Accounting Rule Guidance Statement of Financial Accounting Standards No. 113— Considerations in Risk Transfer Testing

CAS Valuation, Finance, and Investments Committee

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Considerations in Risk Transfer Testing

Valuation, Finance, and Investments Committee (VFIC).

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1. Synopsis.

Genesis.
In an effort to provide some considerations to the CAS membership on risk transfer testing, the CAS Valuation, Finance, and Investment Committee (VFIC) conducted a research project. This paper is the culmination of VFIC's work.

The demonstration of risk transfer for a reinsurance contract is required by FAS 113 in order for the contract in question to receive reinsurance accounting treatment for GAAP purposes. However, there is little supporting literature from which to draw guidance on risk transfer testing methodology, risk metrics, or threshold values; hence this paper.

Approach
After a brief introduction, this paper begins with an overview of FAS 113 (§3) and other related risk transfer statements (§4). VFIC conducted a brief survey of risk transfer practices, which is presented in §5. Next, a series of examples are presented (§6) to illustrate the data requirements, methodology, and considerations involved in approaches commonly used today to demonstrate risk transfer in reinsurance contracts. The remaining sections of the paper (§7-8) are devoted to the discussion of other risk metrics that actuaries could use to characterize the level of risk present in a reinsurance contract.

Conclusions.
Methodology. FAS 113 states that risk transfer testing of reinsurance contracts must include 1) a thorough understanding of contract provisions, 2) a model of the incidence of cash flows between parties, 3) a single, appropriate discount rate, and 4) insurance risk only. By their absence, these requirements preclude consideration of income taxes, reinsurer expenses, brokerage, or credit risk in the determination of risk transfer. To meet the FAS 113 requirements we recommend that risk transfer analysis include a view of the distribution of expected contract losses, identification of an appropriate risk metric and threshold values, and duration-matched or immunized yields as the appropriate discount rates.

Risk Metric. Current practice tends to split risk transfer analysis into separate tests of probability (of an adverse result) and significance (magnitude of the result). A measure of loss at a given probability is called value at risk, or VaR.

While FAS 113 couches risk transfer in words like "*reasonable possibility*" and "*significant loss,*" the broader issue is whether a particular contract transfers risk. In this vein, a variety of other risk metrics were explored. VFIC analyzed expected deficit measures (such as expected policy holder deficit, or EPD), tail value at risk (TVaR), and distributional transforms such as the exponential and Wang transforms. Some of the positive and negative aspects of each of these are discussed in this paper.

Threshold or Critical Values. Over time, common practice seems to have concluded that a 10% chance represents a 'reasonable probability,' and a 10% loss represents a

'significant loss.' That is, the critical value for VaR is –10% at a probability of 10%. Thus we have what many term the 10-10 rule. In practice, other critical values are commonly used. It must be stressed that such rules-of-thumb are used in practice, but FAS 113 itself does not dictate critical values.

Our analysis of TVaR suggested that critical values in the range of –25% would represent minimal risk transfer. The discussion of distribution transforms proposes a critical value for the Wang transform of –10% that is wholly consistent with the 10-10 rule.

Regardless of the model employed or the risk metric used, judgment is still required as to where to establish the threshold or critical values for what constitutes risk transfer and what does not.

Intuitively, it seems natural to judge risk transfer for a reinsurance contract by analyzing whether the cedant has transferred (reduced) risk, not, as FAS 113 requires, by whether the reinsurer has assumed risk. While the answers to these two questions may be the same when focusing on a single transaction (as done in FAS113), on an enterprise-wide basis, they can be different. It should be noted that the recommendation on Index Securitization proposed the opposite to FAS 113: analysis is done from the cedant's perspective on an enterprise-wide basis. This could lead to different accounting treatments for reinsurance products and index securitizations, unless both tests are required for securitization and industry loss triggers.

2. Introduction.

The Valuation, Finance, and Investment Committee (VFIC), a CAS research committee, was asked by CAS membership to investigate and recommend considerations regarding risk transfer testing for reinsurance contracts due to the requirements set forth by FAS 113. This paper is the result of VFIC's research and discussions on the subject. The intent of this paper is to illustrate how risk transfer could be tested given the requirements set forth.

FAS 113 dictates the conditions, namely risk transfer, required for a reinsurance contract to be accounted for as reinsurance for GAAP purposes. Failing these conditions, the contract receives deposit accounting treatment. The statement itself does not provide specific guidelines for the quantification of risk transfer; FASB never intended to provide such specific guidance.

Numerical guidelines for measuring risk transfer—such as the well-known 10-10 rule – have become widely used. While often used in an audit context, auditors are not the only audience for risk transfer, however. Regulators, rating agencies and securities analysts all may want to evaluate whether or not a deal has enough risk transfer to meet FAS 113 requirements, and typical audit criteria may not suit their purposes.

The next section is a review of FAS 113 and related requirements. This is followed by a brief review of current practice. Examples of risk transfer testing are given, shedding light on key considerations. We then look more broadly at how risk transfer might be viewed by actuaries.

3. Overview of FAS 113

Statement. The stated purpose of FAS 113 is as follows.

> "This statement establishes the conditions required for a contract with a reinsurer to be accounted for as reinsurance and prescribes accounting and reporting standards for those contracts."

It is clear from the stated intent that FASB did not intend to make 113 a prescription of methodology.

The summary of FAS 113 goes on to portray the essence of risk transfer:

> "Contracts that do not result in the *reasonable possibility* that the reinsurer may realize a *significant loss* from the *insurance risk* assumed generally do not meet

> the conditions for reinsurance accounting and are to be accounted for as deposits." [emphasis added]

The phrases *reasonable possibility* and *significant loss* are clearly the key considerations in the analysis of risk transfer, but they are largely undefined. The terms *reasonable* and *significant* indicate that FASB is inviting the application of informed judgment. In the measurement methods discussed below, a line has to be drawn to define a cutoff between enough risk for 113 and not enough. It is not the primary intent of this paper to draw those lines, instead different methods of measuring risk that could provide a consistent framework for applying such judgment are emphasized.

Risk Transfer Tests. Property-casualty reinsurance contracts are covered by paragraphs 9 – 11 of FAS 113 – "Reinsurance of Short-Duration Contracts." Paragraph 9 of FAS 113 defines risk transfer conditions as follows.

> "Indemnification of the ceding enterprise against loss or liability relating to insurance risk in reinsurance of short duration contracts requires both of the following, unless the condition in paragraph 11 is met:
>
> > "a. The reinsurer assumes significant insurance risk under the reinsured portions of the underlying reinsurance contracts.
> > "b. It is reasonably possible that the reinsurer may realize a significant loss from the transaction."

Paragraph 9 is clear that risk due to "loss" refers only to insurance risk, i.e. (a) ultimate amount of net cash flows between the parties, **and** (b) the timing of the receipt of cash. Risk factors do not include recognition of reinsurer costs, investment risk, taxes, or credit risk to name a few.

The 'condition in paragraph 11' referred to above states, "(failing tests a and b) the ceding enterprise shall be considered indemnified against a loss or liability relating to insurance risk only if substantially all the insurance risk relating to the reinsured portions of the underlying insurance contracts has been assumed by the reinsurer." (For the sake of discussion, we will refer to this as test c.) The condition described in test c covers fronting arrangements, where a deal may appear highly lucrative, but the assuming party does, in fact, assume virtually the entire risk.

