insurance and reinsurance are intended to provide for indemnification of the insured or reinsured (the "ceding entity") against sudden and unforeseen losses, the probability of which cannot be precisely determined in advance. The possibility of an insurer or reinsurer sustaining a loss under any insurance or reinsurance agreement may range from remote (e.g., earthquake insurance) to likely (e.g., life insurance). The primary determinant of indemnification against loss or liability in an insurance or reinsurance agreement is not the degree to which the insurer or reinsurer is likely to sustain a loss over the term of the agreement, but rather the extent to which the injured or damaged party is indemnified once losses have occurred. A common misconception in attempting to evaluate risk transfer in reinsurance is that probability of loss is a precise measure. For many lines of insurance, probability of loss estimates are imprecise largely due to difficulties in accurately assessing dispersion around expected losses based on historical averages for an individual risk or aggregation of risks. Requiring a minimum probability of loss standard to qualify as reinsurance, such as the 10% threshold below which many industry professionals interpret to mean not "reasonably possible", is not necessarily in the best interest of preserving insurer solvency. For example, consider a reinsurance agreement in which the reinsurer requires the ceding entity to maintain specified rate levels on business reinsured that are estimated to generate an underwriting profit under most outcomes. In order to minimize cost to the ceding entity, the agreement also places a limit on the reinsurer's potential loss in exchange for a limit on the reinsurer's potential profit by providing for a refund to the ceding entity of a portion of the premium paid if experience is favorable. Disqualifying such agreement from reinsurance accounting treatment based primarily on an assessment that probability of loss to the reinsurer is not high enough would cause the ceding entity to (i) decline entering into the agreement resulting in a lost opportunity to protect itself against unforeseen adverse experience, or (ii) negotiate modified terms to increase the probability of loss to the reinsurer likely resulting in rate level adequacy deterioration for both the ceding entity and reinsurer. Furthermore, modification of contract terms for the sole purpose of increasing probability of loss to the reinsurer increases the cost of reinsurance to the ceding entity. Accordingly, in instances where significant loss potential to the reinsurer is reasonably self-evident, cash flow testing of the reinsurance agreement to determine whether sufficient risk has been transferred should not be necessary.

Reasonable Self-Evidence of Significant Loss Potential to the Reinsurer

Reasonable self-evidence of significant loss potential to the reinsurer and exemption from cash flow testing to determine sufficiency of risk transfer in a reinsurance agreement requires both of the following:

a) Maximum premium receivable by the reinsurer no greater than 50% of the maximum loss payable by the reinsurer, both premium and loss amounts being valued on an undiscounted basis; and

b) With respect to the reinsured portions of the underlying insurance agreements, no provisions that reduce the possibility of loss to the reinsurer compared to the possibility of loss to the ceding entity had it not entered into the reinsurance agreement.

- Maximum premium receivable by the reinsurer includes any retrospective adjustments, reinstatement premiums or other additional consideration (after deducting any ceding commission paid or payable by the ceding entity to the reinsurer) without regard to how such premium or other consideration are described or characterized.

- Provisions in a reinsurance agreement that reduce the possibility of loss to the reinsurer are deemed not to include contractual rights of the ceding entity that may be exercised only at its sole option and not under control or direction of the reinsurer (e.g., unilateral right to commute the agreement for a refund if experience is favorable).

Conclusion

The American Academy of Actuaries' active role in the ongoing dialogue concerning regulation of reinsurance transactions is commendable. The subject of risk transfer testing is complex and requires significant intellectual and technical input from the actuarial profession. However, as a practical matter, developing effective criteria and tests that can be consistently applied in all cases to evaluate whether sufficient risk has been transferred in a reinsurance agreement is likely to remain elusive. To mitigate unintended consequences and unnecessary costs in performing cash flow testing for many reinsurance agreements, placing less emphasis on probability of loss and implementation of standards for self-evidence of risk transfer should be seriously considered. Additionally, a concerted effort to narrow the disparity between current regulatory financial ratio thresholds on a gross vs. net of reinsurance basis may further facilitate achievement of a workable solution to narrow gaps that currently exist between the reporting and economic substance of certain reinsurance transactions.

Please note that the comments contained in this letter represent my personal views and not necessarily the views of my employer, Imagine Advisors Inc. or its affiliates. I hope that the commentary will be useful to the Risk Transfer Subgroup in preparing its report to the NAIC.

Nicholas H. Pastor, FCAS, MAAA

Subject: **Request for Suggestions on Risk Transfer Analysis**

This letter is in response to your request for suggestions from property/casualty actuaries regarding the analysis of risk transfer in reinsurance agreements. Please note that this response is based on my own personal opinion and in no way reflects the opinion of my employer or the Casualty Actuarial Society.

I will respond in order to each of the four questions detailed in your letter of June 13, 2005.

1) What is an effective test for risk transfer?

An effective test for risk transfer would specify contractual requirements and limitations that must exist and contain specific definitions of the likelihood and magnitude of risk that must be assumed by the reinsurer. Examples of potential contractual requirements and limitations are:

a) Only a limited percentage (say, 25%) of the insurance risk can be ceded by the reinsurer back to the original cedant (including any affiliate of the cedant).

b) Any side agreements (outside the main contract) must be disclosed and specifically considered in the analysis.

Specific definitions of the likelihood and magnitude of risk that must be assumed are discussed in the response to question 2) below.

2) *What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer?*

The test should have different guidelines for different classes of reinsurance treaties. I would propose a minimum of three classes of treaties: Quota Share, Catastrophe Excess of Loss, and Other Excess of Loss. The latter category could be further split into categories such as aggregate stop loss, retrospective, and per risk if deemed necessary; however, the criteria indicated below would not vary for such sub-categories.

a) Quota Share
   i. Contracts with no aggregate limits, additional premiums, or any other loss-sensitive provisions should be given a safe harbor, regardless of the likelihood of loss.
   ii. Quota share contracts with aggregate limits or other loss-sensitive provisions where the maximum combined ratio is in excess of 200% should be given a safe harbor, regardless of the likelihood of loss.

iii. Other contracts should contain a combined level of risk transfer[1] equal to at least 2%.

b) Catastrophe Excess of Loss
   i. Any contract whose predominant risk of loss comes from catastrophic events (either natural or man-made, including terrorism) where the maximum combined ratio is in excess of 200% should be given a safe harbor, regardless of the likelihood of loss.
   ii. Other contracts should contain a combined level of risk transfer equal to at least 2%.

c) Other Excess of Loss
   i. All contracts should contain a combined level of risk transfer equal to at least 2%.

3) *What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract?*

Various safe harbors are noted above (2.a.i, 2.a.ii, 3.b.i). Beyond such, it may be more desirable to specify conditions where a full risk transfer analysis **is** required. I would propose that any contract containing one or more of the following provisions have a requirement for cash flow testing:

a) Any contract involving a retrocession (of any amount) back to the original cedant.
b) Any contract where a side agreement is in place.
c) Any contract containing a funds withheld or experience account with a guaranteed interest-crediting rate.
d) Any contract where the ratio of the reinsurer's aggregate limit (including expenses) to aggregate premiums (including any additional premiums or reinstatements) is less than 200%.
e) Any contract with a limitation on the timing of recoveries.

Other contracts that do not contain one of the above provisions, but also do not fall into one of the specified safe harbor provisions, would still be required to meet the combined 2% risk transfer requirement; however, the extent of testing that is required could be at the discretion of the reviewer.

4) *What are the advantages and disadvantages of the suggested approach versus other approaches commonly used?*

Currently, I am not aware of any "standard" approaches to testing risk transfer, other than the "10/10" rule. The significant advantage that I see in the above approach is

[1] The combined level of risk transfer is defined as the probability of a specific loss occurring multiplied by the magnitude of that loss (on a present value basis). Hence, the 2% requirement can be met by having any combination of probability times magnitude equaling 2% (e.g. a 20% chance of a 10% loss, a 2% chance of a 100% loss, etc.).

that it would specifically address and require analysis of many of the common issues that significantly influence the level of risk transfer in reinsurance contracts, while exempting contracts where such analysis is unlikely to be necessary. This differs from the current environment where specific types of contracts are not generally included or exempted by rule.

A potential disadvantage of the approach above is that the existence of specific guidelines could encourage some companies to search for potential loopholes. However, provisions that would allow external review wherever deemed necessary could address this issue.

One final comment is that the guidelines should require that any detailed cash-flow analysis be subject to the Actuarial Standards of Practice, regardless of whether or not the analysis is performed by a credentialed actuary.

Thank you for your consideration. If you have any questions or would like to have further discussion, feel free to contact me at (212) 497-9608 or by e-mail at npastor@clarendon-ins.com.

John Pierce, FCAS, MAAA

I have no particular expertise on this issue. However, I do want to comment on the importance of the safe-harbor issues, and on the practical importance of the committee's work on this topic.

Example 1. AIG buys financial reinsurance from General Re, and everyone involved knows that this transaction doesn't pass any reasonable test of risk transfer. Eventually the transaction is exposed, and people at AIG and General Re suffer negative consequences -- bad publicity, job loss, civil and criminal prosecutions.

Example 2. My client Insurer Y buys a quota share reinsurance treaty with Reinsurer X. This treaty has maximum and minimum loss ratios, as well as contingent commissions. However, it's not one of these deals which disappears one day after year-end or which involves retrospective additional premiums. In addition, my client tells me that they have submitted a copy of the treaty to the Department of Insurance. The client also tells me "This treaty is not financial reinsurance". Everyone involved believes this treaty is OK. Eventually (about a year later) the DOI comes back to my client and tells them this treaty does not meet the DOI's standard for transfer of risk.

I feel sorry for the people in Example 1, but I have to admit that they "deserve" the negative consequences which they are now suffering.

I am worried that, without your committee's work, the current climate has a potential for a McCathy-ism with respect to reinsurance transactions -- and even an average actuary (like me in Example 2) will be subject to negative consequences which are not deserved. Your work on "safe harbors" is therefore important to the average practicing actuary.

In short, I don't have any answers -- but I am very happy that you are working on the questions.

Shaun Wang, PhD, FCAS, MAAA

In responding to the Requests for Suggestions on Risk Transfer Analysis, I would like to suggest two methods for testing risk transfer. Both methods require some modeling of the profit-loss distribution of the reinsurance contract. Detailed explanations of both methods are provided in the accompanying Excel documents.

Method #1 proposes a transformed 10-10 rule that gives either "pass" or "fail" test result. The transformed 10-10 rule overcomes some of the obvious drawbacks in the original 10-10 rule. However, it still leaves room for debates; for instance, what to do if the test result is at the borderline between "pass" and "fail", given the uncertainties in the risk modeling assumptions.

Method #2 applies so-called *right-tail deviation* to quantify how much risk transfer is contained in a reinsurance contract. The right-tail deviation measures down-side risk, and exhibits better properties than the standard deviation. We can use a multiple of the right-tail deviation to calculate "*the dollar amount of reinsurance premium that qualifies for risk transfer*." We can select the multiple so that for most standard reinsurance contracts 100% of the premiums can qualify for risk transfer. For a truly finite contract, this method would indicate that less than 100% of premium qualifies for risk transfer. This method has the advantage of preventing companies bending the rule by combining business that has little risk transfer with a super-cat cover, just for the purpose of meeting the 10-10 rule.

When considering any mechanical method for testing risk transfer, we should keep in mind that reinsurance contacts have more functions than pure risk transfer. For instance, a quota share treaty may involve a lot of dollar trading, but nevertheless facilitates sharing of claims-handling and underwriting expertise. Failing a mechanical risk-transfer test should not automatically imply the contract being finite.

I would advice the Committee to do additional testing using real-life examples. In recommending any method that requires risk modeling, it is critical to provide some guidance and benchmark risk parameters by lines of business and by type of contracts.

Wang Transform 10–10 Rule

The 10–10 rule is rather reasonable for testing "risk transfer" for contracts with *normal* loss distributions. However, for contracts where the reinsuer's loss distribution is non-normal, the 10-10 rule can yield absurd implications, and should be replaced by more appropriate rules.

Back in 2002, I recommend to the CAS VFIC Committee an easy and effective fix of the simple 10-10 rule so that it is applicable to contracts with non-normal distributions, and avoid the mischief created by the simple 10-10 rule.

My proposed method is as follows:
Let X represent the ROP (return on premium) of the contract to the reinsurer, when this is negative and zero otherwise. For this variable X with distribution F, define a new risk-measure as follows:

Step 1: For a pre-selected security level α=10%, apply the Wang Transform:
$F^*(x) = \Phi [\Phi^{-1}(F(x)) + \Phi^{-1}(0.1)]$,
where $\Phi(x)$ is the standard normal cumulative distribution function, and $\Phi^{-1}(u)$ is the inverse normal distribution function.

Step 2: Calculate the expected value under $F^*(x)$:
$WT(\alpha) = E^*[X]$, or simply the expected value of X under the transformed distribution $F^*(x)$.

Step3: If $WT(\alpha) < -10\%$, it passes the test, otherwise it fails the test.

When X has a normal distribution, $WT(\alpha)$ is identical to the 100α-th percentile for the normal distribution. This gives us the original simple 10-10-rule for normally distributed loss distribution. For distributions that are non-normal, $WT(\alpha)$ may correspond to a percentile higher or lower than α, depending on the shape of the distribution. In fact, the Wang Transform can combine the frequency and severity information to yield a synthetic indicator of the overall riskiness of the contract.

This Excel Spreadsheet gives some examples of how the Wang Transform 10-10 rule performs.

In Excel, the Wang Transform with α=10% of a probability u (0<u<1) is:
NORMSDIST(NORMSINV(u) + NORMSINV(0.1))

References:

1) The readers are referred to the CAS Valuation, Finance, and Investment Committee Report: http://www.casact.org/pubs/forum/02fforum/02ff305.pdf

   Indeed, Examples 1-3 in this Excel Workbook resembles that of the CAS report.

