Common Pitfalls and Practical Considerations in Risk Transfer Analysis

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The current papers available on risk transfer have provided background and a general description of the tools available for analysis. Risk transfer analysis has many nuances that can trip up an actuary testing a contract. This paper discusses several of these pitfalls and provides direction on how to address them based on previously published materials from the accounting boards, the American Academy of Actuaries (AAA), and the Casualty Actuarial Society (CAS). This paper also addresses several outstanding risk transfer concerns that have no easy answers. While these issues do not have obvious solutions, the intent of the paper is to shed some light on these topics and open the door for further discussion.

To facilitate the discussion of these common pitfalls and practical considerations two example contracts are reviewed with an Expected Reinsurer Deficit (ERD) calculated for both.

Keywords: Risk transfer, Expected Reinsurer Deficit (ERD), FAS 113, Reinsurance Attestation Supplement (RAS), SSAP 62.

1. INTRODUCTION

Current papers available on risk transfer have provided background and a general description of the tools available for analysis. However, risk transfer analysis has many seemingly minor nuances that can trip up an actuary testing a contract. In this paper, we will discuss several of these pitfalls and provide direction on how to address them based on previously published materials from the accounting boards, the American Academy of Actuaries (AAA), and the Casualty Actuarial Society (CAS). We will also highlight a number of practical considerations that have not received as much attention in the available literature. While these practical considerations do not have obvious solutions, we hope to shed some light on the available options and open the door for further discussion on the topic.

1.1 Risk Transfer in Current Literature

This discussion is derived from a review of existing risk transfer literature, most notably "Reinsurance Attestation Supplement 20-1: Risk Transfer Testing Practice Note" from the AAA Committee on Property and Liability Financial Reporting and "Risk Transfer Testing of Reinsurance Contracts: Analysis and Recommendations" from the CAS Research Working Party on Risk Transfer Testing [1][2]. We also relied heavily on the accounting standards, Financial Accounting Standard No. 113, "Considerations in Risk Transfer Testing" (FAS 113) and SSAP 62, "Property and Casualty Reinsurance." While some discussion of the CAS Working Party paper and the AAA Practice Note is necessary, this paper is an attempt to go beyond the framework provided in the

current literature and review the more routine issues faced by actuaries in reviewing reinsurance transactions for risk transfer.

1.2 Objective

In this paper, we will discuss several pitfalls and practical considerations with risk transfer analyses. We will provide direction on how to address the pitfalls based on previously published materials and we hope to shed some light on the available options concerning the practical considerations and open the door for further discussion on the topics.

1.3 Outline

In Section 2 of this paper we will present a brief history and background of risk transfer, including a discussion of the terms "substantially all" and "self-evident," as well as discussion on measuring risk transfer and risk transfer thresholds.

Section 3 will contain a discussion on the pitfalls and practical considerations. We will start by showing two sample contracts that will be used as a basis for much of the discussion, and how to analyze risk transfer. Next we will cover various pitfalls, including discussion on the following topics:

- Profit Commissions
- Reinsurer Expenses
- Interest Rates and Discount Factors
- Premiums
- Evaluation Date
- Commutation and Timing of Payments

In the last part of Section 3, we will highlight some of the practical considerations in risk transfer testing, including discussion on:

- Parameter Selection
- Interest Rate
- Payment Pattern
- Loss Distribution

- Parameter Risk
- Use of Pricing Assumptions
- Commutation Clauses

The fourth and final section of the paper will contain a short wrap up, conclusions and a reminder that risk transfer testing is a principle-based exercise and not just a "plug and chug" methodological exercise.

2. BRIEF HISTORY OF RISK TRANSFER

Since the reinsurance goals of ceding companies are as different as the risks reinsured, reinsurance contracts contain a variety of terms and conditions that can impact the economic structure of the reinsurance transaction. When a contract qualifies as reinsurance there are certain accounting benefits that a ceding company can realize.

The demonstration of risk transfer for reinsurance is required by FAS 113 in order for the contract to receive reinsurance accounting treatment under Generally Accepted Accounting Principles (GAAP). Statutory Accounting Principles (SAP) defined in SSAP 62 are similar in guidance to FAS 113. Generally, both standards for risk transfer require that:

1. The reinsurer assumes significant insurance risk under the reinsured portion of the underlying insurance agreement; and

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

Because the terms "significant insurance risk," "reasonably possible," and "significant loss" are not defined in either accounting standard, the challenge is to appropriately interpret and apply the accounting standards to each reinsurance transaction.

The abuses of the past several years in the use of finite reinsurance contracts have highlighted the need to document and quantify risk transfer. An increase in scrutiny of reinsurance contracts led to the introduction of the "Reinsurance Attestation Supplement," in the 2005 NAIC Annual Statement.

The supplement requires the chief executive officer (CEO) and chief financial officer (CFO) to confirm that:

1. There are no separate written or oral agreements between the reporting entity and assuming

reinsurer.

2. There is documentation for every reinsurance contract for which risk transfer is not reasonably self-evident that details the transaction's economic intent and that documentation evidencing risk transfer is available for review.

3. The reporting entity complies with all requirements set forth in the Statement of Statutory Accounting Principles No. 62, "Property and Casualty Reinsurance" (SSAP 62).

4. The appropriate controls are in place to monitor the use of reinsurance.

CEOs and CFOs have the responsibility to attest to risk transfer in reinsurance transactions. However, since actuaries are uniquely qualified to quantify and evaluate risk transfer, they are increasingly being called upon to quantify risk transfer and provide the necessary documentation.

As mentioned above, GAAP and SAP accounting standards contain similar wording about what is required for risk transfer to be present. Most notably, both require the presence of insurance risk. Insurance risk has two components, underwriting risk and timing risk. If both of these types of risk are not present, then insurance risk has not been transferred. While risk transfer is independently defined in each standard, we are unaware of any examples of a contract that would meet the requirements of one standard, but not the other. Contracts that qualify according to one standard are generally considered to meet the requirements of the other standard as well.

2.1 One Exemption from Risk Transfer Requirements – "Substantially All"

Both GAAP and SAP accounting standards specifically require that it be reasonably possible that the reinsurer may realize a significant loss from the transaction, except in cases where the reinsurer meets the "substantially all" requirement. This is meant to exempt a very narrow definition of contracts where the reinsurer assumes "substantially all of the insurance risk relating to the reinsured portions of the underlying insurance contracts." The most common examples are straight quota share or individual risk contracts with no loss ratio caps or other risk limiting features. The reason for this exemption is that it allows companies to acquire qualifying reinsurance on inherently profitable books of business where it may not be reasonably possible that the reinsurer will realize a significant loss.