So, in essence, to answer the question of risk transfer affirmatively, the reinsurance contract must meet either test **c** or tests **a &.**

Except in the extreme case of **c**, where the cedant ends up with virtually no risk on the ceded portions, the criteria for risk transfer does not look at whether or not the ceding

insurer reduces its risk. Rather the test **a & b** is on whether on not the reinsurer assumes risk[1].

The closest FAS 113 comes to a definition of *significant insurance risk* is in footnote 4 to paragraph 11, which references FAS 97. Here, "*insignificant*" is defined as "having little or no importance; trivial." Presumably a failure to be insignificant would connote significance.

Neither does FAS 113 elaborate on what constitutes a *reasonable possibility*. The term *reasonably possible* is used in FASB Statement No. 5, "Accounting for Contingencies," to mean the scenario's "probability is more than remote." 'Remote' is not defined further in the statement. Based on FAS 5, it can be concluded that the test is applied to the scenario as a whole, not to the individual assumptions in a scenario. Thus, the entire set of assumptions must be reasonably possible.

Tests **a & b**: are discussed in paragraphs 9, 10 and 11 of FAS 113. In paragraph 9, test **a** is characterized by

> "A reinsurer shall not be considered to 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*. Contractual provisions that delay timely reimbursement to the ceding enterprise would prevent this condition from being met."[2]

This is the more clear-cut of the two tests, in that the reinsurer does not have to be able to lose money to meet it but just have uncertainty about both the timing and amount of payments. Again, "remote" is not defined further.

Paragraph 10 discusses test **b** in more detail. It appears that an examination of *reasonably possible outcomes* is anticipated in order to show that this test is met.

> "The ceding enterprise'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 cash flows between the ceding and assuming enterprises under reasonably possible outcomes, without regard to how the individual cash flows are characterized. The same interest rate shall be used to compute the present value of the cash flows for each reasonably possible outcome tested."

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[1] This is in contrast to the issue of securitization and reinsurance based on parametric triggers – for example when the insurer gets a pre-defined recovery if a force 4 hurricane hits Florida. The tests the NAIC is considering for statutory accounting in such cases are based on whether or not the cedant gets a reduction in underwriting risk from entering into such a contract. A number of tests of risk reduction have been proposed to test this. However these are not directly relevant to risk transfer under FAS 113, as the test here is on the reinsurer increasing risk, not on the insurer reducing risk.

[2] This clause was added to avoid contacts that cede losses but allow actual reimbursements according to a schedule in such a way that the reinsurer locks in a profit based on the float of funds.

A simulation of randomly generated outcomes would be one way to carry out test **b**. "Reasonably possible" would then be defined using the probability of observing a result equal to or worse than some critical value based on simulation output. This would be the likely basis of the "10% chance" measure widely used today.

For the set of outcomes examined, the evaluation of whether or not there is a significant loss is one where the present value of the payments to the cedant exceeds the present value of the payments to the reinsurer by a threshold amount. This is never stated so directly, however. This section creates the companion measure of "10% loss," i.e., the net present value of losses ceded is 10% greater than the net present value of the consideration paid. However, when payments are based on netting out of offsetting items, it can be difficult to distinguish the consideration paid from losses and expense credits. For instance, reinstatement premium is very similar to a loss participation.

Paragraph 10 does provide some explicit guidance on risk transfer testing. Namely, it is based on 1) the net present values of cash flows, 2) on cash flows between the parties (e.g., no taxes, no consideration of reinsurer expenses), 3) using a constant interest rate.

Paragraph 11 specifies that the test of significance of loss is relative to the amounts ceded to the reinsurer. Thus presumably the significance of a given loss amount, say $10,000, might be different given different ceded premiums, say $100,000 vs. $1 billion. Thus we put the two parts of the test together and have a "10% chance of a 10% loss," as opposed to a test in dollar terms.

It would be easier to interpret paragraphs 10 and 11 if they could be used to separate the test of a reasonable possibility of a significant loss into two independent steps: generate a lot of scenarios and first test each to see if it generates a significant loss. Then see how many did so, and test to see if enough did. You would need a test of significance to do the first step and a test of reasonable possibility to do the second step, and these could be independent.

However, the wording of these two sections keeps *reasonably possible* and *significant loss* intertwined. It seems completely consistent with these paragraphs to require a stricter standard for *reasonably possible* when *significant loss* is interpreted more broadly, and vice versa. Thus a 5% chance of a loss of 100% of premium might provide as much or more *reasonable possibility of significant loss* as a 10% chance of a loss of 25% of premium, for example.

In fact this kind of linkage might actually be implied by the lack of separation of the two phrases. Under this viewpoint one would still count loss scenarios as part of the test, but the test of reasonable possibility would not be independent of the test of significant loss.

Thus to sum up tests **a** & **b**:

- test **a** is met if the reinsurer has risk of variation in both timing and amount of payments, and payments must be timely to meet this criterion;

- test **b** requires an examination of possible outcomes. To meet this test, at least some of the outcomes have to produce a loss for the reinsurer, where a loss is determined using present values of all cash flows. The significance of losses is to be evaluated relative to the present value of payments to the reinsurer. The test is of reasonable possibility of significant loss, and it would be appropriate, though not required, to evaluate reasonability and significance conjointly.

Looking at test **c**, the reference to *reinsured portions* of the underlying insurance contracts is potentially ambiguous. It could mean *reinsured percentage*, as in a quota share contract, or *reinsured sections,* as in the liability portion of a homeowner's policy. These are actually both rather narrow interpretations of *portions* and probably are consistent with the intent of FAS 113. For example, if a company writes a very profitable book of auto collision insurance, so profitable that it virtually cannot have an underwriting loss, but reinsures some of this on a quota share basis in order to meet financial ratio tests, the reinsurer probably will not be able to meet test **b**. But test **c** would be satisfied so this deal would qualify for reinsurance accounting. Here the reinsurer and ceding insurer share the risk on an equal basis.

A broader interpretation of *portions* would allow a portion of a homeowner's book to constitute all losses on all policies in all events where the insurer's event loss is less than $100 million. If this qualifies as a portion, then there might be cases where a reinsurer could write a capped quota share in which it would be virtually guaranteed a profit even though the cedant could suffer a major loss on the retained book, and this would qualify for reinsurance accounting under test **c**. This broad a definition of *portion* could probably be stretched to fit in any reinsurance deal, and so would negate the need for tests **a** & **b**.

Thus a more narrow definition of *portions* is implied. Interpreting *reinsured portions* as *reinsured percentage* seems to be well within the intent of FAS 113. The same might apply to *reinsured sections,* particularly if there is a separately identifiable premium for the sections under consideration. Conditions that do not refer to individual policy provisions but rather the insurer's experience on a book of policies would seem to stretch the intend of *portions* beyond what FAS 113 seems to consider.

To sum up test **c**: a portion of policies has to be fully ceded, where *portion* probably is restricted to percentage or section, or something similar, and the only risk the cedant can retain on this portion must be trivial, having no importance. This situation describes fronting sorts of relationships and straight unrestricted quota share reinsurance.