2) Paul Brehm and Gary Venter gave a PowerPoint presentation on this subject: www.casact.org/coneduc/clrs/2002/handouts/venter1.ppt

Special thanks go to:

- Paul Brehm
- Gary Venter
- John Kulik
- Todd Bault
- Don Mango
- Phil Heckman

Example 1. Property Catastrophe Excess of Loss

An insurance company has exposure to southeastern U.S. hurricanes. Standard industry catastrophe models were applied, and the following catastrophe loss event cdf (in grean-shaded cells) was produced

10 - 10 - rule

Ceded Reinsurance

Limt	**50,000,000**	Exp Loss	Premium			
	xs	2,350,333	23,503,329	**Lambda**	**-1.282**	
Retention	**15,000,000**	Exp LossRatio	**10.00%**			

Threshold	**10.00%**

Y --- Negative Reinsurance ROP	
Pr(ROP<-10%)	**E*[Y]**
0.00%	**-26.01%**
Failed 10-10-rule	***Passed WT 10-10-rule***

Probability				**Reinsurer**	**Negative**		
F(x)	**Gross Loss**	**Ceded Loss**	**Loss Ratio**	**NPV**	**ROP**	**F*(x)**	**f*(x)**
0.001	63	0	0.00%	0.00%	0.00%	0.000	0.000
0.005	85	0	0.00%	0.00%	0.00%	0.000	0.000
0.010	528	0	0.00%	0.00%	0.00%	0.000	0.000
0.025	2,877	0	0.00%	0.00%	0.00%	0.001	0.000
0.050	26,160	0	0.00%	0.00%	0.00%	0.002	0.001
0.100	95,939	0	0.00%	0.00%	0.00%	0.005	0.003
0.200	302,299	0	0.00%	0.00%	0.00%	0.017	0.012
0.300	607,426	0	0.00%	0.00%	0.00%	0.035	0.019
0.400	1,146,366	0	0.00%	0.00%	0.00%	0.062	0.027
0.500	2,001,899	0	0.00%	0.00%	0.00%	0.100	0.038
0.600	3,185,892	0	0.00%	0.00%	0.00%	0.152	0.052
0.700	4,925,404	0	0.00%	0.00%	0.00%	0.224	0.073
0.800	8,150,810	0	0.00%	0.00%	0.00%	0.330	0.106
0.900	15,632,088	632,088	2.69%	2.59%	0.00%	0.500	0.170
0.950	24,206,066	9,206,066	39.17%	37.66%	0.00%	0.642	0.142
0.975	38,072,833	23,072,833	98.17%	94.39%	0.00%	0.751	0.109
0.990	67,451,525	50,000,000	212.74%	204.55%	-104.55%	0.852	0.101
0.995	83,683,074	50,000,000	212.74%	204.55%	-104.55%	0.902	0.050
0.999	126,792,315	50,000,000	212.74%	204.55%	-104.55%	0.965	0.063
1	163,627,870	50,000,000	212.74%	204.55%	-104.55%	1.000	0.035

Summary of Test Results			
Expected Loss Ratio	**Reins Premium**	**WT(0.10)**	**WT 10-10 rule**
50.00%	4,700,666	-282.77%	pass
10.00%	23,503,329	-26.01%	pass
8.00%	29,379,162	-15.83%	pass
7.00%	33,576,185	-10.74%	pass
6.00%	39,172,215	-5.65%	fail
5.00%	47,006,659	-0.57%	fail
4.00%	58,758,323	0.00%	fail

Example 2: Quota Share Reinsurance

In this example, an insurance company seeks a 50% quota share protection on its accident year results. For the upcoming year, this company forecasts:

Written Premium	$1,000
Earned Premium	1,000
Accident Year Loss Ratio	75%
Ceding Commission	30%

We assume the loss ratio is distributed lognormally with a mean of 75% and a c.v. of 10%. The quota share treaty has a 30% ceding commission. Assume the premiums and the commissions are paid evenly through out the year.

Example 2. Quota Share

Direct Premium	$1
Loss Ratio	**75%**
Interest Discount	96%
Discounted LR	72%
CV	**10.0%**
Comm	**30%**
Threshold	**10.0%**
lambda	1.282
mu	-0.333
sigma	0.100
	80%

Y --- Negative Reinsurance ROP		10
Pr(ROP<-10%)	E*[Y]	-
16.35%	-12.48%	10
Passed 10-10-rule	*Passed WT10-10-rule*	- rule

Loss Ratio	Neg ROP	F(x)	f(x)	F*(x)	f*(x)
0	0%	0.0000	0.0000	0.000	0.000
1.00%	0%	0.0000	0.0000	0.000	0
2.00%	0%	0.0000	0.0000	0.000	4.2E-215
3.00%	0%	0.0000	0.0000	0.000	0
4.00%	0%	0.0000	0.0000	0.000	9.5E-201
5.00%	0%	0.0000	0.0000	0.000	1.9E-172
6.00%	0%	0.0000	0.0000	0.000	6E-151
7.00%	0%	0.0000	0.0000	0.000	6.7E-134
8.00%	0%	0.0000	0.0000	0.000	5.8E-120
9.00%	0%	0.0000	0.0000	0.000	2.6E-108
10.00%	0%	0.0000	0.0000	0.000	2.08E-98
11.00%	0%	0.0000	0.0000	0.000	7.28E-90
12.00%	0%	0.0000	0.0000	0.000	2.08E-82
13.00%	0%	0.0000	0.0000	0.000	7.68E-76
14.00%	0%	0.0000	0.0000	0.000	5.22E-70
15.00%	0%	0.0000	0.0000	0.000	8.55E-65
16.00%	0%	0.0000	0.0000	0.000	4.19E-60
17.00%	0%	0.0000	0.0000	0.000	7.31E-56
18.00%	0%	0.0000	0.0000	0.000	5.2E-52
19.00%	0%	0.0000	0.0000	0.000	1.69E-48
20.00%	0%	0.0000	0.0000	0.000	2.78E-45
21.00%	0%	0.0000	0.0000	0.000	2.49E-42
22.00%	0%	0.0000	0.0000	0.000	1.31E-39
23.00%	0%	0.0000	0.0000	0.000	4.22E-37
24.00%	0%	0.0000	0.0000	0.000	8.87E-35
25.00%	0%	0.0000	0.0000	0.000	1.26E-32
26.00%	0%	0.0000	0.0000	0.000	1.27E-30
27.00%	0%	0.0000	0.0000	0.000	9.21E-29
28.00%	0%	0.0000	0.0000	0.000	5E-27
29.00%	0%	0.0000	0.0000	0.000	2.08E-25
30.00%	0%	0.0000	0.0000	0.000	6.8E-24
31.00%	0%	0.0000	0.0000	0.000	1.77E-22
32.00%	0%	0.0000	0.0000	0.000	3.76E-21
33.00%	0%	0.0000	0.0000	0.000	6.58E-20
34.00%	0%	0.0000	0.0000	0.000	9.65E-19
35.00%	0%	0.0000	0.0000	0.000	1.2E-17
36.00%	0%	0.0000	0.0000	0.000	1.28E-16
37.00%	0%	0.0000	0.0000	0.000	1.19E-15
38.00%	0%	0.0000	0.0000	0.000	9.66E-15
39.00%	0%	0.0000	0.0000	0.000	6.93E-14
40.00%	0%	0.0000	0.0000	0.000	4.43E-13
41.00%	0%	0.0000	0.0000	0.000	2.54E-12
42.00%	0%	0.0000	0.0000	0.000	1.32E-11
43.00%	0%	0.0000	0.0000	0.000	6.19E-11
44.00%	0%	0.0000	0.0000	0.000	2.66E-10
45.00%	0%	0.0000	0.0000	0.000	1.05E-09
46.00%	0%	0.0000	0.0000	0.000	3.83E-09
47.00%	0%	0.0000	0.0000	0.000	1.3E-08
48.00%	0%	0.0000	0.0000	0.000	4.08E-08
49.00%	0%	0.0001	0.0000	0.000	1.2E-07
50.00%	0%	0.0002	0.0001	0.000	3.32E-07
51.00%	0%	0.0003	0.0002	0.000	8.63E-07
52.00%	0%	0.0007	0.0003	0.000	2.12E-06
53.00%	0%	0.0013	0.0006	0.000	4.93E-06
54.00%	0%	0.0023	0.0010	0.000	1.09E-05
55.00%	0%	0.0040	0.0017	0.000	2.29E-05
56.00%	0%	0.0068	0.0027	0.000	4.59E-05
57.00%	0%	0.0110	0.0042	0.000	8.8E-05
58.00%	0%	0.0171	0.0061	0.000	0.000162

Summary of Test Results

CV	Pr(ROP<-10%)	10-10 rule	E*[Y]	WT 10-10 rule
15.00%	24.30%	pass	-17.99%	pass
10.00%	16.35%	pass	-12.48%	pass
8.00%	11.48%	pass	-10.36%	pass
7.00%	8.66%	fail	-9.32%	fail
5.00%	2.99%	fail	-7.29%	fail

59.00%	0%	**0.0258**	**0.0087**	0.001	0.000286
60.00%	0%	**0.0377**	**0.0119**	0.001	0.000485
61.00%	0%	**0.0535**	**0.0158**	0.002	0.000795
62.00%	0%	**0.0736**	**0.0202**	0.003	0.001256
63.00%	0%	**0.0987**	**0.0251**	0.005	0.00192
64.00%	0%	**0.1291**	**0.0303**	0.008	0.002843
65.00%	0%	**0.1647**	**0.0356**	0.012	0.004081
66.00%	0%	**0.2054**	**0.0408**	0.018	0.005687
67.00%	0%	**0.2509**	**0.0455**	0.025	0.007707
68.00%	0%	**0.3004**	**0.0495**	0.036	0.010164
69.00%	0%	**0.3532**	**0.0527**	0.049	0.013063
70.00%	0%	**0.4081**	**0.0549**	0.065	0.016377
71.00%	-1%	**0.4640**	**0.0559**	0.085	0.020047
72.00%	-2%	**0.5199**	**0.0559**	0.109	0.023986
73.00%	-3%	**0.5746**	**0.0547**	0.137	0.028074
74.00%	-4%	**0.6272**	**0.0526**	0.169	0.032173
75.00%	-5%	**0.6769**	**0.0497**	0.205	0.036131
76.00%	-6%	**0.7230**	**0.0461**	0.245	0.039792
77.00%	-7%	**0.7651**	**0.0421**	0.288	0.043009
78.00%	-8%	**0.8030**	**0.0378**	0.334	0.045655
79.00%	-9%	**0.8365**	**0.0335**	0.381	0.04763
80.00%	-10%	**0.8657**	**0.0292**	0.430	0.048866
81.00%	-11%	**0.8908**	**0.0251**	0.480	0.049334
82.00%	-12%	**0.9121**	**0.0213**	0.529	0.049039
83.00%	-13%	**0.9299**	**0.0178**	0.577	0.048023
84.00%	-14%	**0.9447**	**0.0148**	0.623	0.046355
85.00%	-15%	**0.9567**	**0.0121**	0.667	0.044128
86.00%	-16%	**0.9665**	**0.0097**	0.709	0.041448
87.00%	-17%	**0.9742**	**0.0078**	0.747	0.038431
88.00%	-18%	**0.9804**	**0.0061**	0.782	0.035192
89.00%	-19%	**0.9852**	**0.0048**	0.814	0.03184
90.00%	-20%	**0.9889**	**0.0037**	0.843	0.028475
91.00%	-21%	**0.9917**	**0.0029**	0.868	0.02518
92.00%	-22%	**0.9939**	**0.0022**	0.890	0.022027
93.00%	-23%	**0.9955**	**0.0016**	0.909	0.019068
94.00%	-24%	**0.9968**	**0.0012**	0.925	0.01634
95.00%	-25%	**0.9977**	**0.0009**	0.939	0.013866
96.00%	-26%	**0.9983**	**0.0007**	0.951	0.011655
97.00%	-27%	**0.9988**	**0.0005**	0.960	0.009708
98.00%	-28%	**0.9992**	**0.0003**	0.968	0.008015
99.00%	-29%	**0.9994**	**0.0003**	0.975	0.006561
100.00%	-30%	**0.9996**	**0.0002**	0.980	0.005326
101.00%	-31%	**0.9997**	**0.0001**	0.985	0.004289
102.00%	-32%	**0.9998**	**0.0001**	0.988	0.003428
103.00%	-33%	**0.9999**	**0.0001**	0.991	0.002718
104.00%	-34%	**0.9999**	**0.0000**	0.993	0.00214
105.00%	-35%	**0.9999**	**0.0000**	0.995	0.001674
106.00%	-36%	**1.0000**	**0.0000**	0.996	0.0013
107.00%	-37%	**1.0000**	**0.0000**	0.997	0.001003
108.00%	-38%	**1.0000**	**0.0000**	0.998	0.000769
109.00%	-39%	**1.0000**	**0.0000**	0.998	0.000585
110.00%	-40%	**1.0000**	**0.0000**	0.999	0.000443
111.00%	-41%	**1.0000**	**0.0000**	0.999	0.000334
112.00%	-42%	**1.0000**	**0.0000**	0.999	0.00025
113.00%	-43%	**1.0000**	**0.0000**	0.999	0.000186
114.00%	-44%	**1.0000**	**0.0000**	1.000	0.000138
115.00%	-45%	**1.0000**	**0.0000**	1.000	0.000102
116.00%	-46%	**1.0000**	**0.0000**	1.000	7.44E-05
117.00%	-47%	**1.0000**	**0.0000**	1.000	5.43E-05
118.00%	-48%	**1.0000**	**0.0000**	1.000	3.94E-05
119.00%	-49%	**1.0000**	**0.0000**	1.000	2.85E-05
120.00%	-50%	**1.0000**	**0.0000**	1.000	2.05E-05
121.00%	-51%	**1.0000**	**0.0000**	1.000	1.47E-05
122.00%	-52%	**1.0000**	**0.0000**	1.000	1.05E-05
123.00%	-53%	**1.0000**	**0.0000**	1.000	7.46E-06
124.00%	-54%	**1.0000**	**0.0000**	1.000	5.28E-06
125.00%	-55%	**1.0000**	**0.0000**	1.000	3.73E-06
126.00%	-56%	**1.0000**	**0.0000**	1.000	2.62E-06
127.00%	-57%	**1.0000**	**0.0000**	1.000	1.83E-06
128.00%	-58%	**1.0000**	**0.0000**	1.000	1.28E-06
129.00%	-59%	**1.0000**	**0.0000**	1.000	8.9E-07

