EXHIBIT 3

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Catastrophe Exposures and Insurance Industry Catastrophe Management Practices

Executive Summary

The American Academy of Actuaries' Catastrophe Management Work Group was requested by the Coordinating with Federal Regulators Subgroup on Financial Issues of the National Association of Insurance Commissioners to develop a white paper to discuss how property and casualty insurers manage catastrophe risks. This paper is in response to that request and makes the following observations:

- Catastrophe exposures place special demands on insurer capitalization and require a distinct risk management approach. The risk management process for an insurer must integrate all risk management strategies of the insurer, not just a single risk, such as catastrophe risk. The interaction or covariance (versus independence) of the various risks a company faces is an important factor in determining the company's total capital requirements.

- For property and casualty insurers, catastrophes are defined as infrequent events that cause severe loss, injury, or property damage to a large population of exposures.

- Whereas most property insurance claims are fairly predictable and independent, catastrophe events are infrequent and claims for a given event are correlated. The insurance process, if left unmonitored during lengthy catastrophe-free intervals, could produce increasing concentrations of catastrophe exposure.

- Catastrophes represent significant financial hazards to an insurer, including the risk of insolvency, an immediate reduction in earnings and statutory surplus, the possibility of forced asset liquidation to meet cash needs, and the risk of a ratings downgrade.

- Insurers manage catastrophe risk through a continuous learning process that can be described in five steps. The steps are identifying catastrophe risk appetite, measuring catastrophe exposure, pricing for catastrophe exposure, controlling catastrophe exposure, and evaluating ability to pay catastrophe losses.

  - **Identifying catastrophe risk appetite** - An evaluation of catastrophe risk appetite gives underwriters a guideline for determining whether catastrophe risk in the insured portfolio is within acceptable limits.

  - **Measuring catastrophe exposure** - The objective of measuring catastrophe exposure is to be aware of the company's current exposure to catastrophes, both in absolute terms and relative to the company's risk management goals.

- **Pricing for catastrophe exposure** - In setting rates for catastrophe insurance coverage, the general trend is away from using a long historical experience period, toward the application of catastrophe models to current or anticipated exposure distributions. The shortcomings of using historical premium and loss experience are clear, and catastrophe modeling has been widely adopted in making rates for hurricane and earthquake.

- **Controlling catastrophe exposure** - For various reasons, insurers may decide they have a need to control or limit catastrophe risk. Usually this results in reducing exposure in segments where capacity is exceeded, and using reinsurance or capital market instruments to transfer exposure to someone else.

- **Evaluating ability to pay catastrophe losses** - Catastrophe claim payments are funded through normal operating cash flow, asset liquidation, debt financing, or advance funding from reinsurers.

- Actuarial standards exist for appropriate application of catastrophe models. Also, to help regulators evaluate use of the models in making rates, the Catastrophe Insurance Working Group of the NAIC published the *Catastrophe Computer Modeling Handbook* in January 2001.

- Generally, the liquidity (or illiquidity) of an insurer after a catastrophe does not cause insolvency. Rather, it is the magnitude of the event relative to company surplus. Insurers must strike a balance between the benefits of being prepared for low-probability catastrophes and the cost of pre-event preparations.

- There is no one catastrophe risk management procedural template that applies to all insurers. However, the conceptual elements are the same for any property and casualty insurer.

- Reinsurance is the traditional method used by insurers to transfer risk, but capital markets are a growing source of alternate capacity. Capital market products developed to date can be grouped into three categories: insurance-linked notes and bonds, exchange-traded products, and other structured products.

- Catastrophe risk management for reinsurers is similar to that of a primary company. For a reinsurer, the challenges are to obtain adequate catastrophe exposure information from ceding companies, to accurately measure catastrophe exposure aggregations across multiple ceding companies, and to price for the exposure.

- Insurer catastrophe risk management practices are relevant to certain questions of public policy. Examples include the amount of insurer capital, whether insurer capital needs to be segregated for catastrophe purposes, whether to encourage pre-event funding, the tradeoffs between availability and affordability, the extent of governmental involvement in the market place, and potential over-reliance on guaranty funds.

- Policy-makers considering actions designed to affect either catastrophe coverage availability or the solvency of insurers exposed to catastrophe claims can use the five step catastrophe risk management approach to anticipate market effects of the proposals they are considering. Generally, policy actions have more than one consequence, and this framework can help to anticipate secondary (and sometimes unintended) consequences.