4. Related statements.

Statutory Accounting. In statutory accounting, reinsurance is primarily addressed in Chapter 22 of the *NAIC Accounting Practices and Procedures Manuals for Property and Casualty Insurance Companies*. Amendments were made after the GAAP adoption of FAS 113. As a result, the statutory accounting principles established regarding risk transfer and reinsurance accounting are generally consistent with GAAP. Chapter 22 states:

> "Reinsurance Contracts Must Include Transfer of Risk
> The essential ingredient of a reinsurance contract is the shifting of risk. The essential element of every true reinsurance contract is the undertaking by the reinsurer to indemnify the ceding insurer (i.e., reinsured company), not only in form but in fact, against loss or liability by reason of the original insurance. Unless the so-called reinsurance contract contains this essential element of risk transfer, no credit whatsoever shall be allowed on account thereof in any accounting financial statement of the ceding insurer."

SSAP 62, as part of codification, provides the following guidance, drawing heavily on FAS 113:

> [§11] Determining whether an agreement with a reinsurer provides indemnification against loss or liability (transfer of risk) relating to insurance risk requires a complete understanding of that contract and other contracts or agreements between the ceding entity and related reinsurers. A complete understanding includes an evaluation of all contractual features that (a) limit the amount of insurance risk to which the reinsurer is subject (e.g., experience refunds, cancellation provisions, adjustable features, or additions of profitable lines of business to the reinsurance contract) or (b) delay the timely reimbursement of claims by the reinsurer...
>
> [§12] Indemnification of the entity company against loss or liability relating to insurance risk in reinsurance requires both of the following:
>
> a. The reinsurer assumes significant 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.

IASB. The International Accounting Standards Board's (IASB) Insurance Steering Committee has drafted a statement of principles on accounting for insurance contracts. As the statement is not final, it may well be modified before being officially released to the public. With these caveats in mind, it is instructive to compare the IASB's views on risk transfer to FAS 113.

As currently construed, the IASB's Principle 1.2 defines an insurance contract. Reinsurance is simply treated as a sub-set of insurance contracts. Principle 1.3 defines the uncertainty required for a contract to qualify as an (re)insurance contract. This principle, then, is closely related to the risk transfer requirement in FAS 113. Principle 1.3 does introduce the word "*material*" in describing uncertainty or risk transfer, much like FAS 113 refers to "*significant.*" Principle 1.3, however, does not distinguish between underwriting risk and timing risk as does FAS 113.

5. Current Practices.

As risk transfer tests are only defined in broad conceptual terms, practitioners of risk transfer testing are left to model insurance processes as they think best and define key terms such as "*remote*" and "*significant*" operationally. In practice, if the cedant's analysis passes muster with their auditor, reinsurance accounting is granted. Thus auditors, and sometimes the cedant's consultant, need to be able to recognize risk transfer when they see it.

VFIC conducted a brief, informal poll of actuaries at two major consulting firms and three major audit firms regarding their risk transfer testing. In particular, the practitioners were asked 1) does your firm have an official policy regarding risk transfer testing, 2) what threshold value do you use for determining *reasonably possible*, 3) how big of a loss is *significant*, and 4) what methods are used. A brief summary of the interviews follows.

	Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5
Official Policy?	No	No	Yes	Don't know	Don't know
Probability	5% or 10%	10% or 20%	"Reasonable worst case chance"	20%	10%
Significance	5% or 10%	10% or 20%	10%	20%	10%
Method	Establish a probability distribution of expected losses, reflecting the timing thereof. Compare to the present value of premium.	Compare expected value of present value of losses to expected value of present value premiums by scenario	Scenario testing	NA	Net present value of all cash flows.

While there are certainly differences in practices indicated above, there are also some common themes. First, while probability threshold ("possibility") is rarely codified, 5%, 10%, and 20% are typical; 10% is in fact the most typical. The critical value defining significance is almost always the same as the probability threshold, i.e., 5%-5%, 10%-10%, 20%-20%. Again, 10% is the most typical, and thus we have what has become known as the "10-10 rule," whereby if the reinsurer has a 10% chance of suffering a 10% loss, then the contract is deemed to have transferred risk.

It must be emphasized that this 10-10 rule has become a *de facto* practice. FAS 113 makes no reference to it, nor does the statement define "*remote*" and "*significant*" thresholds with any numbers, let alone 10% and 10%. Furthermore, the 10-10 rule has not been officially propagated by anyone.

The 10-10 rule is a test utilizing value-at-risk (VaR) as the risk measure. That is to say, the ceding company must demonstrate a VaR of 10% at the 90th percentile of the distribution of the net present value of underwriting losses on the contract in question. And, in practice, a VaR test makes sense given the construct of FAS 113, i.e., the explicit reference to probability and significance gives rise to viewing risk in two parts – frequency and severity.

There are some other common practices, as well. First, the view is always prospective in nature. Second, "loss" as respects the reinsurer is always measured as the net present value of future cash flows. Finally practitioners interviewed are consistent in their view that reinsurer expenses, taxes, investment risk, and credit risk are not subject of the risk analysis.

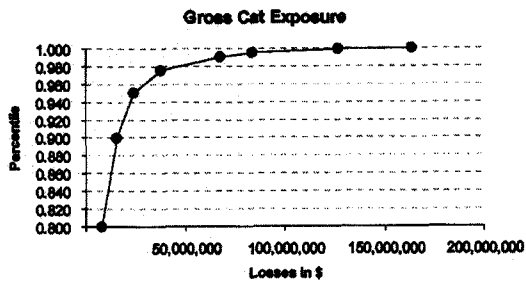
One problem with the 10-10 rule is that many standard reinsurance contracts, ones that everyone would acknowledge are highly risky, would not pass the test. Typical high layer property catastrophe treaties are but one example. Although these can be handled on an exception basis, it would be useful to have methods of measuring risk that agree with the assessments of experienced practitioners. The next section uses a series of examples to highlight this issue as well as to illuminate considerations required in traditional risk transfer testing.

6. Examples and considerations.

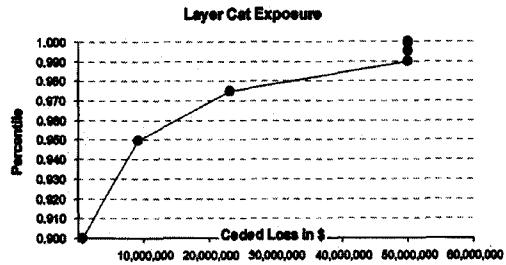
Given currently accepted practice, how could the practitioner prove that there is a less-than-remote-chance that their reinsurers could suffer a significant loss? Following are a series of numerical examples, designed to illustrate the basic data requirements and analysis of present day risk transfer testing. While such analysis presumably suffices for purposes of FAS 113, the examples will serve to show the inadequacies of a simple 10-10 rule (or VaR tests in general).

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 cumulative distribution function was produced:

Probability	Loss
0.001	63
0.005	85
0.010	528
0.025	2,877
0.050	26,160
0.100	95,939
0.200	303,325
0.300	607,426
0.400	1,146,366
0.500	2,001,899
0.600	3,185,892
0.700	4,925,404
0.800	8,150,810
0.900	15,632,088
0.950	24,206,066
0.975	38,072,833
0.990	67,451,525
0.995	83,683,074
0.999	126,792,315
0.9999	163,627,870



Assume the company is content with a $15 million retention, roughly absorbing up to the one-in-ten-year event. Assume, too, that the company accepts a $50 million layer, thereby going through the top on a one-in-one-hundred-year event. Catastrophe losses were simulated according to the above distribution, and layer losses were calculated.