130.00%	-60%	1.0000	0.0000	1.000	6.17E-07
131.00%	-61%	1.0000	0.0000	1.000	4.27E-07
132.00%	-62%	1.0000	0.0000	1.000	2.94E-07
133.00%	-63%	1.0000	0.0000	1.000	2.02E-07
134.00%	-64%	1.0000	0.0000	1.000	1.38E-07
135.00%	-65%	1.0000	0.0000	1.000	9.45E-08
136.00%	-66%	1.0000	0.0000	1.000	6.44E-08
137.00%	-67%	1.0000	0.0000	1.000	4.38E-08
138.00%	-68%	1.0000	0.0000	1.000	2.97E-08
139.00%	-69%	1.0000	0.0000	1.000	2E-08
140.00%	-70%	1.0000	0.0000	1.000	1.35E-08
141.00%	-71%	1.0000	0.0000	1.000	9.1E-09
142.00%	-72%	1.0000	0.0000	1.000	6.11E-09
143.00%	-73%	1.0000	0.0000	1.000	4.09E-09
144.00%	-74%	1.0000	0.0000	1.000	2.73E-09
145.00%	-75%	1.0000	0.0000	1.000	1.82E-09
146.00%	-76%	1.0000	0.0000	1.000	1.21E-09
147.00%	-77%	1.0000	0.0000	1.000	8.07E-10
148.00%	-78%	1.0000	0.0000	1.000	5.35E-10
149.00%	-79%	1.0000	0.0000	1.000	3.54E-10
150.00%	-80%	1.0000	0.0000	1.000	2.34E-10
151.00%	-81%	1.0000	0.0000	1.000	1.54E-10
152.00%	-82%	1.0000	0.0000	1.000	1.01E-10
153.00%	-83%	1.0000	0.0000	1.000	6.71E-11
154.00%	-84%	1.0000	0.0000	1.000	4.43E-11
155.00%	-85%	1.0000	0.0000	1.000	2.83E-11
156.00%	-86%	1.0000	0.0000	1.000	1.84E-11
157.00%	-87%	1.0000	0.0000	1.000	1.22E-11
158.00%	-88%	1.0000	0.0000	1.000	8.4E-12
159.00%	-89%	1.0000	0.0000	1.000	5.19E-12
160.00%	-90%	1.0000	0.0000	1.000	1.04E-11
161.00%	-91%	1.0000	0.0000	1.000	0
162.00%	-92%	1.0000	0.0000	1.000	0
163.00%	-93%	1.0000	0.0000	1.000	0
164.00%	-94%	1.0000	0.0000	1.000	0
165.00%	-95%	1.0000	0.0000	1.000	0
166.00%	-96%	1.0000	0.0000	1.000	0
167.00%	-97%	1.0000	0.0000	1.000	0
168.00%	-98%	1.0000	0.0000	1.000	0
169.00%	-99%	1.0000	0.0000	1.000	0
170.00%	-100%	1.0000	0.0000	1.000	0
171.00%	-101%	1.0000	0.0000	1.000	0
172.00%	-102%	1.0000	0.0000	1.000	0
173.00%	-103%	1.0000	0.0000	1.000	0
174.00%	-104%	1.0000	0.0000	1.000	0
175.00%	-105%	1.0000	0.0000	1.000	0
176.00%	-106%	1.0000	0.0000	1.000	0
177.00%	-107%	1.0000	0.0000	1.000	0
178.00%	-108%	1.0000	0.0000	1.000	0
179.00%	-109%	1.0000	0.0000	1.000	0
180.00%	-110%	1.0000	0.0000	1.000	0
181.00%	-111%	1.0000	0.0000	1.000	0
182.00%	-112%	1.0000	0.0000	1.000	0
183.00%	-113%	1.0000	0.0000	1.000	0
184.00%	-114%	1.0000	0.0000	1.000	0
185.00%	-115%	1.0000	0.0000	1.000	0
186.00%	-116%	1.0000	0.0000	1.000	0
187.00%	-117%	1.0000	0.0000	1.000	0
188.00%	-118%	1.0000	0.0000	1.000	0
189.00%	-119%	1.0000	0.0000	1.000	0
190.00%	-120%	1.0000	0.0000	1.000	0
191.00%	-121%	1.0000	0.0000	1.000	0
192.00%	-122%	1.0000	0.0000	1.000	0
193.00%	-123%	1.0000	0.0000	1.000	0
194.00%	-124%	1.0000	0.0000	1.000	0
195.00%	-125%	1.0000	0.0000	1.000	0
196.00%	-126%	1.0000	0.0000	1.000	0
197.00%	-127%	1.0000	0.0000	1.000	0
198.00%	-128%	1.0000	0.0000	1.000	0
199.00%	-129%	1.0000	0.0000	1.000	0
200.00%	-130%	1.0000	0.0000	1.000	0

Example 3: Quota Share With Sliding Scale

In this example, all underlying numbers are the same as in the quota share example in Example 2. This time, however, we add a loss-offset contact term.With the same provisional ceding commission of 30%, now we add on a sliding scale adjustment:

For every 1% additional loss ratio between 70% and 80% loss ratio (the lower and upper bounds of the sliding scale range), the reinsurer will reduce the ceding commission by 0.6% (the slope of sliding scale is 0.6). Putting in mathematical terms, the final adjusted ceding commission is calculated by

$$CedingComm\ isson = \begin{cases} 30\%, & if \quad LR < 70\% \\ 30\% - 0.6(LR - 70\%), & if \quad 70\% < LR < 80\% \\ 24\% & if \quad 80\% < LR \end{cases}$$

The sliding scale feature apparently reduces the amount of risk transfer.
But how will the sliding scale terms affect the "risk-transfer test"?

Example 3. Quta Share With Sliding Scale

Direct Premium	$1
Loss Ratio	75%
Interest Discount	96%
Discounted LR	72%
CV	10%
Comm+Broke	30%
Threshold	10.0%
lambda	1.282
mu	-0.333
sigma	0.100
Sliding Range	70%
	80%
Sliding Slope	0.600

Y --- Negative Reinsurance ROP	
Pr(ROP<-10%)	E*[Y]
5.53%	-7.69%
Failed Simple 10-10-rule	*Failed WT 10-10 Rule*

	Ceding Co. Loss Ratio	Reins Comm+expense	Negative ROP (return on premium)	F(x)	f(x)	F*(x)	f*(x)
	0	0.3	0%	0.0000	0.0000	0.000	0.000
	1.00%	0.3	0%	0.0000	0.0000	0.000	0
	2.00%	0.3	0%	0.0000	0.0000	0.000	4.2E-215
	3.00%	0.3	0%	0.0000	0.0000	0.000	0
	4.00%	0.3	0%	0.0000	0.0000	0.000	9.5E-201
	5.00%	0.3	0%	0.0000	0.0000	0.000	1.9E-172
	6.00%	0.3	0%	0.0000	0.0000	0.000	6E-151
	7.00%	0.3	0%	0.0000	0.0000	0.000	6.7E-134
	8.00%	0.3	0%	0.0000	0.0000	0.000	5.8E-120
	9.00%	0.3	0%	0.0000	0.0000	0.000	2.6E-108
	10.00%	0.3	0%	0.0000	0.0000	0.000	2.08E-98
	11.00%	0.3	0%	0.0000	0.0000	0.000	7.28E-90
	12.00%	0.3	0%	0.0000	0.0000	0.000	2.08E-82
	13.00%	0.3	0%	0.0000	0.0000	0.000	7.68E-76
	14.00%	0.3	0%	0.0000	0.0000	0.000	5.22E-70
	15.00%	0.3	0%	0.0000	0.0000	0.000	8.55E-65
	16.00%	0.3	0%	0.0000	0.0000	0.000	4.19E-60
	17.00%	0.3	0%	0.0000	0.0000	0.000	7.31E-56
	18.00%	0.3	0%	0.0000	0.0000	0.000	5.2E-52
	19.00%	0.3	0%	0.0000	0.0000	0.000	1.69E-48
	20.00%	0.3	0%	0.0000	0.0000	0.000	2.78E-45
	21.00%	0.3	0%	0.0000	0.0000	0.000	2.49E-42
	22.00%	0.3	0%	0.0000	0.0000	0.000	1.31E-39
	23.00%	0.3	0%	0.0000	0.0000	0.000	4.22E-37
	24.00%	0.3	0%	0.0000	0.0000	0.000	8.87E-35
	25.00%	0.3	0%	0.0000	0.0000	0.000	1.26E-32
	26.00%	0.3	0%	0.0000	0.0000	0.000	1.27E-30
	27.00%	0.3	0%	0.0000	0.0000	0.000	9.21E-29
	28.00%	0.3	0%	0.0000	0.0000	0.000	5E-27
	29.00%	0.3	0%	0.0000	0.0000	0.000	2.08E-25
	30.00%	0.3	0%	0.0000	0.0000	0.000	6.8E-24
	31.00%	0.3	0%	0.0000	0.0000	0.000	1.77E-22
	32.00%	0.3	0%	0.0000	0.0000	0.000	3.76E-21
	33.00%	0.3	0%	0.0000	0.0000	0.000	6.58E-20
	34.00%	0.3	0%	0.0000	0.0000	0.000	9.65E-19
	35.00%	0.3	0%	0.0000	0.0000	0.000	1.2E-17
	36.00%	0.3	0%	0.0000	0.0000	0.000	1.28E-16
	37.00%	0.3	0%	0.0000	0.0000	0.000	1.19E-15
	38.00%	0.3	0%	0.0000	0.0000	0.000	9.66E-15
	39.00%	0.3	0%	0.0000	0.0000	0.000	6.93E-14
	40.00%	0.3	0%	0.0000	0.0000	0.000	4.43E-13
	41.00%	0.3	0%	0.0000	0.0000	0.000	2.54E-12
	42.00%	0.3	0%	0.0000	0.0000	0.000	1.32E-11
	43.00%	0.3	0%	0.0000	0.0000	0.000	6.19E-11
	44.00%	0.3	0%	0.0000	0.0000	0.000	2.66E-10
	45.00%	0.3	0%	0.0000	0.0000	0.000	1.05E-09
	46.00%	0.3	0%	0.0000	0.0000	0.000	3.83E-09
	47.00%	0.3	0%	0.0000	0.0000	0.000	1.3E-08
	48.00%	0.3	0%	0.0000	0.0000	0.000	4.08E-08
0%	49.00%	0.3	0%	0.0001	0.0000	0.000	1.2E-07
0%	50.00%	0.3	0%	0.0002	0.0001	0.000	3.32E-07
0%	51.00%	0.3	0%	0.0003	0.0002	0.000	8.63E-07
0%	52.00%	0.3	0%	0.0007	0.0003	0.000	2.12E-06
0%	53.00%	0.3	0%	0.0013	0.0006	0.000	4.93E-06
0%	54.00%	0.3	0%	0.0023	0.0010	0.000	1.09E-05
0%	55.00%	0.3	0%	0.0040	0.0017	0.000	2.29E-05
0%	56.00%	0.3	0%	0.0068	0.0027	0.000	4.59E-05
0%	57.00%	0.3	0%	0.0110	0.0042	0.000	8.8E-05