2.2 Required Risk Transfer Documentation and Reasonably Self-Evident

When the NAIC introduced the "Reinsurance Attestation Supplement" (RAS) in 2005 they also

introduced a new term to the risk transfer lexicon, "reasonably self-evident." The RAS requires documentation "for every reinsurance contract for which risk transfer is not reasonably self-evident." This classification of contracts is meant to reduce the need to rigorously test every reinsurance contract for risk transfer. Unfortunately, very little guidance was offered on what "reasonably-self evident" encompasses. The AAA Practice Note followed the introduction of the RAS and laid out some general guidelines for establishing when the presence of risk transfer is reasonably self-evident. The guidelines were general in nature and provided characteristics to look for in contracts to determine when risk transfer is reasonably self-evident and when it is not.

The CAS Working Party paper took these guidelines one step further and provided a list of specific contract categories where risk transfer is reasonably self-evident based on meeting a 1% Expected Reinsurer Deficit (ERD) threshold. They point out that this list is preliminary and expect it could be considerably expanded. They also point out that there are exceptions to the list, such as when a contract looks contrived. We feel that it can be dangerous to attempt to codify this terminology with explicit definitions. Every contract is different and must have its terms thoroughly reviewed.

Specifically, the CAS Working Party paper lists a couple of categories that we do not agree are always reasonably self-evident such as individual risk contracts and certain long tail excess of loss treaties. Individual risk treaties with no significant risk limiting features would likely be exempt from the accounting standards since the reinsurer assumes "substantially all" of the underlying risk. For individual risk contracts that do not qualify for this exemption, it is not hard to imagine special features that would restrict risk transfer.

For long tail excess of loss treaties, the CAS Working Party paper provides a few numerical qualifications to meet the reasonably self-evident standard. For excess of loss contracts that are not on short tail exposures, the CAS Working Party paper finds that any contract with aggregate limits no less than one per occurrence limit or twice the premium, meets the reasonably self-evident criteria if there are no ceding commissions and the rate on line is below 500%. It is not difficult to construct a contract around these parameters that clearly does not transfer risk. An extreme example would be a single doctor paying $1M for a $1M x $5M medical malpractice treaty with a $2M aggregate limit. This contract passes the established criteria for the risk transfer to be reasonably self-evident, but I think most would agree that not enough risk is transferred in this contract for it to qualify as reinsurance. This is obviously an unrealistic example, but it shows how applying specific parameters on the terminology can lead to unintended results.

The RAS requires documentation "for every reinsurance contract for which risk transfer is not reasonably self-evident." It seems obvious that any contract requiring a more rigorous review would also require documentation for the model results. However, it is our recommendation that documentation be kept on all reinsurance contracts reviewed for risk transfer. We think it is valuable to have documentation for those contracts found to be exempt for any reason, although the most notable are those that meet the "substantially all" clause. We find it to be just as important to document any contract where the risk transfer is found to be reasonably self-evident. While the term reasonably self-evident might lead one to believe the conclusion is obvious and anyone who picks up the contract will reach the same conclusion, not all contracts that meet this standard are clear cut. This is of particular importance if you are using any reference, such as the previously discussed list from the CAS Working Party Paper, to make your determination. The AAA Practice Note also recommends keeping documentation for reasonably self-evident contracts. The practice note also includes several example checklists in the appendix from companies who have made this type of documentation standard.

2.3 Selected Risk Measuring Method – Expected Reinsurer Deficit (ERD)

Neither SSAP 62 nor FAS 113 provide a clear numeric trigger of when risk transfer fails. The "10-10" rule was developed as a benchmark to give meaning to the criteria in the two accounting standards. The "10-10" rule says that a reinsurance contract exhibits risk transfer if there is at least a 10% chance of a 10% or greater loss for the reinsurer.

Another method that has gained acceptance and overcomes some shortcomings of the "10-10" rule is the Expected Reinsurer Deficit (ERD). ERD can be viewed as the probability of a net present value (NPV) underwriting loss for the reinsurer multiplied by the NPV of the average severity of the underwriting loss. A treaty is typically considered to exhibit risk transfer if ERD is greater than 1%, which is consistent with the "10-10" rule (10% loss multiplied by 10% chance is a 1% ERD). Therefore, contracts that qualify for risk transfer under the "10-10" rule generally qualify under a 1% ERD. We will discuss thresholds more in the next section.

ERD has not been explicitly endorsed by any professional body. However, while the CAS Working Party paper stopped short of endorsing ERD, they did prefer its use as a de facto standard over the "10-10" rule. There are a handful of other methods, but none of them are as widely used as the two previously mentioned. Some methods, such as Value at Risk (VaR) and Tail Value at Risk (TVaR) are generalizations of methodologies we have already discussed. Others, such as the

Right Tail Deviation (RTD) method by Wang outlined in the CAS practice note, have not caught on due to the complexity of the model [4][5]. There are also methods, such as the Risk Coverage Ratio (RCR) by Ruhm, which have not caught on due to the exclusion of key variables [3]. RCR does an adequate job of evaluating risk in the losses that are transferred, but it does not make any comparison to premium.

In this paper we will test for risk transfer using a simple cash flow simulation and calculating the Expected Reinsurer Deficit (ERD). While some of these other measures could be used in our example analysis we will use only ERD in the interest of consistency.

2.4 Risk Transfer Thresholds

The CAS Working Party paper began some brief discussion about what the appropriate guideline threshold percentage should be and suggested that further research be done. Currently, because it is consistent with the "10-10" rule, the most commonly recognized threshold for ERD is 1%. Some have suggested that a 2% threshold would be more appropriate. Our recommendation is to continue using the 1% threshold until a more thorough analysis suggests otherwise. Using 2% would be a more stringent guideline, but the 2% threshold does not appear to be any less arbitrary than the current 1% threshold. While the 1% threshold is based on the somewhat arbitrary "10-10" rule, there is some reasoning behind it. The "10-10" rule was loosely derived from the accounting standard language that required that the reinsurer face a "reasonable chance of a significant loss." For the purposes of risk transfer, it has been commonly accepted that a 10% chance is a "reasonable chance" and that a 10% loss is a "significant loss." From these two accepted values, the ERD of 1% has been derived and this threshold continues to gain acceptance.

The CAS Working Party paper also mentions the possibility of including other requirements, such as a required maximum loss, in order to show risk transfer. We recommend not complicating the methodology with extra arbitrary requirements. While adding a maximum loss requirement may feel intuitive, it begins to complicate the process and makes explaining results to the decision-makers more difficult. Adding requirements can also lead to more engineering of contrived contracts. If a maximum loss is required, any contract can be rewritten to incorporate a rare maximum loss.

3. COMMON PITFALLS AND PRACTICAL CONSIDERATIONS DISCUSSION

In order to illustrate the common pitfalls that can affect a risk transfer analysis it is first important to demonstrate how a basic risk transfer analysis is completed, highlighting many of the issues that can surface along the way. Many of the pitfalls referenced in this section are further emphasized later in the paper.

To demonstrate risk transfer analysis two reinsurance contracts are used. Contract #1 is a quota share contract while Contract #2 is an excess of loss contract.