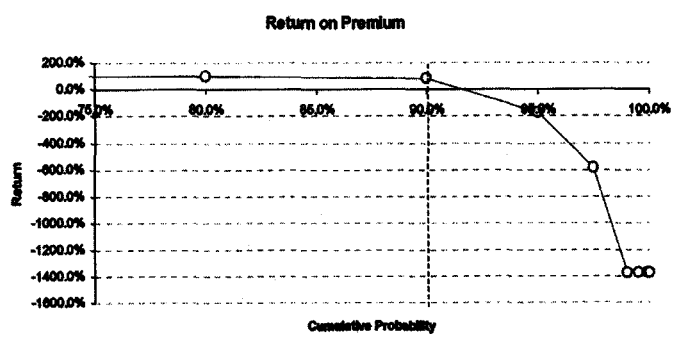
The above distributions produce an expected gross catastrophe loss of $6 million and an expected ceded loss of $1.625 million.

Assume for simplicity that the reinsurance market is pricing catastrophe covers to a 50% loss ratio (premium equals $3.25 million). For this purpose we will ignore reinstatements. Further assume that premiums are paid in full at the beginning of the year and losses are paid in full at the end of the year. As we are dealing with short duration losses, a discount rate of 4% was used.

Given the data and assumptions, the net present value of cash flows between the cedant and the reinsurer can be calculated (shown below as ROP – Return on Premium).

Probability	Gross Loss	Ceded Loss	Loss Ratio	Reinsurer NPV	ROP
0.001	63	-	0.0%	0.0%	100.0%
0.005	85	-	0.0%	0.0%	100.0%
0.010	528	-	0.0%	0.0%	100.0%
0.025	2,877	-	0.0%	0.0%	100.0%
0.050	26,160	-	0.0%	0.0%	100.0%
0.100	95,939	-	0.0%	0.0%	100.0%
0.200	302,299	-	0.0%	0.0%	100.0%
0.300	607,426	-	0.0%	0.0%	100.0%
0.400	1,146,366	-	0.0%	0.0%	100.0%
0.500	2,001,899	-	0.0%	0.0%	100.0%
0.600	3,185,892	-	0.0%	0.0%	100.0%
0.700	4,925,404	-	0.0%	0.0%	100.0%
0.800	8,150,810	-	0.0%	0.0%	100.0%
0.900	15,632,088	632,088	19.4%	18.7%	81.3%
0.950	24,206,066	9,206,066	282.9%	272.1%	-172.1%
0.975	38,072,833	23,072,833	709.1%	681.8%	-581.8%
0.990	67,451,525	50,000,000	1536.7%	1477.6%	-1377.6%
0.995	83,683,074	50,000,000	1536.7%	1477.6%	-1377.6%
0.999	126,792,315	50,000,000	1536.7%	1477.6%	-1377.6%
0.9999	163,627,870	50,000,000	1536.7%	1477.6%	-1377.6%

The reinsurer's "profit curve," the trace of the ROP versus the cumulative probability looks as follows.



A catastrophe example was deliberately chosen as the first example. No one would dispute the clear risk transfer that exists between cedant and reinsurer in a property catastrophe excess of loss program. Yet the above graph clearly demonstrates that the sample transaction fails the 10-10 rule. At the 90th percentile the reinsurer makes an 82% return on premium, thus it is not true that there is at least a 10% chance of at least a 10% loss. Perhaps this can be rectified by simply choosing a different probability to reflect the "*reasonable possibility,*" for at the 95th percentile, the reinsurer suffers a 172% loss.

The first example illustrates a number of key points.

1. Key considerations in this analysis included:
   - A thorough understanding of the reinsurance contract,
   - A probability distribution of expected losses, as determined by the cedant,
   - Incidence or timing of cash flows between the parties,
   - A duration-appropriate discount rate.

2. Elements that were not and should not be considered include:
   - Reinsurer expenses,
   - Brokerage, and
   - Taxes

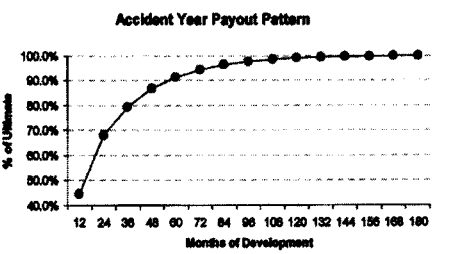
3. A VaR test may work, but risk transfer cannot be judged on a single, simple rule such as 10%-chance-of-a-10%-loss. The whole of the reinsurer's profit and loss curve is important to consider. In this case, while the reinsurer is still in a profit position at the 90th percentile, there is clearly a precipitous and deep drop shortly thereafter. In this situation, the reinsurer or reinsurers stand to lose a considerable amount of money relative to the premium revenue.

Example 2: Quota Share Reinsurance Example
In this example, an insurance company seeks a 50% quota share protection on its accident year results. Even though test **c** may apply, it may be interesting to see how tests **a** and **b** would view this type of contract under different risk measures.

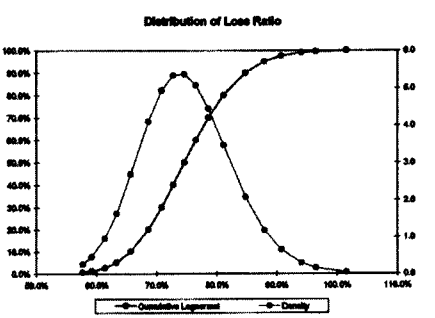
For the upcoming year, this company forecasts:

Written Premium	$1,000
Earned Premium	1,000
Accident Year Loss Ratio	75%
Expense Ratio	32%
Combined Ratio	107%

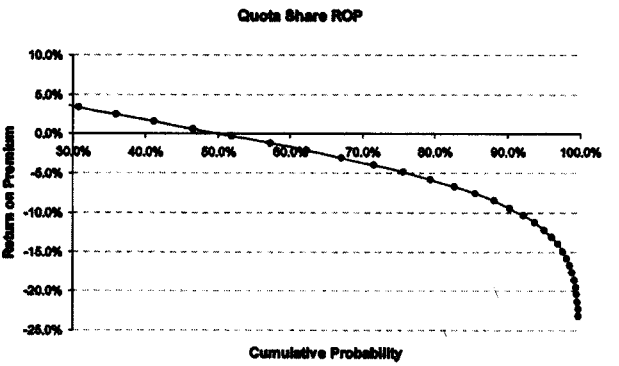
To complete this example, we assume that the insurance company in question is an industry-typical, all lines writer and has an accident year loss payout pattern that mirrors the industry total[3]:



The company has estimated the distribution of the upcoming accident year loss ratio as part of its normal forecasting process. We assume the loss ratio is distributed lognormally with a mean of 75% and a coefficient of variation of 10%.



The quota share treaty has a 30% ceding commission. Premiums and commissions are paid evenly through out the year. Under these assumptions, the reinsurer's profit/loss curve looks as follows.



At the 90.4[th] percentile, the reinsurer suffers a 9.5% of premium loss. It does not literally pass the 10-10 rule test. However, given the precipitous drop in profitability in the tail, and given the inherent uncertainties of the analysis itself, it should be evident that there are "*reasonable possibilities*" of "*significant losses.*"

[3] Source: 1999 Industry total Schedule P, all lines paid triangle from A.M. Best's.