0%	58.00%	0.3	0%	**0.0171**	**0.0061**	0.000	0.000162
0%	59.00%	0.3	0%	**0.0258**	**0.0087**	0.001	0.000286
0%	60.00%	0.3	0%	**0.0377**	**0.0119**	0.001	0.000485
0%	61.00%	0.3	0%	**0.0535**	**0.0158**	0.002	0.000795
0%	62.00%	0.3	0%	**0.0736**	**0.0202**	0.003	0.001256
0%	63.00%	0.3	0%	**0.0987**	**0.0251**	0.005	0.00192
0%	64.00%	0.3	0%	**0.1291**	**0.0303**	0.008	0.002843
0%	65.00%	0.3	0%	**0.1647**	**0.0356**	0.012	0.004081
0%	66.00%	0.3	0%	**0.2054**	**0.0408**	0.018	0.005687
0%	67.00%	0.3	0%	**0.2509**	**0.0455**	0.025	0.007707
0%	68.00%	0.3	0%	**0.3004**	**0.0495**	0.036	0.010164
0%	69.00%	0.3	0%	**0.3532**	**0.0527**	0.049	0.013063
0%	70.00%	0.3	0%	**0.4081**	**0.0549**	0.065	0.016377
1%	71.00%	0.294	0%	**0.4640**	**0.0559**	0.085	0.020047
1%	72.00%	0.288	-1%	**0.5199**	**0.0559**	0.109	0.023986
2%	73.00%	0.282	-1%	**0.5746**	**0.0547**	0.137	0.028074
2%	74.00%	0.276	-2%	**0.6272**	**0.0526**	0.169	0.032173
2%	75.00%	0.27	-2%	**0.6769**	**0.0497**	0.205	0.036131
3%	76.00%	0.264	-2%	**0.7230**	**0.0461**	0.245	0.039792
3%	77.00%	0.258	-3%	**0.7651**	**0.0421**	0.288	0.043009
4%	78.00%	0.252	-3%	**0.8030**	**0.0378**	0.334	0.045655
4%	79.00%	0.246	-4%	**0.8365**	**0.0335**	0.381	0.04763
5%	80.00%	0.24	-4%	**0.8657**	**0.0292**	0.430	0.048866
6%	81.00%	0.24	-5%	**0.8908**	**0.0251**	0.480	0.049334
7%	82.00%	0.24	-6%	**0.9121**	**0.0213**	0.529	0.049039
8%	83.00%	0.24	-7%	**0.9299**	**0.0178**	0.577	0.048023
9%	84.00%	0.24	-8%	**0.9447**	**0.0148**	0.623	0.046355
10%	85.00%	0.24	-9%	**0.9567**	**0.0121**	0.667	0.044128
11%	86.00%	0.24	-10%	**0.9665**	**0.0097**	0.709	0.041448
12%	87.00%	0.24	-11%	**0.9742**	**0.0078**	0.747	0.038431
13%	88.00%	0.24	-12%	**0.9804**	**0.0061**	0.782	0.035192
14%	89.00%	0.24	-13%	**0.9852**	**0.0048**	0.814	0.03184
15%	90.00%	0.24	-14%	**0.9889**	**0.0037**	0.843	0.028475
16%	91.00%	0.24	-15%	**0.9917**	**0.0029**	0.868	0.02518
17%	92.00%	0.24	-16%	**0.9939**	**0.0022**	0.890	0.022027
18%	93.00%	0.24	-17%	**0.9955**	**0.0016**	0.909	0.019068
19%	94.00%	0.24	-18%	**0.9968**	**0.0012**	0.925	0.01634
20%	95.00%	0.24	-19%	**0.9977**	**0.0009**	0.939	0.013866
21%	96.00%	0.24	-20%	**0.9983**	**0.0007**	0.951	0.011655
22%	97.00%	0.24	-21%	**0.9988**	**0.0005**	0.960	0.009708
23%	98.00%	0.24	-22%	**0.9992**	**0.0003**	0.968	0.008015
24%	99.00%	0.24	-23%	**0.9994**	**0.0003**	0.975	0.006561
25%	100.00%	0.24	-24%	**0.9996**	**0.0002**	0.980	0.005326
26%	101.00%	0.24	-25%	**0.9997**	**0.0001**	0.985	0.004289
27%	102.00%	0.24	-26%	**0.9998**	**0.0001**	0.988	0.003428
28%	103.00%	0.24	-27%	**0.9999**	**0.0001**	0.991	0.002718
29%	104.00%	0.24	-28%	**0.9999**	**0.0000**	0.993	0.00214
30%	105.00%	0.24	-29%	**0.9999**	**0.0000**	0.995	0.001674
31%	106.00%	0.24	-30%	**1.0000**	**0.0000**	0.996	0.0013
32%	107.00%	0.24	-31%	**1.0000**	**0.0000**	0.997	0.001003
33%	108.00%	0.24	-32%	**1.0000**	**0.0000**	0.998	0.000769
34%	109.00%	0.24	-33%	**1.0000**	**0.0000**	0.998	0.000585
35%	110.00%	0.24	-34%	**1.0000**	**0.0000**	0.999	0.000443
36%	111.00%	0.24	-35%	**1.0000**	**0.0000**	0.999	0.000334
37%	112.00%	0.24	-36%	**1.0000**	**0.0000**	0.999	0.00025
38%	113.00%	0.24	-37%	**1.0000**	**0.0000**	0.999	0.000186
39%	114.00%	0.24	-38%	**1.0000**	**0.0000**	1.000	0.000138
40%	115.00%	0.24	-39%	**1.0000**	**0.0000**	1.000	0.000102
41%	116.00%	0.24	-40%	**1.0000**	**0.0000**	1.000	7.44E-05
42%	117.00%	0.24	-41%	**1.0000**	**0.0000**	1.000	5.43E-05
43%	118.00%	0.24	-42%	**1.0000**	**0.0000**	1.000	3.94E-05
44%	119.00%	0.24	-43%	**1.0000**	**0.0000**	1.000	2.85E-05
45%	120.00%	0.24	-44%	**1.0000**	**0.0000**	1.000	2.05E-05
46%	121.00%	0.24	-45%	**1.0000**	**0.0000**	1.000	1.47E-05
47%	122.00%	0.24	-46%	**1.0000**	**0.0000**	1.000	1.05E-05
48%	123.00%	0.24	-47%	**1.0000**	**0.0000**	1.000	7.46E-06
49%	124.00%	0.24	-48%	**1.0000**	**0.0000**	1.000	5.28E-06
50%	125.00%	0.24	-49%	**1.0000**	**0.0000**	1.000	3.73E-06
51%	126.00%	0.24	-50%	**1.0000**	**0.0000**	1.000	2.62E-06
52%	127.00%	0.24	-51%	**1.0000**	**0.0000**	1.000	1.83E-06
53%	128.00%	0.24	-52%	**1.0000**	**0.0000**	1.000	1.28E-06
54%	129.00%	0.24	-53%	**1.0000**	**0.0000**	1.000	8.9E-07

55%	130.00%	0.24	-54%	1.0000	0.0000	1.000	6.17E-07
56%	131.00%	0.24	-55%	1.0000	0.0000	1.000	4.27E-07
57%	132.00%	0.24	-56%	1.0000	0.0000	1.000	2.94E-07
58%	133.00%	0.24	-57%	1.0000	0.0000	1.000	2.02E-07
59%	134.00%	0.24	-58%	1.0000	0.0000	1.000	1.38E-07
60%	135.00%	0.24	-59%	1.0000	0.0000	1.000	9.45E-08
61%	136.00%	0.24	-60%	1.0000	0.0000	1.000	6.44E-08
62%	137.00%	0.24	-61%	1.0000	0.0000	1.000	4.38E-08
63%	138.00%	0.24	-62%	1.0000	0.0000	1.000	2.97E-08
64%	139.00%	0.24	-63%	1.0000	0.0000	1.000	2E-08
65%	140.00%	0.24	-64%	1.0000	0.0000	1.000	1.35E-08
66%	141.00%	0.24	-65%	1.0000	0.0000	1.000	9.1E-09
67%	142.00%	0.24	-66%	1.0000	0.0000	1.000	6.11E-09
68%	143.00%	0.24	-67%	1.0000	0.0000	1.000	4.09E-09
69%	144.00%	0.24	-68%	1.0000	0.0000	1.000	2.73E-09
70%	145.00%	0.24	-69%	1.0000	0.0000	1.000	1.82E-09
71%	146.00%	0.24	-70%	1.0000	0.0000	1.000	1.21E-09
72%	147.00%	0.24	-71%	1.0000	0.0000	1.000	8.07E-10
73%	148.00%	0.24	-72%	1.0000	0.0000	1.000	5.35E-10
74%	149.00%	0.24	-73%	1.0000	0.0000	1.000	3.54E-10
75%	150.00%	0.24	-74%	1.0000	0.0000	1.000	2.34E-10
76%	151.00%	0.24	-75%	1.0000	0.0000	1.000	1.54E-10
77%	152.00%	0.24	-76%	1.0000	0.0000	1.000	1.01E-10
78%	153.00%	0.24	-77%	1.0000	0.0000	1.000	6.71E-11
79%	154.00%	0.24	-78%	1.0000	0.0000	1.000	4.43E-11
80%	155.00%	0.24	-79%	1.0000	0.0000	1.000	2.83E-11
81%	156.00%	0.24	-80%	1.0000	0.0000	1.000	1.84E-11
82%	157.00%	0.24	-81%	1.0000	0.0000	1.000	1.22E-11
83%	158.00%	0.24	-82%	1.0000	0.0000	1.000	8.4E-12
84%	159.00%	0.24	-83%	1.0000	0.0000	1.000	5.19E-12
85%	160.00%	0.24	-84%	1.0000	0.0000	1.000	1.04E-11
86%	161.00%	0.24	-85%	1.0000	0.0000	1.000	0
87%	162.00%	0.24	-86%	1.0000	0.0000	1.000	0
88%	163.00%	0.24	-87%	1.0000	0.0000	1.000	0
89%	164.00%	0.24	-88%	1.0000	0.0000	1.000	0
90%	165.00%	0.24	-89%	1.0000	0.0000	1.000	0
91%	166.00%	0.24	-90%	1.0000	0.0000	1.000	0
92%	167.00%	0.24	-91%	1.0000	0.0000	1.000	0
93%	168.00%	0.24	-92%	1.0000	0.0000	1.000	0
94%	169.00%	0.24	-93%	1.0000	0.0000	1.000	0
95%	170.00%	0.24	-94%	1.0000	0.0000	1.000	0
96%	171.00%	0.24	-95%	1.0000	0.0000	1.000	0
97%	172.00%	0.24	-96%	1.0000	0.0000	1.000	0
98%	173.00%	0.24	-97%	1.0000	0.0000	1.000	0
99%	174.00%	0.24	-98%	1.0000	0.0000	1.000	0
100%	175.00%	0.24	-99%	1.0000	0.0000	1.000	0
101%	176.00%	0.24	-100%	1.0000	0.0000	1.000	0
102%	177.00%	0.24	-101%	1.0000	0.0000	1.000	0
103%	178.00%	0.24	-102%	1.0000	0.0000	1.000	0
104%	179.00%	0.24	-103%	1.0000	0.0000	1.000	0
105%	180.00%	0.24	-104%	1.0000	0.0000	1.000	0
106%	181.00%	0.24	-105%	1.0000	0.0000	1.000	0
107%	182.00%	0.24	-106%	1.0000	0.0000	1.000	0
108%	183.00%	0.24	-107%	1.0000	0.0000	1.000	0
109%	184.00%	0.24	-108%	1.0000	0.0000	1.000	0
110%	185.00%	0.24	-109%	1.0000	0.0000	1.000	0
111%	186.00%	0.24	-110%	1.0000	0.0000	1.000	0
112%	187.00%	0.24	-111%	1.0000	0.0000	1.000	0
113%	188.00%	0.24	-112%	1.0000	0.0000	1.000	0
114%	189.00%	0.24	-113%	1.0000	0.0000	1.000	0
115%	190.00%	0.24	-114%	1.0000	0.0000	1.000	0
116%	191.00%	0.24	-115%	1.0000	0.0000	1.000	0
117%	192.00%	0.24	-116%	1.0000	0.0000	1.000	0
118%	193.00%	0.24	-117%	1.0000	0.0000	1.000	0
119%	194.00%	0.24	-118%	1.0000	0.0000	1.000	0
120%	195.00%	0.24	-119%	1.0000	0.0000	1.000	0
121%	196.00%	0.24	-120%	1.0000	0.0000	1.000	0
122%	197.00%	0.24	-121%	1.0000	0.0000	1.000	0
123%	198.00%	0.24	-122%	1.0000	0.0000	1.000	0
124%	199.00%	0.24	-123%	1.0000	0.0000	1.000	0
	200.00%	0.24	-124%	1.0000	0.0000	1.000	0

Example 4: Binary Loss Contract:

Consider a binary loss contract that has only two possible outcomes: either a zero loss, or a $1MM loss, with probability "1-q" and "q", respectively.

$$Loss = \begin{cases} 0, & q \\ 1, & 1-q \end{cases}$$

Targeting a loss ratio of "R", the insurance premium for this contract will be (1-q)/R.

10
-
10
-
rule

Threshold		10%
E[X]	$	40,000
Expected Loss Ratio		15%
Premium	$	266,667

E*[ROP] -88%

Y --- Negative Reinsurance ROP	
Pr(ROP<-10%)	E*[Y]
4.00%	-87.86%
Failed 10-10-rule	*Passed WT 10-10-rule*

x	f(x)	ROP	Neg. ROP	F(x)	F*(x)	f*(x)
$ -	0.96	100%	0%	0.96	0.681	0.681
$ 1,000,000	0.04	-275%	-275%	1	1.000	0.319

Quantify Extent of Risk Transfer Using the Right-Tail Deviation

Here I propose to use the Right-Tail Deviation to quantify the extent of risk-transfer.

> Instead of testing for "pass" or "fail" answer, we can do better by quantifying the percentage of premium qualified for risk transfer accounting.
>
> This can avoid some of the border-line cases associated with any pass-or-fail test (including the 10-10 rule and the transformed 10-10 rule).

Methodology:

1) Use the Right-Tail Deviation as a measure for down-side risk
2) Maximum Qualifying Premium is calculated as a multiple (3 to 5) of the Right-Tail-Deviation
3) The actual transaction premium is compared to the Maximum Qualifying Premium.

The Right-Tail-Deviation Method provides a new tool and a new approach that is simpler, easier to understand, and more powerful. It also offers a major advantage over simple and transformed 10-10 rules:

The Right-Tail-Deviation Method can prevent companies' gaming the rule by combining super risky CAT with a low risk portfolio transfer just to pass risk transfer test. -- Please see Example 5.