The terms for Contract #1 are summarized in Table 1:

Table 1 - Summary of Terms - Contract #1

Inception Date	1/1/2008
Estimated Subject Premium	10,000,000
Reinsurance Premium	8,000,000
Cession	80.0%
Ceding Commission	25.0%
Profit Commission	
Loss Ratio	66.0%
Profit Swing	5.0%
Loss Ratio Cap	100.0%
Reinsurers Expenses as % of Prem.	
Brokerage	*2.0%*
Underwriting Exp.	*2.0%*
Federal Excise Taxes	*1.0%*

The underlying exposure for Contract #1 is multi-state workers compensation. The company has written workers compensation for a number of years. The cession is a straightforward quota share with a loss ratio cap of 100%. This loss ratio cap has the potential to significantly affect risk transfer. The presence of the loss ratio cap does not always indicate a lack of risk transfer. Contracts, with loss ratio caps at 200% to 300% can clearly result in a significant loss ot the reinsurer. Secondly, there is a profit commission provision whereby the ceding company will receive a profit commission if the underlying loss ratio is 66% or less with maximum profit provision of 5.0%. The profit provision swings on a one-to-one basis with the loss ratio. The impact of profit

provisions on risk transfer is discussed later in the paper.

The terms of the second contract are summarized in Table 2:

Table 2 - Summary of Terms - Contract #2

Inception Date	1/1/2008
Estimated Subject Premium	10,000,000
Provisional Reinsurance Rate	8.50%
Provisional Premium	800,000
Maintenance Fee	50,000
Retention	250,000
Limit	250,000
Swing Rate	
Swing Loss Ratio	75.0%
Minimum Rate	6.00%
Maximum Rate	11.00%
Reinsurers Expenses as % of Prem.	
Brokerage	*10.0%*
Underwriting Exp.	*7.0%*
Federal Excise Taxes	*1.0%*

This is an excess of loss contract covering workers compensation exposure that has a number of potential risk limiting features. The contract is swing rated with a provisional rate of 8.5% which can swing up or down by 2.5%. The swing is based on a ceded loss ratio of 75.0%. Secondly, there is a feature that states that the contract is automatically commuted after five years unless the ceding company pays an additional maintenance fee of $50,000.

For the two example contracts it is not reasonably "self-evident" that risk transfer exists due to the presence of such features as low loss ratio caps and swing-rated premiums.

3.1 Analyzing Risk Transfer

The first step in any risk transfer review is to understand the reinsurance contract's terms and conditions, focusing especially on the terms that can affect the amount of risk being transferred. Care must be taken to understand not only the terms of the treaty but also when those terms will be triggered. In Contract #2 there is a commutation clause that requires a maintenance fee to avoid early commutation that is triggered after five years.

Next the reporting dates and premium due dates need to be determined. In both example

contracts the reinsurance premium is payable in quarterly installments due one month after quarter end , i.e., on April 30, July 31, October 31, and January 31 of the following year.

In both contracts there is not a pre-defined loss payment schedule and therefore losses are reimbursed as they occur. To determine the net present value of the losses, a loss payment pattern reflecting the underlying exposure being reinsured is applied. It is further assumed that losses in any given calendar year are paid at the midpoint of the year.

For Contract #2, it is assumed that the first swing rate adjustment is applied two years after the contract's effective date. Most contracts will define the timing of the experience adjustments to the premium. It is also assumed in the model that the impact of the adjustment is correctly identified for the first adjustment with no further changes to the ceding commission necessary. This assumption implies that the ultimate loss ratio is known at the first adjustment.

The second assumption is that the commutation fee will be paid by the ceding company after five years. This is a reasonable assumption since the ceding company may not want to commute the contract and reassume the risk of changes in the unpaid claims estimates.

The risk transfer analysis was completed using Monte Carlo simulation, modeling first the direct loss payments and then projecting the treaty cessions from the direct loss payments. The ceded losses are then discounted to the effective date of the treaty. Next, the final premium amounts are determined based upon the nominal treaty results, not on the discounted premiums or losses. Any premium adjustments are determined from the modeled results. Care must be taken so that the premium payment dates are appropriately modeled. Like the losses, premium payments are discounted to the treaty effective date. The reinsurer profit/loss is then calculated for each iteration of the simulation as the net present value (NPV) of all payments made from the ceding company to the reinsurer minus the NPV of all the payments made from the reinsurer to the ceding company.

All cash flows between the ceding company and reinsurer need to be represented in the model whether they are called premiums, fees, or experience adjustments. Reinsurer expenses are not included in the model since this is not a cash flow between the ceding company and the reinsurer. For instance in Contract #2 the maintenance fee is included in the analysis and the reinsurer expenses are not. The reinsurer expenses are not part of the risk assumed by the reinsurer from the ceding company.

Finally, the Expected Reinsurer Deficit (ERD) is calculated. ERD can be viewed as the probability of a net present value (NPV) underwriting loss for the reinsurer multiplied by the NPV

of the average severity of the reinsurer underwriting losses. The resulting ERD values are 2.85% for Contract #1 and 2.09% for Contract #2. Details of the simulation and ERD calculation can be found in Appendices A and B. These results indicate that both of these contracts appear to exhibit risk transfer. This conclusion is based on the calculated ERD values and the commonly accepted threshold of 1.0%. As with any risk transfer decision, the ultimate determination must be made by the company CEO or CFO or both.

3.2 Common Pitfalls

This section will highlight easy-to-make mistakes or common pitfalls. Most of these come from our own experience in reviewing contracts for risk transfer and reviewing risk transfer analyses of other actuaries. It is our intent to provide concrete solutions citing previously published materials.

3.2.1 Profit Commissions

Profit commissions generally should not be considered in risk transfer analysis. When determining if risk transfer is present, the analysis focuses only on the scenarios resulting in a loss for the reinsurer. While profit commissions can affect the economic results of a treaty, they usually are not triggered during a reinsurer loss.

This exclusion of profit commissions and focus on reinsurer loss scenarios is not necessarily intuitive. However, the accounting standards clearly state that the presence of risk transfer requires a "reasonable chance of a significant loss" to the reinsurer. Therefore, the results of the ceding company should not be considered in a risk transfer analysis.

It is important to remember that contract features like profit commissions can still have an indirect impact on risk transfer. This impact on risk transfer stems from how these features may affect other aspects of the contract, most notably the premium. Reinsurance contracts are priced while considering any and all expected payments paid and received by the reinsurer. Any addition of a profit commission clearly increases the amount of future expected payments by the reinsurer to the ceding company and may result in a higher premium for the contract.

In the example analysis for Contract #1, the profit commissions were included in the simulation to demonstrate that they did not affect the reinsurer in any loss scenarios. However, if the contract failed to meet risk transfer requirements, the ceding company and the reinsurer may consider potential changes that would allow the contract to be accounted for as reinsurance. One potential change would be to eliminate or reduce the profit commissions with a corresponding decrease in

premium. This change in premium may result in the contract meeting risk transfer requirements.