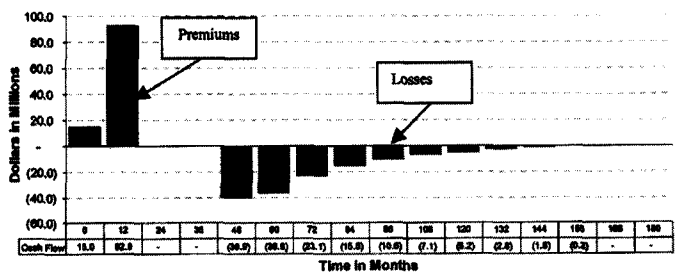
Example 3: Finite Reinsurance Example.
Finite reinsurances are often the principal source of risk transfer questions. In this example, all underlying numbers are the same as in the quota share example. This time, however, the cedant is seeking protection in excess of the planned loss ratio up to a 5%-point limit (i.e., the corridor from 75% to 80%).

Assume the reinsurer charges an up front premium (often called the deposit premium, minimum and deposit premium, the reinsurance premium, or the margin) of $15. As is typical in finite transactions, for every dollar of loss ceded, an additional premium (AP) is charged, in this case 65% of the ceded loss. Because additional premium is ceded, the net expense ratio will deteriorate with increasing cessions. To compensate for the expense ratio effect, losses are typically "over ceded" such that the net combined ratio (or underwriting result) is immunized. So, here ceded losses are grossed up by dividing by 1-AP. The ceding rule is:

If the actual loss ratio is:	Cede:
<75%	0
>75%	(LR-75%)/(1-.65)

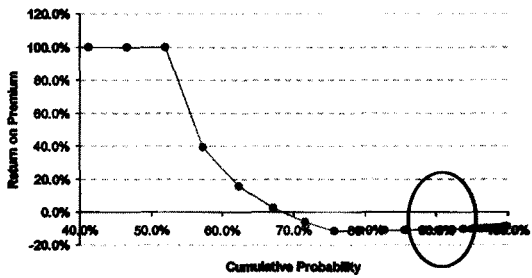
subject to a maximum of the grossed up 5% limit – 5/(1-.65).

To compute the incidence of the cash flows, we assume that the deposit premium is paid at the beginning of the year, and that the AP is paid in full at the end of the year. A recoverable is established on the company's statutory and GAAP balance sheets immediately when the expected ultimate exceeds the retention. Loss recoveries are not made until the *paid loss ratio* exceeds the retention. For a loss ratio of 80%, the cash flows between the cedant and the reinsurer would look as follows.



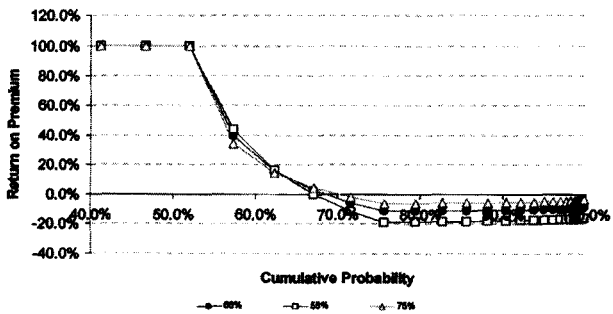
The cash flow graph above highlights the zeal behind using aggregate stop loss contracts, especially in a soft market. A ceded recoverable is established for the full, nominal dollar loss reserves above a certain loss ratio, but due to the time lag in receiving recoveries, the reinsurance price reflects a sizable discount. The difference between the discount and the nominal value of the reserves in question becomes income for statutory or GAAP purposes. Economically speaking, no value is really created nor destroyed beyond the reinsurer's margin.

Cash flows as shown above were produced for loss ratios ranging from 70% to 100%. For each loss ratio, the net present value of cash flows was calculated using a 5% discount rate. Net present values were graphed as a function of cumulative probability (of the loss ratio) to produce the reinsurer's profit/loss curve.



This finite example was produced to demonstrate the 10-10 rule almost exactly. Here there is a chance of a 10% loss or more at the 90.4th percentile, almost exactly satisfying the 10-10 rule.

This same graph was re-drawn for the above base case as well as cases with a 55% AP and a 75% AP:



In the above graph, the 75% AP program would presumably not pass risk transfer under a 10-10 rule test. The 55% program would pass. Even in the 65% example, however, consideration must be given to the entire profit/loss curve, not just the 90th percentile. How much profit is made on the upside? How bad is the downside?

Aggregate stop loss deals specifically and finite reinsurance in general can be considerably more complicated than this example. It is critically important here to have a thorough understanding of the contract terms. Some common variations include:

- Funds held arrangements[4],
- Commutation provisions,
- Capacity charges,
- Margin charges,
- Inclusion of expenses, and
- Caps on economic loss.

Summary of Considerations in Applying VaR tests.
Risk transfer testing requirements are prospective in nature. Thus the mean result (loss ratio, statutory underwriting result, GAAP underwriting result...) is a forecast of a future period. The actuary must account for pricing changes, loss trends, credibility, etc., i.e., all of the typical on-leveling adjustments ordinarily made to historic data.

Practitioners must go beyond the mean. The distribution associated with the mean result should be calculated in accordance with the model employed for the forecasting. Distributions can be estimated by methods applied to loss triangles, collective risk theory models, or variances estimated from time series of relevant results

A model of the incidence of cash flows is required. The model must distinguish between funds held and funds transferred between parties. Dependencies between cash flows and the magnitude of the loss must be accounted for, e.g., the effect of catastrophes on an assumed loss payout pattern. Cash flows should be discounted at the same, appropriate rate. A risk free rate is specified, preferably a pre tax, immunized yield

In the end, a discounted cash flow model, perhaps a dynamic model should suffice. Clearly a thorough understanding of the contract terms is required for a thorough analysis.

"Remote" results can be judged on the basis of closed form distributions of results, simulations, or through scenario testing. Significance is defined by the magnitude of the net present value of cash flows between parties as a percent of revenues.

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[4] Funds held arrangements, wherein the cedant holds the loss fund and earns the associated investment income. Here the actuary must consider what constitutes the basis for measuring the 10% loss. Is premium the appropriate base? On one hand, it would seem not, as it is not cash between the parties. On the other hand, FAS 113 states, "Payments and receipts under a reinsurance contract may be settled net. The ceding enterprise may withhold funds...Determining the amounts paid or deemed to have been paid (hereafter referred to as "amounts paid") for reinsurance requires and understanding of all contract provisions."

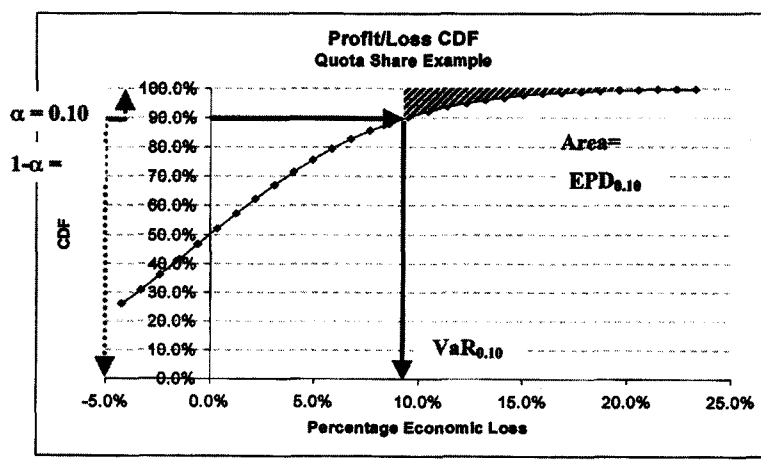
7. Beyond VaR Tests.