Thanks to:

- Paul Brehm
- Gary Venter
- John Kulik
- Todd Bault
- Don Mango
- Phil Heckman
- Tom Wallace

for assistance and comments

Right-Tail Deveiation: Concept, Algorithm and Properties

References

1) Shaun Wang (1998) An Actuarial Index of the Right-Tail Risk, North American Actuarial Journal
2) Robert Bear (1999). Allocation of Surplus Based Upon Right Tail Deviation, Presented at CARE June 1999
http://www.casact.org/coneduc/reinsure/1999/handouts/bear.ppt
3) GIRO Capital Allocation Working Party
http://www.actuaries.org.uk/files/library/proceedings/gen_ins/2000gic/cap_all_wp.ppt

Algorithm for calculating the **Right-Tail Deviation** of X with cumulative distribution function F:

Step 1: Sort values x_j in ascending order with corresponding values of $F(x_j)$

Step 3: Apply the transform: $F^*(x_j) = 1 - \sqrt{1 - F(x_j)}$

Step 4: The Right-Tail-Deviation is defined as the difference between the expected value under the transformed distribution F^*, and the expected value under the original distribution F:

$$RTD[X] = E^*[X] - E[X]$$

Value of X (ascending order)	Cumulative Distribution Function of X	Transformed Cumulative Distribution Function
x_1	$F(x_1)$	$F^*(x_1)$
x_2	$F(x_2)$	$F^*(x_2)$
x_3	$F(x_3)$	$F^*(x_3)$
x_4	$F(x_4)$	$F^*(x_4)$
x_5	$F(x_5)$	$F^*(x_5)$

Example 1. Property Catastrophe Excess of Loss
An insurance company has exposure to southeastern U.S. hurricanes. Standard industry catastrophe models were applied, and the following catastrophe loss event cdf (in grean-shaded cells) was produced

Limt	**50,000,000**
	xs
Retention	**15,000,000**
Exp Loss	$ 2,350,333
Premium	$ 7,834,443
Exp LossRatio	**30.00%**

Multiple for RTD	**4.00**
Ceded Loss "L"	
E[L]	**$ 2,350,333**
E*[L]	**$ 10,352,271**
RTD	**$ 8,001,938**
Max Qualified Premiums	**$ 32,007,751**
Non-Qualified Premium	**$ -**

Portion of Premium Qualified for Risk Transfer

100%

Probability

F(x)	f(x)	Gross Loss	Ceded Loss	F*(x)	f*(x)
0.001	0.001	63	0	0.001	0.001
0.005	0.004	85	0	0.003	0.002
0.010	0.005	528	0	0.005	0.003
0.025	0.015	2,877	0	0.013	0.008
0.050	0.025	26,160	0	0.025	0.013
0.100	0.050	95,939	0	0.051	0.026
0.200	0.100	302,299	0	0.106	0.054
0.300	0.100	607,426	0	0.163	0.058
0.400	0.100	1,146,366	0	0.225	0.062
0.500	0.100	2,001,899	0	0.293	0.067
0.600	0.100	3,185,892	0	0.368	0.075
0.700	0.100	4,925,404	0	0.452	0.085
0.800	0.100	8,150,810	0	0.553	0.101
0.900	0.100	15,632,088	632,088	0.684	0.131
0.950	0.050	24,206,066	9,206,066	0.776	0.093
0.975	0.025	38,072,833	23,072,833	0.842	0.065
0.990	0.015	67,451,525	50,000,000	0.900	0.058
0.995	0.005	83,683,074	50,000,000	0.929	0.029
0.999	0.004	126,792,315	50,000,000	0.968	0.039
1	0.001	163,627,870	50,000,000	1.000	0.032

Example 2: Quota Share Reinsurance

In this example, an insurance company seeks a 50% quota share protection on its accident year results. For the upcoming year, this company forecasts:

Written Premium	$1,000
Earned Premium	1,000
Accident Year Loss Ratio	75%
Ceding Commission	30%

We assume the loss ratio is distributed lognormally with a mean of 75% and a c.v. of 10%. The quota share treaty has a 30% ceding commission. Assume the premiums and the commissions are paid evenly through out the year.

Example 2. Quota Share

Direct Premium	$1,000
Loss Ratio	75%
Interest Discount	96%
Discounted LR	72%
CV	10.0%
Commission	30%

mu	-0.333
sigma	0.100

70%

Multiple for RTD	4.00
Ceded Loss "L"	
E[L]	$ 720
E*[L]	$ 780
RTD	$ 60
Max Qualified Premiums	$ 238
Non-Qualified Premium	$ 762

Portion of Premium Qualified for Risk Transfer
24%

Loss Ratio	F(x)	f(x)	F*(x)	f*(x)
0	0.0000	0.0000	0.000	0.000
1.00%	0.0000	0.0000	0.000	0
2.00%	0.0000	0.0000	0.000	0
3.00%	0.0000	0.0000	0.000	0
4.00%	0.0000	0.0000	0.000	0
5.00%	0.0000	0.0000	0.000	0
6.00%	0.0000	0.0000	0.000	0
7.00%	0.0000	0.0000	0.000	0
8.00%	0.0000	0.0000	0.000	0
9.00%	0.0000	0.0000	0.000	0
10.00%	0.0000	0.0000	0.000	0
11.00%	0.0000	0.0000	0.000	0
12.00%	0.0000	0.0000	0.000	0
13.00%	0.0000	0.0000	0.000	0
14.00%	0.0000	0.0000	0.000	0
15.00%	0.0000	0.0000	0.000	0
16.00%	0.0000	0.0000	0.000	0
17.00%	0.0000	0.0000	0.000	0
18.00%	0.0000	0.0000	0.000	0
19.00%	0.0000	0.0000	0.000	0
20.00%	0.0000	0.0000	0.000	0
21.00%	0.0000	0.0000	0.000	0
22.00%	0.0000	0.0000	0.000	0
23.00%	0.0000	0.0000	0.000	0
24.00%	0.0000	0.0000	0.000	0
25.00%	0.0000	0.0000	0.000	0
26.00%	0.0000	0.0000	0.000	0
27.00%	0.0000	0.0000	0.000	0
28.00%	0.0000	0.0000	0.000	0
29.00%	0.0000	0.0000	0.000	0
30.00%	0.0000	0.0000	0.000	0
31.00%	0.0000	0.0000	0.000	0
32.00%	0.0000	0.0000	0.000	0
33.00%	0.0000	0.0000	0.000	1.9984E-15
34.00%	0.0000	0.0000	0.000	1.77636E-14
35.00%	0.0000	0.0000	0.000	1.52878E-13
36.00%	0.0000	0.0000	0.000	1.13776E-12
37.00%	0.0000	0.0000	0.000	7.41784E-12
38.00%	0.0000	0.0000	0.000	4.27535E-11
39.00%	0.0000	0.0000	0.000	2.19639E-10
40.00%	0.0000	0.0000	0.000	1.01336E-09
41.00%	0.0000	0.0000	0.000	4.22785E-09
42.00%	0.0000	0.0000	0.000	1.60519E-08
43.00%	0.0000	0.0000	0.000	5.5784E-08
44.00%	0.0000	0.0000	0.000	1.78397E-07
45.00%	0.0000	0.0000	0.000	5.27602E-07
46.00%	0.0000	0.0000	0.000	1.44959E-06
47.00%	0.0000	0.0000	0.000	3.71567E-06
48.00%	0.0000	0.0000	0.000	8.92034E-06
49.00%	0.0001	0.0000	0.000	2.01306E-05
50.00%	0.0002	0.0001	0.000	4.28481E-05
51.00%	0.0003	0.0002	0.000	8.62933E-05
52.00%	0.0007	0.0003	0.000	0.000164922
53.00%	0.0013	0.0006	0.001	0.000299942
54.00%	0.0023	0.0010	0.001	0.000520471
55.00%	0.0040	0.0017	0.002	0.000863848

56.00%	0.0068	0.0027	0.003	0.001374652
57.00%	0.0110	0.0042	0.005	0.002102117
58.00%	0.0171	0.0061	0.009	0.003095928
59.00%	0.0258	0.0087	0.013	0.004400739
60.00%	0.0377	0.0119	0.019	0.00605014
61.00%	0.0535	0.0158	0.027	0.00806096
62.00%	0.0736	0.0202	0.038	0.010428858
63.00%	0.0987	0.0251	0.051	0.013125915
64.00%	0.1291	0.0303	0.067	0.01610064
65.00%	0.1647	0.0356	0.086	0.01928036
66.00%	0.2054	0.0408	0.109	0.022575672
67.00%	0.2509	0.0455	0.134	0.025886319
68.00%	0.3004	0.0495	0.164	0.029107792
69.00%	0.3532	0.0527	0.196	0.032137945
70.00%	0.4081	0.0549	0.231	0.034883
71.00%	0.4640	0.0559	0.268	0.037262498
72.00%	0.5199	0.0559	0.307	0.039212908
73.00%	0.5746	0.0547	0.348	0.040689787
74.00%	0.6272	0.0526	0.389	0.04166852
75.00%	0.6769	0.0497	0.432	0.042143793
76.00%	0.7230	0.0461	0.474	0.042128016
77.00%	0.7651	0.0421	0.515	0.041648962
78.00%	0.8030	0.0378	0.556	0.040746898
79.00%	0.8365	0.0335	0.596	0.039471458
80.00%	0.8657	0.0292	0.633	0.037878499
81.00%	0.8908	0.0251	0.670	0.036027123
82.00%	0.9121	0.0213	0.703	0.033976996
83.00%	0.9299	0.0178	0.735	0.031786074
84.00%	0.9447	0.0148	0.765	0.02950877
85.00%	0.9567	0.0121	0.792	0.027194582
86.00%	0.9665	0.0097	0.817	0.024887172
87.00%	0.9742	0.0078	0.839	0.022623837
88.00%	0.9804	0.0061	0.860	0.020435344
89.00%	0.9852	0.0048	0.878	0.018346045
90.00%	0.9889	0.0037	0.895	0.016374219
91.00%	0.9917	0.0029	0.909	0.014532587
92.00%	0.9939	0.0022	0.922	0.012828919
93.00%	0.9955	0.0016	0.933	0.011266712
94.00%	0.9968	0.0012	0.943	0.009845879
95.00%	0.9977	0.0009	0.952	0.008563426
96.00%	0.9983	0.0007	0.959	0.007414085
97.00%	0.9988	0.0005	0.965	0.006390896
98.00%	0.9992	0.0003	0.971	0.005485719
99.00%	0.9994	0.0003	0.976	0.004689679
100.00%	0.9996	0.0002	0.980	0.00399353
101.00%	0.9997	0.0001	0.983	0.003387965
102.00%	0.9998	0.0001	0.986	0.002863846
103.00%	0.9999	0.0001	0.988	0.002412389
104.00%	0.9999	0.0000	0.990	0.002025292
105.00%	0.9999	0.0000	0.992	0.001694819
106.00%	1.0000	0.0000	0.993	0.001413858
107.00%	1.0000	0.0000	0.995	0.001175936
108.00%	1.0000	0.0000	0.996	0.000975223
109.00%	1.0000	0.0000	0.996	0.000806512
110.00%	1.0000	0.0000	0.997	0.000665194
111.00%	1.0000	0.0000	0.998	0.000547214
112.00%	1.0000	0.0000	0.998	0.000449031
113.00%	1.0000	0.0000	0.998	0.000367575
114.00%	1.0000	0.0000	0.999	0.000300194
115.00%	1.0000	0.0000	0.999	0.000244613
116.00%	1.0000	0.0000	0.999	0.000198889
117.00%	1.0000	0.0000	0.999	0.000161374
118.00%	1.0000	0.0000	0.999	0.000130669
119.00%	1.0000	0.0000	1.000	0.0001056
120.00%	1.0000	0.0000	1.000	8.51797E-05
121.00%	1.0000	0.0000	1.000	6.85827E-05
122.00%	1.0000	0.0000	1.000	5.51225E-05
123.00%	1.0000	0.0000	1.000	4.42287E-05
124.00%	1.0000	0.0000	1.000	3.54296E-05
125.00%	1.0000	0.0000	1.000	2.83361E-05
126.00%	1.0000	0.0000	1.000	2.26281E-05
127.00%	1.0000	0.0000	1.000	1.80433E-05
128.00%	1.0000	0.0000	1.000	1.43668E-05

129.00%	1.0000	0.0000	1.000	1.14238E-05
130.00%	1.0000	0.0000	1.000	9.07149E-06
131.00%	1.0000	0.0000	1.000	7.19433E-06
132.00%	1.0000	0.0000	1.000	5.69854E-06
133.00%	1.0000	0.0000	1.000	4.50834E-06
134.00%	1.0000	0.0000	1.000	3.5626E-06
135.00%	1.0000	0.0000	1.000	2.81212E-06
136.00%	1.0000	0.0000	1.000	2.21734E-06
137.00%	1.0000	0.0000	1.000	1.74656E-06
138.00%	1.0000	0.0000	1.000	1.37433E-06
139.00%	1.0000	0.0000	1.000	1.0804E-06
140.00%	1.0000	0.0000	1.000	8.48545E-07
141.00%	1.0000	0.0000	1.000	6.65853E-07
142.00%	1.0000	0.0000	1.000	5.22024E-07
143.00%	1.0000	0.0000	1.000	4.08934E-07
144.00%	1.0000	0.0000	1.000	3.20084E-07
145.00%	1.0000	0.0000	1.000	2.50317E-07
146.00%	1.0000	0.0000	1.000	1.95667E-07
147.00%	1.0000	0.0000	1.000	1.52763E-07
148.00%	1.0000	0.0000	1.000	1.19269E-07
149.00%	1.0000	0.0000	1.000	9.30388E-08
150.00%	1.0000	0.0000	1.000	7.24675E-08
151.00%	1.0000	0.0000	1.000	5.64777E-08
152.00%	1.0000	0.0000	1.000	4.37874E-08
153.00%	1.0000	0.0000	1.000	3.43119E-08
154.00%	1.0000	0.0000	1.000	2.68858E-08
155.00%	1.0000	0.0000	1.000	2.03935E-08
156.00%	1.0000	0.0000	1.000	1.57084E-08
157.00%	1.0000	0.0000	1.000	1.23111E-08
158.00%	1.0000	0.0000	1.000	1.0124E-08
159.00%	1.0000	0.0000	1.000	7.51044E-09
160.00%	1.0000	0.0000	1.000	4.73614E-09
161.00%	1.0000	0.0000	1.000	6.17226E-09
162.00%	1.0000	0.0000	1.000	4.36445E-09
163.00%	1.0000	0.0000	1.000	0
164.00%	1.0000	0.0000	1.000	1.05367E-08
165.00%	1.0000	0.0000	1.000	0
166.00%	1.0000	0.0000	1.000	0
167.00%	1.0000	0.0000	1.000	0
168.00%	1.0000	0.0000	1.000	0
169.00%	1.0000	0.0000	1.000	0
170.00%	1.0000	0.0000	1.000	0
171.00%	1.0000	0.0000	1.000	0
172.00%	1.0000	0.0000	1.000	0
173.00%	1.0000	0.0000	1.000	0
174.00%	1.0000	0.0000	1.000	0
175.00%	1.0000	0.0000	1.000	0
176.00%	1.0000	0.0000	1.000	0
177.00%	1.0000	0.0000	1.000	0
178.00%	1.0000	0.0000	1.000	0
179.00%	1.0000	0.0000	1.000	0
180.00%	1.0000	0.0000	1.000	0
181.00%	1.0000	0.0000	1.000	0
182.00%	1.0000	0.0000	1.000	0
183.00%	1.0000	0.0000	1.000	0
184.00%	1.0000	0.0000	1.000	0
185.00%	1.0000	0.0000	1.000	0
186.00%	1.0000	0.0000	1.000	0
187.00%	1.0000	0.0000	1.000	0
188.00%	1.0000	0.0000	1.000	0
189.00%	1.0000	0.0000	1.000	0
190.00%	1.0000	0.0000	1.000	0
191.00%	1.0000	0.0000	1.000	0
192.00%	1.0000	0.0000	1.000	0
193.00%	1.0000	0.0000	1.000	0
194.00%	1.0000	0.0000	1.000	0
195.00%	1.0000	0.0000	1.000	0
196.00%	1.0000	0.0000	1.000	0
197.00%	1.0000	0.0000	1.000	0
198.00%	1.0000	0.0000	1.000	0
199.00%	1.0000	0.0000	1.000	0
200.00%	1.0000	0.0000	1.000	0