Another way profit commissions can affect risk transfer is through carryforwards. Carryforwards may be used in multi-year contracts where the profits or losses from prior years may affect the results of the future years. A contract for periods of more than one year usually requires further testing for risk transfer and any carryforwards that may impact a loss position for the reinsurer would need to be incorporated into the model. Carryforwards can also be used in one-year contracts where the primary company and reinsurer agree to terms each year and at that time choose whether or not results will be carried forward. In this case each contract renewal may require a specific analysis. If there is a carryforward from a previous year that would affect results when there is a loss for the reinsurer, then it must be incorporated into the cash flow model. However, when considering one-year contracts with no impact from prior carryforwards there is no need to incorporate potential future carryforwards since they have no impact on the contract being reviewed.

3.2.2 Reinsurer Expenses

Only cash flows between the ceding company and the reinsurer should be considered in a risk transfer analysis. According to SSAP 62, "The evaluation is based on the present value of all cash flows between the ceding and assuming enterprises under reasonably possible outcomes." This means that broker expenses, operating expenses, fees related to letters of credit, and taxes should bear no impact on the analysis. As can be seen in the Appendices, the analyses of the example contracts did not incorporate any of these expenses that did not result in a cash flow between the reinsurer and the ceding company.

3.2.3 Interest Rates and Discount Factors

SSAP 62 requires a constant interest rate to be used for discounting across all simulated scenarios. The interest rate should not vary by scenario because risk transfer analysis should only consider insurance risk. Non-insurance risks such as investment risk, currency risk, and credit risk should not be included. The AAA Practice Note interprets this to also mean that the same interest rate should be applied to all cash flows, including premiums and losses.

SSAP 62 only requires the selection of the interest rate to be reasonable and appropriate. The AAA Practice Note recommends the risk free rate as a reasonable choice. This is not necessarily a conservative selection. Because the risk free rate is commonly below a reinsurer's expected

investment returns, it will actually result in higher projected present valued losses. However, the investment abilities of the reinsurer should not affect the presence of risk transfer, so the risk-free rate is a consistent and reasonable selection for the analysis. The selection of other interest rates is considered later in the paper.

SSAP 62 states that a reasonable and appropriate interest rate "generally would reflect the expected timing of payments to the reinsurer and the duration over which those cash flows are expected to be invested by the reinsurer." Therefore the duration used to select an interest rate should be based on the net cash flows to the reinsurer.

There has been a lot of guidance on interest rate selection and there is very little room for deviation from the use of a constant interest rate in all risk transfer analyses. However, in the selection of the interest rate the accounting standards do not prescribe a set framework and note that judgment is involved. While using a risk-free rate with duration equal to that of the reinsurers net cash flows is recommended, a selected rate could still be considered a "reasonable and appropriate rate".

Page 4 of Appendix A provides an example of calculating a duration using loss and premium payments and then selecting a risk-free rate based on that duration. To get the duration of the net cash flows we performed two duration calculations. First we determined the duration of the premium payments. This was straight forward since the premium payment schedule is laid out in the contract. Next the loss duration is calculated using an industry payment pattern. The duration of the net cash flows is then the difference between the two. This calculation may not be exact, but it is a good approximation of the "duration over which those cash flows are expected to be invested by the reinsurer," as the standard requires. The calculated duration of net cash flows was then used to select an interest rate based on the years of maturity and yield curve rates from the U.S. Treasury in Columns (7) and (8). This interest rate was used in the analysis for Contract #1.

For Contract #2 an interest rate was selected with consideration given to the current risk-free rates and longer expected payment pattern for an excess of loss contract.

3.2.4 Premiums

The premium paid by the ceding company is one of the most significant inputs when determining if risk transfer is present. When using the "10-10" rule or ERD all potential loss situations are going to be compared against the premium to calculate a percent of loss. While its importance is clear, what the premium should include is not nearly as straightforward.

First, the premiums used in risk transfer analysis should be gross premiums. This is specifically pointed out in SSAP 62. Gross premiums entail all premium paid to the reinsurer before the consideration of any payments back such as a ceding commission.

When making comparisons against premium to determine a reinsurer's profit or loss, it is required that the present value of the premium be used. Reinsurance contracts often lay out specific payment plans for premium. The same interest rate used to discount losses should be applied to calculate the present value of the premium. While the risk transfer analysis is a present value calculation, it is important to model the actual functioning of the contract. This means that the application of the loss ratio caps and experience adjustments are based upon the nominal premium and loss amounts. As shown in Appendix A, the loss ratio cap in Contract #1 is applied to nominal losses and premiums in the simulation. The discounting of premium and losses happens after the contract losses and premiums are determined and any caps or experience based features are applied.

When the premium of a reinsurance contract is dependent upon future events, using the proper premium in a cash flow simulation is slightly more complicated.

There are a number of premiums that could be considered for this purpose. The initial deposit premium is an intuitive and simple choice, but it does not account for future payments from the ceding company to the reinsurer and could therefore be easily manipulated. The other options are to use an expected premium or the actual premium in each scenario.

The use of expected premiums may also seem intuitive, but can be troublesome as well. The most significant concern with using expected premiums is the potential over detection of risk transfer. When premium is dependent upon loss experience, the highest premium levels often occur when the loss experience is the poorest and the reinsurer's losses are at their highest. If the reinsurer's percent of loss is calculated using an average expected premium, it is likely that the resulting reinsurer loss percentage will be a larger negative value than what is actually possible. Because of this it is imperative that actual premiums are developed along with the losses for each scenario and that each scenario has a corresponding percent of reinsurer loss developed. From these simulated results, percentiles and values such as ERD can be calculated.

It is not uncommon for a reinsurance contract to include fees other than premium. When there are fees that depend upon future events, the impact of these events should be included in the model. If it is not possible to include certain events in the model, a general assumption about their impact on any future cash flows may be necessary. The conservative decision would be to include all fees

that the ceding company may be required to pay to the reinsurer. There is an example of this in Contract #2, which requires a fee to delay mandatory commutation of the contract after five years. In the example it is assumed that the primary company will not want to commute the contract and reassume the risk after five years and therefore will be required to pay a fee of $50,000. When this type of fee is expected to occur, it should be considered as premium in any calculation of reinsurer loss. While the fee may be entirely administrative and related to the reinsurer's claim handling costs, any cash flows from the ceding company to the reinsurer should be considered as premium. If this were not the case, the determination of risk transfer could be manipulated based upon the labeling of certain cash flows as premiums or fees.

3.2.5 Evaluation Date

The date used in risk transfer analysis will likely only be used in the selection of an interest rate or in determination of how much was known about potential losses when the contract was entered into. SSAP 62 states that "risk transfer assessment is made at the inception date based on facts and circumstances known at the time." Therefore any parameters that may be affected by the date at which they were determined should be considered from the time of the contract's inception. The contract inception date is the date the contract comes into force, or the original effective date. According to SSAP 62 it is not necessary to retest for risk transfer at every renewal unless there are any significant amendments made to the treaty. If a contract is tested at inception, the results of that test are unlikely to change. In the case of an amendment that makes a material change to the amount of risk being transferred, the amendment date should be treated as the inception date of the contract and the contract should be reviewed again for risk transfer.