FAS 113 does not prescribe a specific method to test for risk transfer. Furthermore, given a model, FAS 113 does not precisely define whether the model output would imply that the contract in question passed or failed. While we must meet the considerations of FAS 113, actuaries needn't demonstrate risk transfer using the 10-10 rule or VaR test more generally.

Expected Deficit Methods.
The examples presented above suggest that a single point of *remote probability* and a single critical value for *significance* maybe inadequate, e.g., 10-10. Instead risk/reward is perhaps better viewed across the entire spectrum of profit and loss (consider the property catastrophe example). That is, there is a trade-off between probability and significance.

The 10-10 rule is used as a rule of thumb, for simplicity or as a starting point. Assume for the moment that a 10% chance of a 10% loss is, in fact, evidence of risk. It is simply not an exclusive evidence of risk. What if risk was defined by the trace of a line – almost akin to an efficient frontier – of those points that, by their combination of probability and magnitude, define risk transfer: 10-10, 5-20, 1-100, 0.1-1000? From such a set of points, one coordinate measuring probability, one measuring the magnitude of the loss, we can construct a single risk measure: the expected policyholder deficit (or in this case, the expected reinsurer's deficit).

The graph below compares the 10-10 rule ($VaR_{\alpha=10}$) with EPD. This graph was drawn using the data from the quota share example provided above.



In the continuous case, expected reinsurer's deficit (ERD) is defined as

$$\int_{NPV(loss)>NPV(premium)}^{\infty}[NPV(premium)-NPV(loss)]f(x)dx$$

In the discrete case, the expected reinsurer's deficit is

$$\sum_{NPV(loss)>NPV(premium)}^{\infty}[NPV(premium)-NPV(loss)]\Pr(x)$$

That is, the expected reinsurer's deficit is the average, or expected, deficit over all values where a deficit exists. If the NPV's above are divided by premiums (or cash to the reinsurer) the expected deficit is per unit of revenue. Using the pairs of numbers above, assuming these were our only loss scenarios, the ERD = (.10*-.10) + (.05*-.20) + (.01*-1.0) + (.001*-10) = -.04 or -4%. For comparison, the ERD's calculated for the three examples previously are as follows.

- Property Catastrophe = -40%
- Quota Share = -3%
- Finite = -3%

This metric has some appeal in that it is well grounded in actuarial theory concerning the measurement of risk. It also overcomes the 10-10 rule weakness (or VaR rules in general) of relying on a singular point to define risk transfer. We still have the problem of critical values, however: in this instance, what ERD defines risk transfer? In the above examples, property catastrophe has a –40% ERD, a number significant enough to likely be granted worthy of risk transfer (even though it didn't pass the 10-10 rule test). The quota share and finite examples have –3% ERDs. Here it is less clear that there is meaningful risk transfer.

Tail Value at Risk.
More recently, VaR and EPD measures have come under criticism in actuarial and finance circles because they are not coherent measures of risk. Given random losses X and Y, a risk measure, ρ, is considered coherent if it conforms to the following properties[5].

1. Sub-additivity: For variables X and Y, $\rho(X+Y) \leq \rho(X)+\rho(Y)$
2. Monotonicity: If $X \leq Y$, $\rho(X) \leq \rho(Y)$
3. Positive Homogeneity: for $\lambda \geq 0$, $\rho(\lambda X)=\lambda\rho(X)$
4. Translation Invariance: $\rho(X+a) = \rho(X)+a$

The sub-additivity property simply requires that the combination of two risk factors does not create additional risk; in fact, risk is the same or less. Value at Risk, despite its popularity, violates this axiom.

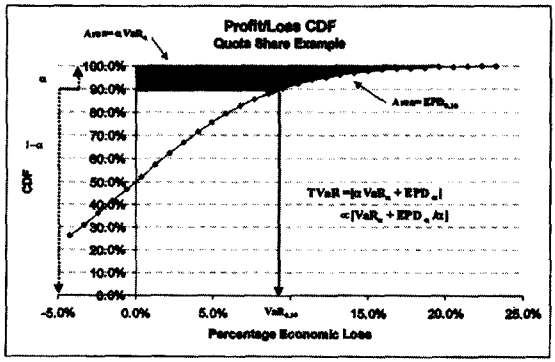
In the alternative, Tail Value at Risk, or TVaR, is a coherent risk measure. TVaR is equal to the expected value of a loss variable, say X, given that X exceeds the critical value VaR_α, i.e.,

$$TVaR_\alpha = E[X \mid x > VaR_\alpha]$$

If α is the probability of default, then VaR_α is the total assets, and TVaR may be expressed as:

$$TVaR_\alpha = \alpha^*\text{assets} + EPD, \text{ or } TVaR \propto \text{assets} + EPD_\alpha/\alpha$$

As in the EPD case, above, TVaR can be represented graphically as follows.



[5] See the discussion in Meyers [2]

TVaR's were calculated for each of the three examples above at the 90th percentile.

- Property Catastrophe = -319%
- Quota Share = -42%
- Finite = -23%

Recall from the previous section that the "ERD" did not discriminate between the quota share contract and the finite contract. TVaR does, and indicates that the quota share contract has more risk.

We do not have enough research, or perhaps even the prerogative, to suggest a threshold TVaR that implies a contract passes risk transfer. However, in the examples presented here, a finite contract, that by all accounts only marginally passes more traditional, 10-10 test and has no meaningful downside beyond the 10% loss, has a TVaR of -23%. Perhaps this suggests a threshold value in the 20-25% range or less would reflect minimal risk transfer.

Other Coherent Risk Measures

Coherent risk measures are characterized statistically as expected values of outcomes under adjusted probability distributions. For instance, TVaR, is expressed as:

$$E[X \mid x > VaR_\alpha]$$

This could equally well be expressed as the adjusted expected value of X under transformed probabilities, where the transformed probability is zero for $X < VaR_\alpha$ and is the actual probability adjusted to sum to unity otherwise.

This particular measure has been criticized on at least two grounds (e.g., see Wang (2001) *A Risk Measure that Goes Beyond Coherence*, Institute of Insurance and Pension Research, Research Report No. 18, University of Waterloo). First, it ignores all results below VaR_α. Second, it just measures losses above VaR_α on an expected basis, which is an under-weighting compared to moment-based measures, which use higher powers to represent the extreme risks of extreme events.

An alternative probability adjustment, which produces an alternative coherent risk measure that addresses these concerns, is provided by the Wang transform. This transform adjusts each scenario probability u by first calculating the normal-distribution percentile of u, then applying a functional transform to that percentile, and finally taking the normal probability of the transformed percentile. In mathematical notation:

Let $\Phi(x)$ be the standard normal cumulative distribution function, and $\Phi^{-1}(u)$ be its inverse, the percentile function, which applied to a probability u gives the corresponding percentile. Let h(x) be the percentile distortion function. Then the probability transform

applied to a cumulative loss probability u is $v = g(u) = \Phi[h(\Phi^{-1}(u))]$. A simple example is to take h(x) linear, such as bx+a, or even an additive constant, such as x+a.