Example 3: Quota Share With Sliding Scale

In this example, all underlying numbers are the same as in the quota share example in Example 2. This time, however, we add a loss-offset contact term.With the same provisional ceding commission of 30%, now we add on a sliding scale adjustment:

For every 1% additional loss ratio between 70% and 80% loss ratio (the lower and upper bounds of the sliding scale range), the reinsurer will reduce the ceding commission by 0.6% (the slope of sliding scale is 0.6). Putting in mathematical terms, the final adjusted ceding commission is calculated by

$$CedingComm\ \ isson = \begin{cases} 30\%, & if \quad LR < 70\% \\ 30\% - 0.6(LR - 70\%), & if \quad 70\% < LR < 80\% \\ 24\% & if \quad 80\% < LR \end{cases}$$

The sliding scale feature apparently reduces the amount of risk transfer.
But how will the sliding scale terms affect the "risk-transfer test"?

Example 3. Quta Share With Sliding Scale

Direct Premium	$1,000
Loss Ratio	75%
Interest Discount	96%
Discounted LR	72%
CV	10%
Comm+Broke	30%
mu	-0.333
sigma	0.100
Sliding Range	70%
	80%
Sliding Slope	0.600

Multiple for RTD	4.00
Ceded Loss "L"	
E[L]	$ 703
E*[L]	$ 744
RTD	$ 41
Max Qualified Premiums	$ 164
Non-Qualified Premium	$ 836

Portion of Premium Qualified for Risk Transfer
16%

	Ceding Co. Loss Ratio	Reins Comm+expense	Ceded Loss	F(x)	f(x)	F*(x)	f*(x)
	0	0.3	$ -	0.0000	0.0000	0.000	0.000
	1.00%	0.3	$ 10	0.0000	0.0000	0.000	0
	2.00%	0.3	$ 20	0.0000	0.0000	0.000	0
	3.00%	0.3	$ 30	0.0000	0.0000	0.000	0
	4.00%	0.3	$ 40	0.0000	0.0000	0.000	0
	5.00%	0.3	$ 50	0.0000	0.0000	0.000	0
	6.00%	0.3	$ 60	0.0000	0.0000	0.000	0
	7.00%	0.3	$ 70	0.0000	0.0000	0.000	0
	8.00%	0.3	$ 80	0.0000	0.0000	0.000	0
	9.00%	0.3	$ 90	0.0000	0.0000	0.000	0
	10.00%	0.3	$ 100	0.0000	0.0000	0.000	0
	11.00%	0.3	$ 110	0.0000	0.0000	0.000	0
	12.00%	0.3	$ 120	0.0000	0.0000	0.000	0
	13.00%	0.3	$ 130	0.0000	0.0000	0.000	0
	14.00%	0.3	$ 140	0.0000	0.0000	0.000	0
	15.00%	0.3	$ 150	0.0000	0.0000	0.000	0
	16.00%	0.3	$ 160	0.0000	0.0000	0.000	0
	17.00%	0.3	$ 170	0.0000	0.0000	0.000	0
	18.00%	0.3	$ 180	0.0000	0.0000	0.000	0
	19.00%	0.3	$ 190	0.0000	0.0000	0.000	0
	20.00%	0.3	$ 200	0.0000	0.0000	0.000	0
	21.00%	0.3	$ 210	0.0000	0.0000	0.000	0
	22.00%	0.3	$ 220	0.0000	0.0000	0.000	0
	23.00%	0.3	$ 230	0.0000	0.0000	0.000	0
	24.00%	0.3	$ 240	0.0000	0.0000	0.000	0
	25.00%	0.3	$ 250	0.0000	0.0000	0.000	0
	26.00%	0.3	$ 260	0.0000	0.0000	0.000	0
	27.00%	0.3	$ 270	0.0000	0.0000	0.000	0
	28.00%	0.3	$ 280	0.0000	0.0000	0.000	0
	29.00%	0.3	$ 290	0.0000	0.0000	0.000	0
	30.00%	0.3	$ 300	0.0000	0.0000	0.000	0
	31.00%	0.3	$ 310	0.0000	0.0000	0.000	0
	32.00%	0.3	$ 320	0.0000	0.0000	0.000	0
	33.00%	0.3	$ 330	0.0000	0.0000	0.000	2E-15
	34.00%	0.3	$ 340	0.0000	0.0000	0.000	1.78E-14
	35.00%	0.3	$ 350	0.0000	0.0000	0.000	1.53E-13
	36.00%	0.3	$ 360	0.0000	0.0000	0.000	1.14E-12
	37.00%	0.3	$ 370	0.0000	0.0000	0.000	7.42E-12
	38.00%	0.3	$ 380	0.0000	0.0000	0.000	4.28E-11
	39.00%	0.3	$ 390	0.0000	0.0000	0.000	2.2E-10
	40.00%	0.3	$ 400	0.0000	0.0000	0.000	1.01E-09
	41.00%	0.3	$ 410	0.0000	0.0000	0.000	4.23E-09
	42.00%	0.3	$ 420	0.0000	0.0000	0.000	1.61E-08
	43.00%	0.3	$ 430	0.0000	0.0000	0.000	5.58E-08
	44.00%	0.3	$ 440	0.0000	0.0000	0.000	1.78E-07
	45.00%	0.3	$ 450	0.0000	0.0000	0.000	5.28E-07
	46.00%	0.3	$ 460	0.0000	0.0000	0.000	1.45E-06
	47.00%	0.3	$ 470	0.0000	0.0000	0.000	3.72E-06
	48.00%	0.3	$ 480	0.0000	0.0000	0.000	8.92E-06
-50000%	49.00%	0.3	$ 490	0.0001	0.0000	0.000	2.01E-05
-51000%	50.00%	0.3	$ 500	0.0002	0.0001	0.000	4.28E-05
-52000%	51.00%	0.3	$ 510	0.0003	0.0002	0.000	8.63E-05
-53000%	52.00%	0.3	$ 520	0.0007	0.0003	0.000	0.000165
-54000%	53.00%	0.3	$ 530	0.0013	0.0006	0.001	0.0003
-55000%	54.00%	0.3	$ 540	0.0023	0.0010	0.001	0.00052
-56000%	55.00%	0.3	$ 550	0.0040	0.0017	0.002	0.000864
-57000%	56.00%	0.3	$ 560	0.0068	0.0027	0.003	0.001375

-58000%	57.00%	0.3	$ 570	0.0110	0.0042	0.005	0.002102
-59000%	58.00%	0.3	$ 580	0.0171	0.0061	0.009	0.003096
-60000%	59.00%	0.3	$ 590	0.0258	0.0087	0.013	0.004401
-61000%	60.00%	0.3	$ 600	0.0377	0.0119	0.019	0.00605
-62000%	61.00%	0.3	$ 610	0.0535	0.0158	0.027	0.008061
-63000%	62.00%	0.3	$ 620	0.0736	0.0202	0.038	0.010429
-64000%	63.00%	0.3	$ 630	0.0987	0.0251	0.051	0.013126
-65000%	64.00%	0.3	$ 640	0.1291	0.0303	0.067	0.016101
-66000%	65.00%	0.3	$ 650	0.1647	0.0356	0.086	0.01928
-67000%	66.00%	0.3	$ 660	0.2054	0.0408	0.109	0.022576
-68000%	67.00%	0.3	$ 670	0.2509	0.0455	0.134	0.025886
-69000%	68.00%	0.3	$ 680	0.3004	0.0495	0.164	0.029108
-70000%	69.00%	0.3	$ 690	0.3532	0.0527	0.196	0.032138
-70400%	70.00%	0.3	$ 700	0.4081	0.0549	0.231	0.034883
-70800%	71.00%	0.294	$ 704	0.4640	0.0559	0.268	0.037262
-71200%	72.00%	0.288	$ 708	0.5199	0.0559	0.307	0.039213
-71600%	73.00%	0.282	$ 712	0.5746	0.0547	0.348	0.04069
-72000%	74.00%	0.276	$ 716	0.6272	0.0526	0.389	0.041669
-72400%	75.00%	0.27	$ 720	0.6769	0.0497	0.432	0.042144
-72800%	76.00%	0.264	$ 724	0.7230	0.0461	0.474	0.042128
-73200%	77.00%	0.258	$ 728	0.7651	0.0421	0.515	0.041649
-73600%	78.00%	0.252	$ 732	0.8030	0.0378	0.556	0.040747
-74000%	79.00%	0.246	$ 736	0.8365	0.0335	0.596	0.039471
-75000%	80.00%	0.24	$ 740	0.8657	0.0292	0.633	0.037878
-76000%	81.00%	0.24	$ 750	0.8908	0.0251	0.670	0.036027
-77000%	82.00%	0.24	$ 760	0.9121	0.0213	0.703	0.033977
-78000%	83.00%	0.24	$ 770	0.9299	0.0178	0.735	0.031786
-79000%	84.00%	0.24	$ 780	0.9447	0.0148	0.765	0.029509
-80000%	85.00%	0.24	$ 790	0.9567	0.0121	0.792	0.027195
-81000%	86.00%	0.24	$ 800	0.9665	0.0097	0.817	0.024887
-82000%	87.00%	0.24	$ 810	0.9742	0.0078	0.839	0.022624
-83000%	88.00%	0.24	$ 820	0.9804	0.0061	0.860	0.020435
-84000%	89.00%	0.24	$ 830	0.9852	0.0048	0.878	0.018346
-85000%	90.00%	0.24	$ 840	0.9889	0.0037	0.895	0.016374
-86000%	91.00%	0.24	$ 850	0.9917	0.0029	0.909	0.014533
-87000%	92.00%	0.24	$ 860	0.9939	0.0022	0.922	0.012829
-88000%	93.00%	0.24	$ 870	0.9955	0.0016	0.933	0.011267
-89000%	94.00%	0.24	$ 880	0.9968	0.0012	0.943	0.009846
-90000%	95.00%	0.24	$ 890	0.9977	0.0009	0.952	0.008563
-91000%	96.00%	0.24	$ 900	0.9983	0.0007	0.959	0.007414
-92000%	97.00%	0.24	$ 910	0.9988	0.0005	0.965	0.006391
-93000%	98.00%	0.24	$ 920	0.9992	0.0003	0.971	0.005486
-94000%	99.00%	0.24	$ 930	0.9994	0.0003	0.976	0.00469
-95000%	100.00%	0.24	$ 940	0.9996	0.0002	0.980	0.003994
-96000%	101.00%	0.24	$ 950	0.9997	0.0001	0.983	0.003388
-97000%	102.00%	0.24	$ 960	0.9998	0.0001	0.986	0.002864
-98000%	103.00%	0.24	$ 970	0.9999	0.0001	0.988	0.002412
-99000%	104.00%	0.24	$ 980	0.9999	0.0000	0.990	0.002025
-100000%	105.00%	0.24	$ 990	0.9999	0.0000	0.992	0.001695
-101000%	106.00%	0.24	$ 1,000	1.0000	0.0000	0.993	0.001414
-102000%	107.00%	0.24	$ 1,010	1.0000	0.0000	0.995	0.001176
-103000%	108.00%	0.24	$ 1,020	1.0000	0.0000	0.996	0.000975
-104000%	109.00%	0.24	$ 1,030	1.0000	0.0000	0.996	0.000807
-105000%	110.00%	0.24	$ 1,040	1.0000	0.0000	0.997	0.000665
-106000%	111.00%	0.24	$ 1,050	1.0000	0.0000	0.998	0.000547
-107000%	112.00%	0.24	$ 1,060	1.0000	0.0000	0.998	0.000449
-108000%	113.00%	0.24	$ 1,070	1.0000	0.0000	0.998	0.000368
-109000%	114.00%	0.24	$ 1,080	1.0000	0.0000	0.999	0.0003
-110000%	115.00%	0.24	$ 1,090	1.0000	0.0000	0.999	0.000245
-111000%	116.00%	0.24	$ 1,100	1.0000	0.0000	0.999	0.000199
-112000%	117.00%	0.24	$ 1,110	1.0000	0.0000	0.999	0.000161
-113000%	118.00%	0.24	$ 1,120	1.0000	0.0000	0.999	0.000131
-114000%	119.00%	0.24	$ 1,130	1.0000	0.0000	1.000	0.000106
-115000%	120.00%	0.24	$ 1,140	1.0000	0.0000	1.000	8.52E-05
-116000%	121.00%	0.24	$ 1,150	1.0000	0.0000	1.000	6.86E-05
-117000%	122.00%	0.24	$ 1,160	1.0000	0.0000	1.000	5.51E-05
-118000%	123.00%	0.24	$ 1,170	1.0000	0.0000	1.000	4.42E-05
-119000%	124.00%	0.24	$ 1,180	1.0000	0.0000	1.000	3.54E-05
-120000%	125.00%	0.24	$ 1,190	1.0000	0.0000	1.000	2.83E-05
-121000%	126.00%	0.24	$ 1,200	1.0000	0.0000	1.000	2.26E-05
-122000%	127.00%	0.24	$ 1,210	1.0000	0.0000	1.000	1.8E-05
-123000%	128.00%	0.24	$ 1,220	1.0000	0.0000	1.000	1.44E-05
-124000%	129.00%	0.24	$ 1,230	1.0000	0.0000	1.000	1.14E-05