3.2.6 Commutations and Timing of Payments

According to SSAP 62, any reinsurance contracts that have prescribed payment patterns do not meet the risk transfer requirements. In order to have risk transfer in a reinsurance contract, there must be timing risk as well as underwriting risk. Prescribed payment plans remove the timing risk necessary for risk transfer. In order for the contract to contain timing risk the reinsurer must make "timely reimbursement payments."

Contracts with commutation clauses may still meet risk transfer requirements, but to the extent they affect the cash flows between the ceding company and reinsurer, they must be modeled. If a fee is required to avoid an early forced commutation, this fee should be considered as part of the expected premium paid. If the commutation decision is unilateral, it may be necessary to

incorporate the commutation decision into the model based on economically rational decision making. To the extent the commutation clause impacts the payment pattern, this too should be considered in the cash flow model.

3.3 Practical Considerations

This section is meant to highlight a number of practical considerations that commonly appear in risk transfer analyses and have not been thoroughly addressed in the current literature. While not all of these practical considerations have obvious solutions, we hope to shed some light on the available options and open the door for further discussion on the topics.

3.3.1 Parameter Selection

One of the first and most important steps in performing a cash flow simulation for risk transfer analysis is choosing the parameters. Any parameters that are not given by the contract must be selected after some contemplation. This includes the interest rate, payment pattern, and any loss distributions used for projecting cash flows.

3.3.2 Interest Rate

Making the appropriate interest rate selection was previously addressed in the Common Pitfalls section. Using a risk-free rate based upon a duration calculation and the expected premium and loss payments is recommended by the AAA Practice Note. It is also required by the accounting standards that the same rate be used throughout the analysis.

While the risk-free rate is recommended, there are other possibilities to consider. It is difficult to envision a scenario were it would be reasonable to use an interest rate that is lower than the risk-free rate. This may seem conservative, but using a lower interest rate would lead to higher losses at present value and could result in over-detecting risk transfer. It is also difficult to construct an argument for why a company would not have the risk-free rate available to them. Therefore, it seems reasonable to treat the risk-free rate as the lowest possible choice, or floor, when selecting an interest rate.

A better argument could be made for selecting an interest rate above the risk-free rate. The most logical argument is that the reinsurer in the contract has a higher expected return on investments and this expected return should be used when determining if they face a "reasonable chance of a significant loss." While this argument is intuitive, it does have its flaws. First, this is not likely an

available parameter if the risk transfer analysis is being done on behalf of the ceding company. Next, if a reinsurer's expected investment returns are used in the risk transfer analysis, it will create the situation where a contract may be found to exhibit risk transfer for a reinsurer with poor investment strategy, but be found not to transfer risk for a reinsurer with superior investment strategies. This type of counter-intuitive result is also why cash flows that are not between the ceding company and the reinsurer are not considered.

Based on these considerations it is difficult to construct an argument for using anything that is not at least loosely based upon the risk-free rate. For consistency and to provide support for the interest rate selected, it may be worthwhile to base the selection on the treasury yields available at the inception date of the contract and the expected duration of the cash flows, as was done in the example for Contract #1. This approach is consistent with the recommendation from the AAA Practice Note. However, depending on the situation and in an effort to keep an analysis simple, it may also be just as reasonable to select an appropriate approximation of the current risk-free rate, as was done in the example for Contract #2.

An alternative to selecting a duration-matched interest rate, which has been used by some practitioners, is the selection of a constant yield curve. Use of a yield curve is common in company planning and in making economic decisions on contracts. However, the use of yield curves in risk transfer analysis does not appear to be consistent with the accounting standards. The AAA Practice Note finds that SSAP 62 requires, "that a single interest rate be used to present-value the cash flows."

A constant yield curve would generally result in a more stringent risk transfer analysis since interest rates tend to be higher at longer durations. The typical yield curve would lead to more discount being applied to losses in comparison to the premiums, which are often paid much quicker. While the use of a yield curve may seem like an improvement to the analysis, the language in the accounting standards clearly leads to a similar conclusion to the AAA Practice Note. Both standards refer to the use of "a constant interest rate," through all cash flow scenarios. The intent of the standards appears to be that interest rate risk should not be incorporated in the model. Thus, an interest rate that varies by scenario is not allowed. Capturing interest rate risk is not the intent of incorporating a yield curve into the analysis. A constant yield curve across all scenarios would only result in a different interest rate when the timing of the cash flows differed, which reflects risk due to the timing of losses and premiums, not the interest rate. However, the use of a yield curve to discount cash flows would result in a different effective interest rate when no losses are paid

compared to a situation where significant losses are paid. This appears to violate the requirement in SSAP 62 that the "same interest rate shall be used to compute the present value of cash flows for each reasonable possible outcome tested."

3.3.3 Payment Pattern

Payment patterns are often based on previous experience for the ceding company or industry benchmarks or both. While this can be a simple parameter to select, it is important to remember that there is uncertainty involved in the payment pattern. While this risk is more difficult to measure than the risk involved in a loss distribution, the timing of payments can play a significant role in the amount of risk transferred. For example, when a constant payment pattern is applied to a loss distribution, the results will not recognize the potential impact of quicker than expected payments. This will have the most significant impact on the tails of the distribution, which is often the portion we are the most interested in for determining risk transfer. While introducing variability into a payment pattern may be too complicated for the benefit it provides, it is important to at least consider this risk as you complete your analysis.

3.3.4 Loss Distribution

Loss distributions are often based on previous company experience, industry benchmarks, pricing information, or judgment, or all of these factors. For transactions covering large books of business with several years of historical experience available, selecting a loss distribution can be as easy as fitting a distribution to the available data. For books of business with low premium volume or immature loss experience, selecting the appropriate distribution can be much more difficult. Even for mid-size books of business it can be difficult to select a loss distribution because risk transfer testing focuses on the right tail of the distribution. This concern is compounded when working with high-level excess of loss contracts. However the loss distribution is determined, it is important to test the reasonableness of the tail results. Having an adequate comfort level with the tail results produced by the selected distribution is crucial.

When a company does not have enough historical loss experience to base a distribution upon, it is typical to turn to industry benchmarks or the information used to price the reinsurance contract. The use of pricing assumptions in risk transfer analyses is discussed later in the paper. Industry data can provide a starting point for overall expected loss ratios or frequencies and severities. However, it is difficult to select a distribution and develop a variance using only industry results. Individual companies can experience significantly higher variance in their loss than the industry as a whole. In

these instances it may be necessary to rely on some generally accepted distributions. Likewise a selected variance will be required. This selection will depend on a number of considerations, such as the size of the book of business, the type of coverage, the type of business being underwritten, and a variety of other factors.

3.3.5 Parameter Risk

A key consideration for any simulation model is parameter risk. Cash flow simulations for risk transfer are no different. As we previously discussed, selecting parameters to simulate future loss payments is a difficult process and it is important to account for the risk that the selected parameters or model are incorrect. Accounting for this increased variability in your simulation will increase the likelihood that your analysis will determine risk transfer is present. This is a reasonable result when you consider that the reinsurer is clearly accepting this same parameter risk when entering into the contract.