One use of risk measures is to calculate the market price of risk transfer. Wang has shown that prices of risk in a number of markets, including catastrophe bonds, corporate bonds, and stock options can be approximated fairly closely by choosing the appropriate h function for each market. (Risk pricing may vary across markets in part due to the degree of hedging and liquidity available, as well as to the degree to which financial results are subject to sudden large drops.) The key issue to getting the right h function is applying enough probability distortion in the tails of the distributions to capture the market reaction to tail events. However, even a linear h function provides a non-linear price effect in the tails, and thus can be used for benchmarking.

Quantifying the market price of the risk inherent in a given transaction could be an alternative method for determining if there is enough risk transfer to satisfy the requirements of FAS 113. Even if a contract is priced above the market value of the risk it has, it still might meet the FAS requirements for risk transfer. However, as *significant loss* is to be interpreted relative to ceded premium, a deal could fail risk transfer, but pass if the premium is reduced. Thus there is a pricing continuum from weak pricing to strong pricing to excessive pricing to not enough risk transfer for 113 to no risk at all.

As an example of the application of the Wang transform to risk transfer, let $h(x) = 0.7x - 1.3$. This gives prices quite a bit above market standards, but might be in the area between excessive pricing and no risk transfer. To apply this to risk transfer testing, a number of scenarios can be simulated showing the present-value profitability to the reinsurer for each scenario, and resorted into a cumulative probability distribution. The expected value of the profit should be positive under this distribution, or the reinsurer would not be interested. But if you distort the probabilities with the Wang transform to give more weight to the adverse scenarios, the transformed expected value could be negative. If it is negative with the target h function selected, then risk transfer would be deemed to be established.

With the linear h assumed, the 50 excess 15 catastrophe cover in Example 1 would pass risk transfer, with a transformed mean of –440%, and would still barely pass (with a mean of –2%) with the premium increased to as much as $25M., which gives a 1% probability of a 92% loss. This premium is well above typical market standards, but may be in the gray area between no risk transfer and excessive pricing. Setting the h function would be the judgment part of this approach. With these values, the quota share from Example 2 easily passes risk transfer with a transformed mean return of –19%.

Premium for the catastrophe cover much above $25M would fail risk transfer by this standard. It might seem unusual to find a catastrophe cover not meeting risk transfer, but grossly overpriced catastrophe covers could be used as payback or to add the appearance of risk to basically cosmetic deals. An actuarial risk-measurement procedure should be able to identify them.

Exponential Transform

Oakley Van Slyke and Rodney Kreps, in an unpublished manuscript [2], suggest another possible approach to testing risk transfer through measuring the capital cost inherent in a reinsurance transaction. This is based on the work of Karl Borch, 1962 on quantifying risk costs. Borch shows that under certain assumptions the only risk-reflecting pricing transform that properly measures risk cost is an exponential transform. His assumptions - as discussed in Giuseppe Russo and Oakley E. Van Slyke [4] are essentially:

- There are no arbitrage opportunities. That is, the cedant would never pay more to cede a loss than the amount of the loss. In turn, no one would be able to sell insurance for a premium greater than the amount of the exposure.
- The evaluation of an alternative is robust with respect to the input data. That is, a small change in an input parameter should not lead to a large change in the evaluation of an alternative.
- The evaluation of an alternative is robust with respect to the analytical process one is using. For example, making small refinements to a particular scenario should not drastically change the evaluation of a particular alternative.
- The evaluation of an alternative is robust to changes in the time scale. For example, changing the time intervals of the analysis from quarterly to monthly should not have a significant change in the evaluation of an alternative.
- If there is no risk, one can determine the present value of a stream of future cash flows by discount factors derived from the term structure of interest rates.

These assumptions lead to establishing an equivalent constant risk-adjusted value (RAV) of a risky deal, subject to the risk capacity c that is carried. First let X represent the random loss from the deal, prior to any premium payments Then the Risk Adjusted Value of liabilities for risk-carrying capacity c > 0 is:

$$RAV(c) = c \ln\left\{ E\left[e^{X/c} \right] \right\}$$

this emphasizes large losses, more so as c is small and less so as c is large.

The risk load to take on these liabilities = RAV(c) – E[X], is then expressed as:

$$\pi = c \ln\left\{E\left[e^{X/c}\right]\right\} - E[X]$$

Van Slyke and Kreps then impose the condition that the capacity available is a multiple of the risk load:

$$c = \pi/s \Rightarrow \pi = \pi/s \ln\left\{E\left[e^{sX/\pi}\right]\right\} - E[X]$$

If you subtract a constant premium p from X and then evaluate the risk in the deal, E[X] and the RAV also decrease by p. Thus the risk load to package and resell the whole deal is the same as that for the losses alone. Then taking the financial scale as multiples of p would make X the negative of the return on premium. Taking Y = –X as the return on premium gives:

$$\pi = E[Y] + (\pi/s) \ln E[e^{-sY/\pi}]$$

as the equation for the risk load as a percent of premium for reselling the entire deal. If the market s is known, this equation can be solved numerically for π, which then can be used to compute the risk adjusted value of the deal. If the RAV is positive, the price is below market levels. If RAV is slightly negative, the deal is priced above the market, but still could be fairly risky. As with the Wang transform, however, when the RAV is too negative, the pricing eventually crosses the line between excessive pricing and no risk transfer.

Van Slyke did some other research that suggests that s = 0.4 would fairly represent pricing in a number of financial markets. This value will be assumed in the discussion which follows.

Taking the RAV cutoff point for return on premium as RAV = –70% would be similar to the Wang transform values illustrated above. For Example 1, the RAV would be about positive 75%, which would suggest that the postulated pricing is light in terms of market risk pricing. With the premium increased to $25M, the RAV drops to – 67.2%, so barely passes risk transfer by this standard. For the quota share Example 2, the RAV is about 25%, which suggests there is considerable risk remaining in this deal.

The Borch approach is based on somewhat different market assumptions than the transformed distribution approach. Although these are consistent for independent risks, there could be inconsistencies for correlated risks. For example, see G.G. Venter, *Premium Calculation Implications of Reinsurance without Arbitrage*, ASTIN Bulletin 21, #2, November 1991, where it is shown that arbitrage-free pricing for both correlated and independent risks can be done only with expected values from transformed distributions. This was one of the precursors of Wang's work. However by just focusing on the ending

distribution and ignoring intermediate changes in value, distribution transforms fail to account for the sudden drops in value that are modeled in stochastic financial pricing methods. The potential for discontinuous price drops seems to require more risk premium, possibly because dynamic hedging strategies are less effective. Thus although probability transforms on ending distributions can produce good benchmarking rules, they are not as fundamental as the financial stochastic process models, and have to be calibrated separately to each market studied.

Transformed 10 – 10 Rule

If the 10 – 10 rule is accepted for normal distributions, then a transformation can provide an equivalent standard for skewed distributions.

To see this, 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:*

1. *For a pre-selected security level* α=10%, *let* $\lambda = \Phi^{-1}(\alpha) = -1.282$, which is the α-th percentile of the standard normal distribution.
2. *Apply the Wang Transform*: $F^*(x) = \Phi[\Phi^{-1}(F(x)) - \lambda]$.
3. *Calculate the expected value under* F^*: $WT(\alpha) = E^*[X]$.
4. If $WT(\alpha) < -10\%$, it passes the test, otherwise it fails the test.

When X has a Normal(μ,σ^2) distribution, $WT(\alpha)$ is identical to the 100α-th percentile. This serves as a base or benchmark for 10-10-rule. 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.