-125000%	130.00%	0.24	$ 1,240	1.0000	0.0000	1.000	9.07E-06
-126000%	131.00%	0.24	$ 1,250	1.0000	0.0000	1.000	7.19E-06
-127000%	132.00%	0.24	$ 1,260	1.0000	0.0000	1.000	5.7E-06
-128000%	133.00%	0.24	$ 1,270	1.0000	0.0000	1.000	4.51E-06
-129000%	134.00%	0.24	$ 1,280	1.0000	0.0000	1.000	3.56E-06
-130000%	135.00%	0.24	$ 1,290	1.0000	0.0000	1.000	2.81E-06
-131000%	136.00%	0.24	$ 1,300	1.0000	0.0000	1.000	2.22E-06
-132000%	137.00%	0.24	$ 1,310	1.0000	0.0000	1.000	1.75E-06
-133000%	138.00%	0.24	$ 1,320	1.0000	0.0000	1.000	1.37E-06
-134000%	139.00%	0.24	$ 1,330	1.0000	0.0000	1.000	1.08E-06
-135000%	140.00%	0.24	$ 1,340	1.0000	0.0000	1.000	8.49E-07
-136000%	141.00%	0.24	$ 1,350	1.0000	0.0000	1.000	6.66E-07
-137000%	142.00%	0.24	$ 1,360	1.0000	0.0000	1.000	5.22E-07
-138000%	143.00%	0.24	$ 1,370	1.0000	0.0000	1.000	4.09E-07
-139000%	144.00%	0.24	$ 1,380	1.0000	0.0000	1.000	3.2E-07
-140000%	145.00%	0.24	$ 1,390	1.0000	0.0000	1.000	2.5E-07
-141000%	146.00%	0.24	$ 1,400	1.0000	0.0000	1.000	1.96E-07
-142000%	147.00%	0.24	$ 1,410	1.0000	0.0000	1.000	1.53E-07
-143000%	148.00%	0.24	$ 1,420	1.0000	0.0000	1.000	1.19E-07
-144000%	149.00%	0.24	$ 1,430	1.0000	0.0000	1.000	9.3E-08
-145000%	150.00%	0.24	$ 1,440	1.0000	0.0000	1.000	7.25E-08
-146000%	151.00%	0.24	$ 1,450	1.0000	0.0000	1.000	5.65E-08
-147000%	152.00%	0.24	$ 1,460	1.0000	0.0000	1.000	4.38E-08
-148000%	153.00%	0.24	$ 1,470	1.0000	0.0000	1.000	3.43E-08
-149000%	154.00%	0.24	$ 1,480	1.0000	0.0000	1.000	2.69E-08
-150000%	155.00%	0.24	$ 1,490	1.0000	0.0000	1.000	2.04E-08
-151000%	156.00%	0.24	$ 1,500	1.0000	0.0000	1.000	1.57E-08
-152000%	157.00%	0.24	$ 1,510	1.0000	0.0000	1.000	1.23E-08
-153000%	158.00%	0.24	$ 1,520	1.0000	0.0000	1.000	1.01E-08
-154000%	159.00%	0.24	$ 1,530	1.0000	0.0000	1.000	7.51E-09
-155000%	160.00%	0.24	$ 1,540	1.0000	0.0000	1.000	4.74E-09
-156000%	161.00%	0.24	$ 1,550	1.0000	0.0000	1.000	6.17E-09
-157000%	162.00%	0.24	$ 1,560	1.0000	0.0000	1.000	4.36E-09
-158000%	163.00%	0.24	$ 1,570	1.0000	0.0000	1.000	0
-159000%	164.00%	0.24	$ 1,580	1.0000	0.0000	1.000	1.05E-08
-160000%	165.00%	0.24	$ 1,590	1.0000	0.0000	1.000	0
-161000%	166.00%	0.24	$ 1,600	1.0000	0.0000	1.000	0
-162000%	167.00%	0.24	$ 1,610	1.0000	0.0000	1.000	0
-163000%	168.00%	0.24	$ 1,620	1.0000	0.0000	1.000	0
-164000%	169.00%	0.24	$ 1,630	1.0000	0.0000	1.000	0
-165000%	170.00%	0.24	$ 1,640	1.0000	0.0000	1.000	0
-166000%	171.00%	0.24	$ 1,650	1.0000	0.0000	1.000	0
-167000%	172.00%	0.24	$ 1,660	1.0000	0.0000	1.000	0
-168000%	173.00%	0.24	$ 1,670	1.0000	0.0000	1.000	0
-169000%	174.00%	0.24	$ 1,680	1.0000	0.0000	1.000	0
-170000%	175.00%	0.24	$ 1,690	1.0000	0.0000	1.000	0
-171000%	176.00%	0.24	$ 1,700	1.0000	0.0000	1.000	0
-172000%	177.00%	0.24	$ 1,710	1.0000	0.0000	1.000	0
-173000%	178.00%	0.24	$ 1,720	1.0000	0.0000	1.000	0
-174000%	179.00%	0.24	$ 1,730	1.0000	0.0000	1.000	0
-175000%	180.00%	0.24	$ 1,740	1.0000	0.0000	1.000	0
-176000%	181.00%	0.24	$ 1,750	1.0000	0.0000	1.000	0
-177000%	182.00%	0.24	$ 1,760	1.0000	0.0000	1.000	0
-178000%	183.00%	0.24	$ 1,770	1.0000	0.0000	1.000	0
-179000%	184.00%	0.24	$ 1,780	1.0000	0.0000	1.000	0
-180000%	185.00%	0.24	$ 1,790	1.0000	0.0000	1.000	0
-181000%	186.00%	0.24	$ 1,800	1.0000	0.0000	1.000	0
-182000%	187.00%	0.24	$ 1,810	1.0000	0.0000	1.000	0
-183000%	188.00%	0.24	$ 1,820	1.0000	0.0000	1.000	0
-184000%	189.00%	0.24	$ 1,830	1.0000	0.0000	1.000	0
-185000%	190.00%	0.24	$ 1,840	1.0000	0.0000	1.000	0
-186000%	191.00%	0.24	$ 1,850	1.0000	0.0000	1.000	0
-187000%	192.00%	0.24	$ 1,860	1.0000	0.0000	1.000	0
-188000%	193.00%	0.24	$ 1,870	1.0000	0.0000	1.000	0
-189000%	194.00%	0.24	$ 1,880	1.0000	0.0000	1.000	0
-190000%	195.00%	0.24	$ 1,890	1.0000	0.0000	1.000	0
-191000%	196.00%	0.24	$ 1,900	1.0000	0.0000	1.000	0
-192000%	197.00%	0.24	$ 1,910	1.0000	0.0000	1.000	0
-193000%	198.00%	0.24	$ 1,920	1.0000	0.0000	1.000	0
-194000%	199.00%	0.24	$ 1,930	1.0000	0.0000	1.000	0
	200.00%	0.24	$ 1,940	1.0000	0.0000	1.000	0

Example 4: Binary Loss Contract:

Consider a binary loss contract that has only two possible outcomes: either a zero loss, or a $1MM loss, with probability "1-q" and "q", respectively.

$$Loss = \begin{cases} 0, & q \\ 1, & 1-q \end{cases}$$

Targeting a loss ratio of "R", the insurance premium for this contract will be (1-q)/R.

Portion of Premium Qualified for Risk Transfer
80%

E[X]	$ 40,000
Expected Loss Ratio	5%
Premium	$ 800,000

x	f(x)	F(x)	F*(x)	f*(x)
$ -	0.96	0.96	0.800	0.800
$ 1,000,000	0.04	1	1.000	0.200

Multiple for RTD	4.00
Ceded Loss "L"	
E[L]	$ 40,000
E*[L]	$ 200,000
RTD	$ 160,000
Max Qualified Premiums	$ 640,000
Non-Qualified Premium	$ 160,000

Example 5: Packaging A Binary Loss Contract with a low-risk Portfolio Transfer:

5.1 The Binary Loss Contract:
Consider a binary loss contract that has only two possible outcomes: either a zero loss, or a $1MM loss, with probability "1-q" and "q", respectively.

$$Loss = \begin{cases} 0, & q \\ 1, & 1-q \end{cases}$$

Targeting a loss ratio of "R", the insurance premium for this contract will be (1-q)/R.

5.2. Low Risk Loss Portfolio Transfer:
A loss portfolio with E[Y] = $V million, lognormally distributed but with low coefficient of variation

Portion of Premium Qualified for Risk Transfer
10%

Binary Catastrophic Risk			Low Risk LPT		Combined Contract	
E[X]	$	40,000	E[Y]	$ 10,000,000	E[Z]=E[X+Y]	10,040,000
			coeff.var [Y]	1.00%		
			ELR [Y]	100%		
ELR [X]		40%			ELR [Z]	99%
Premium for X	$	100,000	Premium for Y	$ 10,000,000	Total Premium	10,100,000

Multiple for RTD	4.00
Ceded Loss "L"	
E[L]	$ 10,040,000
E*[L]	$ 10,296,374
RTD	$ 256,374
Max Qualified Premiums	$ 1,025,495
Non-Qualified Premium	$ 9,074,505

Russell B. Wenitsky, ACAS

Risk Transfer Testing Proposal

The fundamental problem with current risk transfer testing, as well as some recently proposed revisions, is the binary nature of the decision. Risk is treated as an absolute value, and either risk transfer is achieved or it is not. While in theory the current accounting guidance is "principles based", in practice the vast majority of transactions deemed to required testing fall under the 10/10 rule or some similar rule. So what we have in practice is a de facto bright line rule creating a binary risk transfer decision. The reality of course is that risk is a continuum. And so any reasonable standard should reflect that continuum.

Understandably, regulators and auditors are not happy with the current approach. Transactions with very different risk profiles can often provide very similar accounting benefits. A transaction that barely passes the bright line test receives full credit, as does a transaction with significantly more risk. The line becomes a target for clever structuring and creative assumptions. Thus proposals to codify bright line tests and raise absolute standards merely shift the decision line, and invite new and creative ways around that line. This will not solve the fundamental problem – the disparity between reality (continuous) and practice (binary)- and in fact will have unintended consequences. If regulators desire an approach that fairly reflects the economic substance of reinsurance transactions, then the concept of relative risk transfer provides a reasonable solution.

The proposed concept is simple. *If the reinsurer is in the same risk position on the ceded exposure as the cedant would have been had they retained the exposure, then the relative risk positions are identical, and full credit (reinsurance accounting) would be granted. To the extent that the reinsurer has mitigated the risk and is thus not "standing in the shoes" of the cedant, a portion of the transaction, commensurate with the extent of relative risk mitigation, should be deposit accounted.* It is not necessary that there be significant risk, in the absolute sense, in the cedant's portfolio. Only that the relative risk positions are considered. A quota share provides the simplest example of how this approach would be implemented. For now let's assume that an appropriate risk metric for measuring risk is the Expected Downside (ED), which is defined as the average over all possible economic loss scenarios (negative NPVs). In the case of a simple quota share, with no caps, corridors, slides, profit sharing, etc, the reinsurer's expected downside (ED_R) would be identical to the cedant's expected downside (ED_C) had they

retained the exposure, since all losses and premiums would be shared in equal proportions. The ratio of ED_R to ED_C would therefore be 100%, and so 100% of the transaction would receive reinsurance accounting. Now consider a quota share containing a cap which reduces the reinsurer's downside such that the ratio of ED_R to ED_C is 85%. In this case the reinsurer and the cedant are not in the same relative risk position, and therefore the cedant should account for 85% as reinsurance and 15% as a deposit. Obviously, as the cap is lowered (raised) the ratio decreases (increases), and a greater (lesser) portion is deposit accounted.

Provided that the selected risk metric is reasonable, the above approach would fairly reflect the entire risk continuum. Of course other risk metrics may be needed to capture the various types of reinsurance transactions. Describing catastrophic risk, for example, may require a different metric. Testing of actual transactions should be performed to determine the appropriate metric or combination of metrics. Once the metric is determined, for a given transaction define the Relative Risk Factor (RRF) as the ratio of the risk metric (RM) for the reinsurer and cedant.

$$RRF = RM_R/RM_C$$

The RRF would then be used as in the above example to bifurcate the accounting.

The relative risk approach has numerous advantages.

- First and foremost there is no arbitrary, magic bright line beyond which risk transfer is achieved, and therefore the possibility of similar accounting benefit for dissimilar risk transfer is eliminated.
- It works equally well for excess transactions.
- It is sensitive to market conditions to the extent that the relative risk varies as those conditions change.
- It will create greater accounting consistency between cedants and reinsurers. The reinsurer and cedant may have different RRFs, but the differences will only be in degree. There will be fewer situations where one party uses reinsurance accounting and the other deposit accounting.
- It fairly and consistently reflects the economic substance of transactions.