Parameter risk can be accounted for explicitly or implicitly. Implicitly it can be reflected in a slightly higher expected loss selection or in an increase to the expected volatility of losses. In the case of explicit recognition it is common to see a probability distribution assigned to key parameters and then to have them simulated also. This provides some variability to the selected parameters to help account for parameter risk. While this is a more concrete method than including it implicitly, it also depends on judgment and the selection of more distributions and parameters. There is not much information available about incorporating parameter risk into cash flow simulation models. Currently, there are no widely accepted methods and the costs of more complicated techniques may tend to outweigh the benefits.

Parameter risk is going to have the greatest impact on the losses simulated, but it can affect other facets of the analysis as well. When premium projections must be estimated based on the treaty terms, there is some additional parameter risk, but it will rarely affect the result of the analysis. There is also parameter risk in the discounting function used in the analysis. However, not all of that risk should be accounted for in a risk transfer analysis.

The majority of the parameter risk in discounting comes from two key inputs, the payment pattern and the interest rate. As we previously discussed, there is real risk in not incorporating an accurate payment pattern. This risk relates to timing risk, which is a part of insurance risk and should be considered in a risk transfer analysis. The second piece of the discount, the interest rate, however, should not contribute any risk, parameter or process, to the analysis. SSAP 62 clearly

states that "the possibility of investment income varying from expectations is not an element of insurance risk."

Because there are no widely accepted methods and because the methods available either require some arbitrary selections or may add more cost than benefit to the analysis, we do not feel that parameter risk must be explicitly shown in a risk transfer analysis. We would strongly encourage practitioners to at least include it implicitly if not explicitly. Regardless, we recommend documenting the existence of parameter risk and, whether or not it is included in the analysis, documenting how it could affect the results. This documentation can be beneficial if another actuary needs to review the analysis. More importantly, parameter risk is too important to entirely exclude from both the analysis and the report when the analysis may be directly used to make the decision on risk transfer.

3.3.6 Use of Pricing Assumptions

One potential resource, if available, for selecting parameters for small or immature books of business is the reinsurance pricing assumptions. This concept is very attractive since a properly priced reinsurance agreement is likely to be based on an appropriate expected loss assumption with an appropriate risk load and payment pattern. While we are often more interested in a loss distribution than just the expected losses for testing risk transfer, these assumptions can help provide some of the necessary parameters for our simulation.

Pricing assumptions can also be helpful in parameter selection since they reflect how risky the market views a particular piece of business. The reinsurance market may provide a better indication of the amount of risk involved in a small new primary company searching for reinsurance than what you could find based on industry benchmarks. Of course, this market-driven view of a reinsurance contract is also one of the biggest drawbacks to using pricing assumptions. Simulation testing for risk transfer should be based on expected loss experience and should not be market-driven. Pricing assumptions should only be used in selecting parameters when reasonable. A hard insurance market with higher premiums does not mean that companies do not need to meet the same risk transfer standards. Because of this, when available, the underlying data that the pricing assumption was based upon can be even more beneficial than the parameters actually used in the pricing of the reinsurance.

To correctly apply the expected loss assumptions from a pricing model to a risk transfer analysis, it is important to properly account for the risk load in the pricing. In many reinsurance contracts,

risk load is a significant piece of the puzzle. It may be implicitly added into the expected loss ratio or explicitly stated in the development of the rate. If it is implicit in the expected losses, it is important not to blindly carry forward the expected losses without recognizing the extra loaded amount. If it is explicitly stated, intuitively there should be a relationship between this risk load amount and the level of risk inherent in the underlying coverage. While this risk load reflects the amount of variability the reinsurer anticipates in the contract, it is not easy to translate this load into a variance for your loss distribution. However, it is worthwhile to at least consider the size of this risk load when selecting the loss distribution and variance.

Another caveat to remember when using pricing information to select parameters for risk transfer testing is that while both practices are generally aimed at determining expected future losses, they both are doing so for very different reasons. The differences in intent can lead to different approaches and selections. Notably, when pricing a reinsurance contract, it might be considered prudent to make conservative selections. This might lead to slightly higher expected losses and risk load. These selections would not be considered conservative in a risk transfer analysis. Selecting higher expected losses and increasing the expected variability would lead to over-detecting risk transfer. For risk transfer testing the more conservative approach would be to use lower expected losses and variability. These differences in approach are important to remember anytime you are relying on assumptions from an analysis developed for a different purpose.

While pricing assumptions can clearly provide valuable input to any risk transfer analysis, it should also be clear that there are variety of reasons one may deviate from them. This is true even for reinsurance analysts who may be testing the same contracts they priced. These two exercises might require different assumptions about the modeled losses. Loss models used for pricing are often optimized based on their projections of all the potential results. Risk transfer, on the other hand, requires a model that is optimized on the right tail of the distribution. Due to this distinct difference in focus, the resulting selections for loss distribution and/or parameters may not be the same for pricing and risk transfer analysis.

3.3.7 Commutation Clauses

As previously discussed, any mandatory fees to delay a required commutation should be included when determining if risk transfer is present. Commutation clauses should be read carefully to determine their entire impact on risk transfer. While commutation clauses do not often prohibit a contract from exhibiting risk transfer, it is important to recognize that any commutation requirement

does restrict the amount of risk transferred. It is not uncommon for these clauses to set a predetermined date for commutation based on an actuarial determination of the unpaid claim estimates at that time. While this is a fair method for completing a commutation, it does require the ceding company to reassume the risk of any changes in the unpaid claims after the predetermined commutation date. This clearly returns some risk back to the ceding company, limiting the amount of risk transferred in the original transaction.

If a commutation clause states that the future commutation will be based on a mutually agreed upon value or on an actuarial determination, the payment pattern used to discount losses in the risk transfer analysis may not need to be adjusted. While the commutation may result in an earlier payment than anticipated by the reinsurer for any outstanding claims, the payment should reflect the present value of expected payments at that time and the impact on the original payment pattern assumption should be minimal. If there are explicit rules for the calculation of the value of outstanding claims at commutation, these rules may need to be included in the original analysis and may affect the selected payment pattern.

4. CONCLUSIONS

It is important to remember that none of the methods to test risk transfer provide a "bright line" indicator for its existence. While actuaries have the necessary skill set to evaluate the existence of risk transfer in any reinsurance contract, the final decision belongs to the CEO or CFO of the company. Risk transfer analysis, and more specifically ERD, is a tool to aid them in that decision. If a risk transfer analysis produces a borderline result, such as an ERD of 0.95% or 1.05%, it will likely require further consideration and documentation to show that risk transfer does or does not exist in the contract being reviewed. Risk transfer testing is a principle-based exercise and the existence of risk transfer is entirely based upon there being a "reasonable chance of a significant loss" to the reinsurer. ERD and other methodologies are just tools to help determine if a contract meets this standard.