For Example 1, the catastrophe layer, these values of the transform are a little less strict than the tests evaluated above, with premium as high as \$34M for the layer meeting the test. For Example 2, the quota share, $WT(0.10) = -14.39\% < -10\%$, so it passes the transformed 10-10-rule.

In conclusion, at its core, FAS 113 requires only that risk transfer be present to gain reinsurance accounting treatment. FAS 113 does not require a 10-10 rule in gauging the risk transfer. The preceding sections offered some alternative measures such as TVaR, the Wang Transform, and the exponential transform for judging the degree of risk.

8. Beyond FAS 113.

Insights from the Securitization Task Force.
As configured, FAS 113 requires that the cedant establish that the reinsurer has assumed some amount of risk. If one were to consider the evaluation of risk transfer beyond that which is described in FAS 113, it would seem preferable that the cedant demonstrate a complementary concept: that they have, in fact, ceded risk. Thus, risk transfer would not be defined based on cash flows between parties, but rather the changed risk of the cedant – before and after application of the contract in question. This is essentially the logic the Index Securitization Task Force has used in proposing methods and metrics for companies to justify whether or not a hedge should qualify for reinsurance accounting.

The Index Securitization Task Force, in its paper [1], *Evaluating the Effectiveness of Index-Based Derivative in Hedging Property/Casualty Insurance Transactions*, describes potential quantitative measures of hedge effectiveness. These include change in Expected Policyholder Deficit, change in Value at Risk, change in Standard Deviation, coverage ratio and correlation. Of these, the first three examine the reduction of risk attributable to the hedge. At the request of the task force, VFIC narrowed this list to two measures that best demonstrated a reduction in exposure to loss, thus enabling a hedge to receive underwriting accounting treatment versus investment accounting treatment. These measures are: reduction in Tail Value at Risk and reduction in Standard Deviation.

As discussed above, Tail Value at Risk is defined as the average of all loss scenarios over the 100^{p} th percentile, where p is a selected probability level, such as .90. One can consider this measure a melding of the expected policyholder deficit and value at risk measures. The tail value at risk measure captures both the probability and magnitude of large under-recoveries. Based on empirical studies, the committee found that tail value at risk produced more consistent results than value at risk when the probability levels were varied.

The other measure the committee recommended, reduction in standard deviation, distinguishes between true hedges and speculative investments since it is sensitive to both upside deviation and downside risk.

With respect to the degree of risk reduction, one may consider that risk has been transferred if both or either of these measures demonstrates that their value is less following the application of the hedge or reinsurance contract. A more conservative view would set specific thresholds by some predefined amount.

Given this application of risk measurement for gauging the effectiveness of a hedge for reinsurance accounting treatment, it is not inconceivable that the same sort of standard be utilized to gauge risk transfer in reinsurance contracts. In fact, in the absence of consistent treatment, there is the potential for different standards and approaches to be applied when evaluating a reinsurance contract for risk transfer versus evaluating hedge effectiveness for index-based securitization.

9. Conclusions.

In order to garner reinsurance accounting treatment for GAAP accounting purposes, a reinsurance contract must meet the requirements set forth in FAS 113. FAS 113 requires that a reinsurance contract transfer risk. There is little supporting literature to find guidance in what constitutes an acceptable demonstration of the existence of risk in a reinsurance contract. In an effort to provide some guidance to the CAS membership on risk transfer testing, VFIC conducted a research project on risk transfer. Based on this research and analysis, VFIC concludes:

1. **Statement**. FAS 113 requires the reinsurer to be exposed to a "*reasonable possibility*" of a "*significant loss*" from the "*insurance risk*," but it stops short of prescribing methodology for testing, metrics for measuring, or specific thresholds to judge risk transfer against. This is appropriate given the diversity and complexity of reinsurance transactions.

2. **Methodology**. Regarding methodology, FAS 113 articulates that risk transfer testing include:
   - A thorough understanding of contract provisions,
   - A model of the incidence of cash flows between parties,
   - Cash flows should be discounted at the same, appropriate rate, and
   - Incorporating insurance risk only

   These requirements preclude consideration of income taxes, reinsurer expenses, brokerage, or credit risk in the determination of risk transfer.

   To meet the FAS 113 requirements, we recommend that risk transfer analysis include:
   - *"Reasonable possibility"* requires a view of the distribution of expected contract losses,
   - Identification of threshold values for "*reasonable possibility*" of a "*significant loss*" based on the loss distribution, and
   - Duration-matched or immunized yields as the appropriate discount rates,

3. **Metrics**. Current practice, born out of the phrases "*reasonable possibility*" of a "*significant loss*," splits risk transfer analysis into separate tests of probability and significance. Using a singular loss metric for a given probability is a metric known as Value at Risk, or VaR. This paper offered examples of three types of reinsurance contracts and calculated a VaR for each using 10% as the "*reasonable possibility.*"

   One weakness of VaR is that it does consider only a single point on the loss distribution. While FAS 113 literally speaks to the existence of a "*reasonable possibility*" of a "*significant loss*," the broader issue involved with FAS 113 is whether a particular contract transfers risk. In this vein, VFIC explored risk

metrics other than VaR. First among these was expected policyholder deficit (EPD). Expected deficit methods were able to illustrate risk transfer for a property catastrophe example where the standard VaR measure (with α=10%) was not.

Both VaR and EPD measures have been criticized as risk measures because they are not coherent. Tail Value at Risk (TVaR) is a coherent risk measure. TVaR was analyzed, as well, and was found in simple examples to discriminate risk levels between contract types where EPD and VaR did not. Even TVaR has been criticized as a risk measure in that it ignores losses below VaR_α and loss above VaR_α are treated on an expected basis only.

Distributional transforms were researched as alternatives to traditional risk measures. Transforms are coherent and address the shortcomings of TVaR noted above. The exponential and Wang transforms provide risk transfer metrics founded in the risk load required for a market-based transaction to transfer the risk.

4. **Thresholds or Critical Values.** Over time, common practice seems to have concluded that a 10% chance represents a reasonable probability, and a 10% loss represented a significant loss. Thus we have what many term the 10-10 rule. This rule-of-thumb is really just a statement of the critical values associated with a VaR risk measure. There are clearly exceptions to this "rule," as other critical values are frequently used in practice.

   A sample finite reinsurance contract, designed to have minimal risk transfer, generated a TVaR of -23%. While this represents limited research, it may suggest a minimal threshold value for demonstrating risk transfer with this measure.

   Section 7 proposes a transformed 10-10 rule for the Wang transform, suggesting a critical value of –10% from the mean of the transformed distribution as an adequate demonstration of risk transfer.

   Regardless of the model employed or the risk metric used, judgment is still required as to where to establish the threshold values for probability (frequency) and significance (severity) for VaR tests or for pass/fail more generally for other risk measures. .

5. Intuitively, it seems natural to judge risk transfer for a reinsurance contract by analyzing whether the cedant has transferred (reduced) risk, not, as FAS 113 requires, by whether the reinsurer has assumed risk. On an enterprise-wide basis, the two can be different. On a single transaction, as FAS 113 addresses, the two perspectives may be the same. However, it should be noted that the recommendation on Index Securitization proposed the opposite: analysis is done from the cedant's perspective on an enterprise-wide basis. This could lead to

different accounting treatments for reinsurance products and index securitizations, unless both tests are required for securitization and industry loss triggers.

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