- It is only marginally more difficult to apply than current approaches.

Clearly not all reinsurance transactions should require testing. Safe harbors may be appropriate for many types of agreements. But rather than list the types of transactions that do not require testing, it may be easier to define those that do. For example, transactions with the following features should be tested.

- Any sort of profit sharing (the essence of finite risk reinsurance)
- Quota share agreements with loss limitations or loss sensitive features
- Loss sensitive premiums (or other charges such as balance sheet fees, etc.)
- Other loss sensitive or time sensitive features, such as floating or indexed retentions, deductibles, maintenance fees etc.

There are some disadvantages. In particular, double accounting entries would be required for bifurcated agreements.

Below are two examples demonstrating the above approach. The first example (A) is a simple capped quota share. For simplicity I have ignored investment income, reinsurer expenses, and any difference between the insurer's actual expenses and the ceding commission.

(A) Capped Quota Share Terms

- Expected Loss Ratio = 70%
- Ceding Commission = 25%
- Assumes loss ratio is lognormally distributed

The table below shows how the expected downside varies with changes in the cap and volatility assumption. For a given cap, the RRF is the ratio of the expected downside to the unlimited expected downside.

	CV = 20%		CV = 15%	
Loss Ratio Cap	Reinsurer Expected Downside	RRF	Reinsurer Expected Downside	RRF
75%	0.0%	0.0%	0.0%	0.0%
80%	-4.1%	38.1%	-3.8%	50.1%
85%	-6.9%	63.0%	-5.9%	77.0%
90%	-8.6%	78.6%	-6.9%	90.1%
95%	-9.6%	88.0%	-7.3%	96.0%
100%	-10.2%	93.4%	-7.5%	98.5%
105%	-10.5%	96.5%	-7.6%	99.4%
110%	-10.7%	98.1%	-7.6%	99.8%
115%	-10.8%	99.0%	-7.6%	99.9%
Unlimited	-10.9%	100.0%	-7.7%	100.0%

For illustrative purposes the above example does not consider any other risk metric, but the mechanics of the RRF calculation would be the same. For comparison, RRFs above were calculated at two different coefficients of variation (CVs). Note that the RRFs increase in a smooth and simple fashion as the ceded risk increases. There is no point of discontinuity at which risk suddenly appears or disappears. Also note that the greater the volatility the lower the relative risk of the reinsurer for a given cap. This is exactly what one would expect for a capped quota share.

As is currently the case, insurer and reinsurer may have different opinions on the amount of risk transfer, and hence mirror accounting would not necessarily exist. If the insurer believes the CV is 20% and the reinsurer believes it is 15%, each will use a different RRF. Of course there is no "right" answer. A range of parameters, sometimes quite wide, is perfectly reasonable given the great uncertainty involved in making such estimates. Often it is this range of opinion that creates a market for reinsurance in the first place.

The second example (B) demonstrates the approach for an aggregate excess cover with a 100% profit share provision. This is (or was) a very common type of "finite" cover. Terms are shown below. Instead of a lognormal distribution of loss ratios, a simple discreet distribution was assumed.

(B) Aggregate Excess Example

Amounts in millions $

TERMS		Loss Ratio Distribution	
Subject Premium =	**900**	Probability	Gross Loss Ratio
Company Expense Ratio	**25.0%**	**28.0%**	**55.0%**
Attachment Point =	**65.0%**	**60.0%**	**65.0%**
Limit =	**10.0%**	**12.0%**	**75.0%**
Reinsurers' Margin =	**9.00**		
Profit Share =	**100.0%**	100.0%	63.4%
Ceded Premium -	**32.00**		

Given the above terms we can calculate the RRF as follows.

Reinsurer Results

Gross Loss Ratio	Ceded Loss	Ceded Premium	Profit Share	Downside
55.0%	0	32.00	23	0.00
65.0%	0	32.00	23	0.00
75.0%	90	32.00	0	-58.00
63.4%	10.8	32.00	20.24	-6.96

RRF = 75%

Ceding Company Position Before Reinsurance

Gross Loss Ratio	Ceded Loss	Allocated Premium	Downside
55.0%	0	12.78	0.00
65.0%	0	12.78	0.00
75.0%	90	12.78	-77.22
63.4%	10.8	12.78	-9.27

With 100% profit sharing, the expected downside of the reinsurer is -6.96 million. The ceding company's risk position, had they not ceded the risk,

would present them with an expected downside of -9.27 million. The ratio of these two risk metrics would be the RRF = 75%. The key difference in the calculation for this example compared to the quota share example is the need to allocate premium to the layer. In the quota share example the premium charged by the cedant for the exposure is well known. Since a comparison is needed to the cedant's position had they not purchased reinsurance, it is necessary to determine the portion of the gross premium allocable to the layer of coverage. This is a very simple exercise, and does not require the projection of any amounts not already required in the pricing or assessing of the coverage.

The premium allocated to the layer of coverage was determined as follows.

Expected Ceded Loss =	10.8
Expected Ceded Loss as % of Gross Expected Loss =	1.85% = 10.8/(900*63.4%)
Allocated Premium =	12.78 = 1.85%*(1-.25)*900

If investment income were to be considered, the above would be based on discounted values of expected ceded and gross loss. Also, it is clear that the allocated premium is dependent upon market conditions. If the prices softened, the expected ceded loss, and hence the allocated premium, would increase given the same terms.

The above represents only one view of the RRF. As with the quota share example, the cedant and reinsurer will have different assumptions about the loss ratio distribution, and hence different RRFs. Assuming the above to be the cedant's view, below is a summary of the statutory financials demonstrating the impact of the proposed RRF approach.

If the loss ratio is below the attachment point the bifurcation has little impact, and the accounting results are very similar to current accounting. But at a loss ratio of 75%, the RRF approach reduces the benefit to both the liabilities and the underwriting result by 25%, precisely commensurate with the reduction in relative risk. This is a very intuitively appealing outcome.

Summary of Company Financials

	Gross Loss Ratio = 55%		Gross Loss Ratio = 75%	
No Bifurcation	(1)	(2)	(3)	(4)
	GROSS	NET	GROSS	NET
Assets	**1,000.00**	991.00	1,000.00	968.00
Liabilities	495.00	495.00	675.00	585.00
Surplus	505.00	496.00	325.00	383.00
NWP	900.00	868.00	900.00	868.00
Loss Ratio	55.00%	57.03%	75.00%	67.40%
NWP/Surplus	1.78	1.75	2.77	2.27
Underwriting Result $	180.00	171.00	0.00	58.00
Underwriting Result %	20.0%	19.7%	0.0%	6.7%
RRF Bifurcation				
	GROSS	NET	GROSS	NET
Assets	1,000.00	993.24	1,000.00	975.97
Liabilities	495.00	495.00	675.00	607.40
Surplus	505.00	498.24	325.00	368.56
	0.00		0.00	
NWP	900.00	875.97	900.00	875.97
Loss Ratio	55.00%	56.51%	75.00%	69.34%
NWP/Surplus	1.78	1.76	2.77	2.38
Underwriting Result $	180.00	173.24	0.00	43.56
Underwriting Result %	20.0%	19.8%	0.0%	5.0%

Jeffrey D. White, FCAS, MAAA

At work, I have spent a great deal of time recently on FAS 113/SSAP 62 risk transfer issues regarding my company's reinsurance contracts. While I have not yet found any useful actuarial techniques, I have discovered some important truths.

What all parties should avoid in a reinsurance standard

I do not believe the profitability of a contract should have any relevance to what we call the contract. Current standards require the reinsurer to have a reasonable chance of a significant loss for a contract to be called reinsurance. This type of standard leads to issues such as:

> An insurer wishes to reinsure $100 million of a basic limits (i.e. non-standard) personal auto premium on a quota share basis for surplus relief. Given the very low volatility of this book, if the insurer is writing the book at a nice profit, there is not a reasonable chance of a significant loss for either party. If the insurer is writing the book at no profit or a loss, there is a reasonable chance of a loss (though perhaps not significant). Thus, the standard allows a contract to be reinsurance in a soft market but not reinsurance in a hard market. This is not logical or practical – either something is reinsurance or it isn't!

Accounting rules should not protect insurers from themselves. If insurers wish to purchase reinsurance that provides a windfall for the reinsurer, FAS 113/SSAP 62 should not be the regulation that protects them. In other words, reinsurers should not be forced to change terms of a contract to lower their profit because of an accounting rule. If regulators wish to offer such protections, they should pass such regulation.

Regulators must be careful not to confuse accounting rules as regulation. Regulators may object to certain practices, but they should restrict these through regulation and not accounting rules. For example, Commissioner Garamendi may object to title insurers paying what amounts to additional commission through reinsurance arrangements. The solution is not to say these contracts are not reinsurance – the solution is to create regulation that prevents insurers from entering into these transactions.

Regulators must be careful how they proceed. It is not in the best interest of solvency to discourage the use of legitimate reinsurance. Over regulating these contracts may reduce the needed use of these contracts. Also, reinsurance contracts are fairly transparent in that they are reported on STAT statements. If we change what we call reinsurance, deposit accounting will lose that transparency (they simply subtract and add income like any other expense). Perhaps the solution is greater disclosure regarding material reinsurance contracts rather than classifying items as not reinsurance.

What all parties should want in a reinsurance standard

We should also allow each component of a contract to be tested on its own. For example, a quota share contract with a catastrophe corridor should be reinsurance if each component is deemed to be reinsurance. Since many quota share contracts cannot pass

the tests in paragraph 9 of FAS 113, companies must rely on paragraph 11. Paragraph 11 however requires perfect matching of terms, rendering the contract described above not reinsurance.

I believe a more practical approach to risk transfer testing should focus around defining types of reinsurance, explaining what each is, and focusing on the important tenets of what reinsurance is.

The three types of reinsurance of which I know take one of three forms:

Quota Share

The insurance risk is shared proportionately between the insurer and the reinsurer.

Per Claim/Occurrence Excess of Loss

The reinsurer agrees to pay for amounts over and above a certain threshold per claim/occurrence.

Aggregate Stop Loss

The reinsurer agrees to pay for amounts over and above a certain loss ratio or loss dollar threshold.

Insurance risk is defined to be variability in the timing and amount of claim (loss and LAE) reimbursements.

Possible reinsurance test

For all three, the variability in the timing and amount of all variable components should be similar for both parties; cash flow tests would show similarities.

Issues

There are issues that GAAP and STAT regulators have pursued. Restrictions should be placed to exclude certain transactions (i.e. there should be definitions as to what reinsurance is not).

Discounting of reserves or hiding runoff poor performing books of business

A reinsurance contract only covers claims to be incurred. A reinsurance contract never covers claims that have already been incurred. This definition will exclude loss portfolio transfers and other similar types of contracts.

Reinsurance disguised as loans or that provide earnings stability

A reinsurance contract does not include any restrictions on the timing and amount of reimbursements. A reinsurance contract should not have retrospective rating components, including variable/contingent commissions. No component should exist such that components are variable for one party but static for another. For example, a corridor should not exist where the insurer's loss ratio ranges from 60% to 80% while the reinsurer's reimbursement is effectively fixed at 5% for this range.

In conclusion, future standards of reinsurance should not consider either parties' profitability. Instead, standards should be certain that timing and amounts of reimbursements are truly variable and that these timing and amounts mirror those obligations of the insurer (with some allowance for reasonable reporting delay).

All opinions expressed herein are strictly my own and should not be construed to represent the opinions of my employer or any other party.

Name Withheld

Suggestions on Risk Transfer Analysis

Note: All of these comments are gut reactions. They are not detailed policy recommendations.

1. **Effective Test:** Testing should include a qualitative review of the subject business, the benefit that the ceding company derives from buying the treaty, and a review of a projected distribution of discounted profits to reinsurers. The aggregate distribution should not include internal expense and brokerage and should discount using risk free rates. The aggregate distribution should implicitly or explicitly reflect parameter uncertainty, particularly with regard to potential variability around selected loss development, trend, and rate change. As a reality check and in order to illustrate this parameter uncertainty, the final risk transfer analysis exhibit should include a projection of actual un-trended ultimate loss ratios for recent years. Creators and reviewers of the aggregate distribution should comment upon factors that could cause future results of the book to be different than past results. For example, a company that has written vanilla GL for years could make a decision to start writing nursing home business.
2. **Criteria:** The 10/10 rule could be a starting point. The adjustment that I would make is that a 5% chance of a 20% loss, a 2% chance of a 50% loss, or a 1% chance of a 100% loss could also pass. In addition, the reviewer should be open to qualitative justification that a treaty passes risk transfer. For example, the past results of a ceding company may have been very stable, but they might be writing a large new bloc of business in the upcoming year that could cause a greater variability in results.
3. **Safe Harbors:** a) Any proportional treaty where the reinsurers assume 100% or nearly 100% of the risk of a book of business, b) Any excess of loss contract where the discounted aggregate limit is greater than 150% of the maximum possible ceded premium, c) Any proportional treaty where the minimum commission is at least equal to the ceding company's expenses, it has no loss retention corridors, the property occurrence limit is greater than 150% of premium, and the discounted aggregate limit is greater than 150% of premium.
4. **Advantages versus other commonly used practices:** I think the above approach is generally in line with reasonable current practice. However, I am suggesting that actuaries and auditors reviewing deals for risk transfer should give greater consideration to parameter uncertainty and qualitative issues that could cause reinsurers to lose money. They should also focus on the treaty structure and the benefit to the ceding company when making their evaluations. In other words, instead of simply performing numerical calculations on an aggregate distribution that is viewed as gospel, reviewers need to use their brain and think about the underlying business and the true intent of the buyers.