Acknowledgment

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Abbreviations and notations

AAA, American Academy of Actuaries
CAS, Casualty Actuarial Society
ERD, Expected Reinsurer Deficit
FAS 113, Financial Accounting Standard No. 113
RAS, Reinsurance Attestation Supplement
SSAP, Statement of Statutory Accounting Principles

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ACME Insurance
Quota Share
Risk Transfer - Simulation Analysis

Table 1 - Summary of Terms - Contract #1

Inception Date	1/1/2008
Estimated Subject Premium	10,000,000
Reinsurance Premium	8,000,000
Cession	80.0%
Ceding Commission	25.0%
Profit Commission	
Loss Ratio	66.0%
Profit Swing	5.0%
Loss Ratio Cap	100.0%
Reinsurers Expenses as % of Prem.	
Brokerage	*2.0%*
Underwriting Exp.	*2.0%*
Federal Excise Taxes	*1.0%*

Table 2 - Simulation Assumptions

Model Loss Ratio excluding ALAE	
Lognormal distribution	
Mean	65.0%
Standard Deviation	20.0%
Minimum Loss	45.0%

Table 3 - Results

Frequency	Sum of Col (10) / 10,000	19.7%
Severity	Sum of Col (9) / Sum of Col (10)	-14.5%
ERD as a % of Reins Prem.	ERD / Reinsurance Premium	-2.85%

Table 4 - Percentiles

Percentile	Loss Ratio	NPV Of Reinsurer Profit / Loss
75%	95.9%	4.1%
80%	99.7%	0.3%
90%	110.5%	-10.5%
95%	118.5%	-18.5%

Iteration #	Direct Loss and LAE Ratio (1)	Direct Losses and LAE (2)	Ceded Losses and LAE (3)	NPV Treaty Losses (4)	Ceding Commission (5)	Profit Commission (6)	NPV Treaty Premium Net of Ceding & Profit Comm (7)	NPV Reinsurer Gain/Deficit (8)	NPV Reinsurer Deficit as a % of NPV of Treaty Premium (9)	Frequency of Deficit (10)
1	63%	6,342,599	5,074,079	4,649,828	2,000,000	164,736	5,724,700	1,074,871	0.0%	0
2	58%	5,792,740	4,634,192	4,246,721	2,000,000	320,000	5,578,412	1,331,691	0.0%	0
3	52%	5,175,628	4,140,502	3,794,309	2,000,000	320,000	5,578,412	1,784,103	0.0%	0
4	45%	4,500,000	3,600,000	3,298,999	2,000,000	320,000	5,578,412	2,279,413	0.0%	0
5	45%	4,500,000	3,600,000	3,298,999	2,000,000	320,000	5,578,412	2,279,413	0.0%	0
6	80%	7,973,888	6,379,111	5,845,744	2,000,000	0	5,879,913	34,169	0.0%	0
7	45%	4,500,000	3,600,000	3,298,999	2,000,000	320,000	5,578,412	2,279,413	0.0%	0
8	53%	5,307,827	4,246,262	3,891,226	2,000,000	320,000	5,578,412	1,687,186	0.0%	0
9	69%	6,928,552	5,542,842	5,079,397	2,000,000	0	5,879,913	800,516	0.0%	0
10	45%	4,500,000	3,600,000	3,298,999	2,000,000	320,000	5,578,412	2,279,413	0.0%	0
9,990	48%	4,783,431	3,826,745	3,506,785	2,000,000	320,000	5,578,412	2,071,627	0.0%	0
9,991	113%	11,284,849	9,027,879	7,331,108	2,000,000	0	5,879,913	-1,451,196	-24.7%	1
9,992	55%	5,470,802	4,376,642	4,010,705	2,000,000	320,000	5,578,412	1,567,707	0.0%	0
9,993	86%	8,606,365	6,885,092	6,309,420	2,000,000	0	5,879,913	-429,507	-7.3%	1
9,994	122%	12,230,549	9,784,439	7,331,108	2,000,000	0	5,879,913	-1,451,196	-24.7%	1
9,995	54%	5,350,772	4,280,618	3,922,709	2,000,000	320,000	5,578,412	1,655,703	0.0%	0
9,996	91%	9,128,508	7,302,806	6,692,208	2,000,000	0	5,879,913	-812,295	-13.8%	1
9,997	81%	8,050,084	6,440,067	5,901,604	2,000,000	0	5,879,913	-21,691	-0.4%	1
9,998	106%	10,578,897	8,463,117	7,331,108	2,000,000	0	5,879,913	-1,451,196	-24.7%	1
9,999	79%	7,892,701	6,314,161	5,786,225	2,000,000	0	5,879,913	93,688	0.0%	0
10,000	83%	8,319,856	6,655,885	6,099,377	2,000,000	0	5,879,913	-219,464	-3.7%	1

Column
(1) Based upon the model assumptions in Table 2
(2) Estimated Subject Premium x Col (1)
(3) Cession Percent x Col (2)
(4) Minimum of Col (3) or Loss Ratio Cap x Reinsurance Premium, multiplied by Page 3 Col (2)
(5) Reinsurance Premium x Ceding Commission
(6) 1% for every 1% of ultimate loss that is lower than 66%, maximum adjustment 5%
(7) Total Page 2 Col (6) + Col (6) / [(1 + Discount Rate)^2.0833], assumes profit commision is paid 2 years one month after policy effective date
(8) Col (7) - Col (4)
(9) If Col (8) < 0 then Col (8) / Col (7) else 0
(10) If Col (8) < 0 then 1 else 0

ACME Insurance
Quota Share
Risk Transfer - Simulation Analysis
Premium Discount Factor - Exclude Profit Share

Discount Rate Assumption:

(1)	Interest Rate	2.9%
(2)	Discount Factor	0.980

Time of Payments in Months (3)	Premium (4a)	NPV of Premium (4b)	Ceding Commission (5)	Premium Net of Ceding Commission (6)	Discounted Premium Net of Ceding Commission (7)
4	2,000,000	1,981,032	-500,000	1,500,000	1,485,774
7	2,000,000	1,966,925	-500,000	1,500,000	1,475,193
10	2,000,000	1,952,917	-500,000	1,500,000	1,464,688
13	2,000,000	1,939,010	-500,000	1,500,000	1,454,257
Total	8,000,000	7,839,884	-2,000,000	6,000,000	5,879,913

Column/Row	Note
(1)	Page 4, Row (12)
(2)	Total Col (7) / Total Col (6)
(3)	Month premium is due, assumes quarterly payments due one month after quarter end.
(4a)	Reinsurance Premium divided by 4, assumes quarterly payments.
(4b)	Col (4a) / {[1 + Col (1)] ^ (Col (3) / 12)}
(5)	Ceding Commission divided by 4, assumes quarterly payments.
(6)	Col (4a) + Col (5)
(7)	Col (6) / {[1 + Col (1)] ^ (Col (3) / 12)}

ACME Insurance
Quota Share
Risk Transfer - Simulation Analysis
Discount Factor

Discount Rate Assumption:

(1)	Interest Rate	2.9%
(2)	Discount Factor	0.916

Years of Maturity	% of Ultimate Paid Cum.	Incr.	Discounted Payment
(3)	(4)	(5)	(6)
0	0.00%	0.00%	0.00%
1	20.00%	20.00%	19.72%
2	42.00%	22.00%	21.08%
3	60.00%	18.00%	16.76%
4	70.00%	10.00%	9.05%
5	77.50%	7.50%	6.59%
6	82.00%	4.50%	3.85%
7	90.00%	8.00%	6.64%
8	95.00%	5.00%	4.04%
9	100.00%	5.00%	3.92%

Column/Row	Note
(1)	Page 4, Row (12)
(2)	Sum Col (6) / Sum of Col (5)
(4)	Industry Benchmarks
(5)	Current (4) - prior (4)
(6)	Col (5) discounted to time zero

ACME Insurance
Quota Share
Risk Transfer - Simulation Analysis
Interest Rate

Years of Maturity	% of Ultimate Losses Paid Cum.	Incr.	Time of Payments in Months	% of Ultimate Premiums Paid Cum.	Incr.	Daily Treasury Years of Maturity	Yield Curve Rates
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	0.00%	0.00%	4	25.00%	25.00%	0.5	3.32%
1	20.00%	20.00%	7	50.00%	25.00%	1.0	3.17%
2	42.00%	22.00%	10	75.00%	25.00%	2.0	2.88%
3	60.00%	18.00%	13	100.00%	25.00%	3.0	2.89%
4	70.00%	10.00%				5.0	3.28%
5	77.50%	7.50%				7.0	3.54%
6	82.00%	4.50%				10.0	3.91%
7	90.00%	8.00%					
8	95.00%	5.00%					
9	100.00%	5.00%					
10	100.00%	0.00%					

(9)	Duration of Loss Payments	3.14
(10)	Duration of Premium Payments	0.71
(11)	Duration of Net Cash Flows	2.43
(12)	Selected Interest Rate	2.9%

Column/Row	Note
(2)	Page 3 Column (4)
(3)	Page 3 Column (5)
(4), (5), (6)	Based on premium payments on Page 2
(8)	Rates from U.S. Treasury Securities as of 1/2/08
(9)	Based on loss payment pattern in Column (3)
(10)	Based on premium payment pattern in Column (6)
(11)	Row (9) - Row (10)
(12)	Selected

ACME Insurance
Excess of Loss
Risk Transfer - Simulation Analysis

Table 1 - Summary of Terms - Contract #2

Inception Date	1/1/2008
Estimated Subject Premium	10,000,000
Provisional Reinsurance Rate	8.50%
Provisional Premium	800,000
Maintenance Fee	50,000
Retention	250,000
Limit	250,000
Swing Rate	
Swing Loss Ratio	75.0%
Minimum Rate	6.00%
Maximum Rate	11.00%
Reinsurers Expenses as % of Prem.	
Brokerage	*10.0%*
Underwriting Exp.	*7.0%*
Federal Excise Taxes	*1.0%*
Modeled Loss Ratio	120.0%

Table 2 - Simulation Assumptions

Model Severity ALAE		Model Frequency	
Lognormal distribution		Poisson distribution	250
Mean	30,000		
Standard Deviation	120,000		
Minimum Loss	0		

Table 3 - Results

Frequency	Sum of Col (10) / 10,000	10.4%
Severity	Sum of Col (9) / Sum of Col (10)	-20.1%
ERD as a % of Reins Prem.	ERD / Reinsurance Premium	-2.09%

Table 4 - Percentiles

Percentile	NPV Of Reinsurer Loss
75%	0.0%
80%	0.0%
90%	-1.0%
95%	-16.5%

Claim #	Direct Loss and LAE (1)	Ceded Loss and LAE (2)	NPV Ceded Loss and LAE (3)	Provisional Premium (4)	Experience Adjustment (5)	Commutation Fee (6)	Final Premium and Fees (7)	NPV Treaty Premium Net of Rate Swing (8)	NPV Reinsurer Gain/Deficit (9)	NPV Reinsurer Deficit as a % of NPV of Treaty Premium (10)	Frequency of Deficit (11)
1	1,758	0	0	800,000	250,000	50,000	1,100,000	1,056,133	204,656	0.00%	0
2	3,566	0	0								
3	2,762	0	0								
4	15,271	0	0								
5	5,648	0	0								
6	11,158	0	0								
7	39,765	0	0								
8	326,745	76,745	68,050								
9	36,936	0	0								
10	10,469	0	0								

Column
(1) Based upon the model assumptions in Table 2
(2) Ceded loss based upon the treaty terms
(3) Col (2) x Appendix B, Page 3
(4) Estimated subject premium times provisional reinsurance rate
(5) Actual modeled loss ratio minus swing loss ratio + provisional reinsurance rate; subject to Maximum and Minimum rate
(6) Assumes fee to commute under all scenerios
(7) (4) + (5) + (6)
(8) Page 2 Col (4b) + Col (5) / [(1 + Interest rate) ^ 2.0833] + Col (6) / [(1 + Interest rate) ^ 5.0833]
(9) Col (8) - sum of Col (3)
(10) If Col (9) < 0 then Col (9) / Col (8) else 0
(11) If Col (9) < 0 then 1 else 0

Discount Rate Assumption:

(1)	Interest Rate	3.5%
(2)	Discount Factor	0.976

Time of Payments in Months (3)	Premium (4a)	NPV of Premium (4b)
4	200,000	197,720
7	200,000	196,027
10	200,000	194,348
13	200,000	192,684
Total	800,000	780,778

Column/Row	Note
(1)	Selected
(2)	Total Col (4b) / Total Col (4a)
(3)	Month premium is due, assumes quarterly payments due one month after quarter end
(4a)	Reinsurance Premium divided by 4, assumes quarterly payments
(4b)	Col (4a) / {[1 + Col (1)] ^ (Col (3) / 12)}

Discount Rate Assumption:

(1)	Interest Rate	3.5%
(2)	Discount Factor	0.887

Years of	% of Ultimate Paid		Discounted
Maturity	Cum.	Incr.	Payment
(3)	(4)	(5)	(6)
0	0.00%	0.00%	0.00%
1	19.27%	19.27%	18.94%
2	42.02%	22.75%	21.61%
3	58.15%	16.13%	14.80%
4	68.72%	10.57%	9.37%
5	75.41%	6.69%	5.73%
6	79.71%	4.29%	3.55%
7	82.97%	3.27%	2.61%
8	85.24%	2.27%	1.76%
9	87.01%	1.76%	1.32%
10	88.41%	1.40%	1.01%
11	95.50%	7.09%	4.94%
12	100.00%	4.50%	3.03%
13	100.00%	0.00%	0.00%

Column/Row	Note
(1)	Selected
(2)	Sum Col (6) / Sum of Col (5)
(4)	Industry workers compensation benchmarks
(5)	Current (4) - prior (4)
(6)	Col (5) discounted to time zero