Introduction

At the June 2000 Summer National Meeting, the National Association of Insurance Commissioners (NAIC) formed the Coordinating with Federal Regulators Subgroup on Financial Issues (Subgroup). The Subgroup was asked to:

- define the components of catastrophe, underwriting, and insurance risk
- identify relevant insurance regulatory tools that might assist the Federal Reserve Board in supervising FHCs and suggest ways federal regulators may make effective use of the tools
- determine the information needs of other functional regulators (e.g., FRS member banks, FDIC, OCC, OTS, NASD, SEC) regarding insurance companies within a FHC and develop procedures necessary to obtain such information, where appropriate
- make recommendations for information sharing and other coordination between federal functional regulators and state insurance regulators with respect to catastrophe, underwriting, and insurance risk

The Subgroup plans to meet with Federal Reserve Board staff to present their initial findings in three areas:

- how insurers manage catastrophe risk (coverage, pricing, underwriting, risk aggregation and management, and capital adequacy)
- risk transfer mechanisms for spreading catastrophe risk (reinsurance, catastrophe bonds, and other forms of securitization)
- regulation of insurance company catastrophe risk management

The Subgroup asked the American Academy of Actuaries Catastrophe Management Work Group to provide technical assistance in the form of a white paper to address the first and second issues: insurance company management of catastrophe risks and risk transfer mechanisms. This paper addresses property catastrophe exposures which broadly impact the insurance industry and discusses the following issues:

- definition of catastrophes
- capital considerations
- managing catastrophe risk
- reinsurance and risk transfer
- public policy implications

Several appendices have been included that expand on topics outlined in the paper.

I. What is a Catastrophe?

For property and casualty insurers, catastrophes are infrequent events that cause severe loss, injury or property damage to a large population of exposures.[1] While the term is most often associated with natural events (e.g., earthquakes, floods or hurricanes), it can also be used when there is concentrated or widespread damage from man-made disasters (e.g., fires, explosion, pollution or nuclear fallout).

Whether losses arising out of an event are defined as a catastrophe depends on the size of the loss to the company or to the entire industry. Property Claim Services (PCS), a unit of the Insurance Services Office, Inc., analyzes catastrophes based on their impact on the industry as a whole. PCS monitors industry loss reports and assigns a catastrophe number to an event if direct insured losses to property exceed $25 million and it affects a significant number of insureds and insurance companies. In addition, many individual insurers establish company thresholds for defining a catastrophic loss. An insurance company may utilize internal criteria to determine whether an event is a catastrophe as it relates to its specific book of business even if the event has not been labeled as a catastrophe for the industry as a whole.

Not all catastrophes are covered by property and casualty insurers. Some may not be privately insured because of difficulties in quantifying and pricing the hazard (e.g., nuclear hazard). In addition, catastrophes that could be subject to adverse selection may be specifically excluded from coverage (e.g., flood). Frequently, if the insurance industry does not provide coverage for a catastrophic peril a governmental program or facility may be available.[2]

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[1] The term "exposures" refers to units for measuring the size of an insurance portfolio, such as the number of policies, number of property locations, aggregated coverage amounts, or other alternative measures.

[2] Appendix A discusses the extent to which traditional insurance products cover catastrophe perils. Appendix B outlines various governmental programs that protect individuals against catastrophic risks.

II. Insurer Capital Considerations

A property and casualty insurer provides contractual coverages to consumers and businesses, which exposes the insurer's capital to risk. The company's owners expect financial returns commensurate with the risks.

Catastrophe exposures place special demands on insurer capitalization and require a distinct risk management approach. Catastrophe risk management is a component of a property and casualty insurers' overall risk management program, but the overall program is stronger if unique consideration is given to catastrophe risk.

The following sections further demonstrate this by contrasting noncatastrophe exposures with catastrophe exposures.

A. Noncatastrophe Exposures

Like other businesses, insurers perform most efficiently when costs are known before prices are set and sales are made. It is the nature of insurance, however, that prices must be set before coverage is sold and losses have occurred. Future insurance losses must be estimated. Thus, any arrangement that produces more accurate estimates is of great interest to insurers. In statistical terms two conditions are very desirable:[3]

- predictable frequency of claims over time
- each exposure experiences loss independently of other exposures

For the most part, noncatastrophe exposures are independent. By writing larger volumes of business, the occurrence of claims becomes more predictable. Under these conditions, insurers can use historical data to calculate reliable and useful statistics, such as the expected average incurred loss per future exposure. An insurer is able to compare prices it can charge in a competitive marketplace with actuarial estimates of the cost of providing coverage, and use that knowledge to develop marketing and underwriting strategies.

In theory, the goal is to insure large numbers of exposures, at prices sufficient to cover expected losses and expenses that achieve an adequate rate of return on capital commensurate with the risk inherent in the exposure portfolio.

B. Catastrophe Exposures

Catastrophe exposures differ from noncatastrophe exposures in that they do not meet the conditions identified above. By definition, catastrophes are infrequent, producing no losses in most years, and large losses in a few years, a clear violation of the first condition. The second

[3] The Central Limit Theorem or "Law of Large Numbers" is beyond the scope of this paper, but it is the theoretical foundation for these two conditions.

condition for noncatastrophe exposures was independence. Catastrophes cause loss to many exposures at once. Significant or high correlation among exposures is a key feature of catastrophe risk.[4]

Assume an insurer covers a large number of policyholders who would be affected by the same catastrophes, and assume for simplicity this insurer backs up its contractual obligation to those policyholders by accumulating an extraordinary amount of capital.[5] The insurer must either find a way to bear the cost of holding that capital, or create a catastrophe risk management plan to deal with its existing exposure. The return on capital should be commensurate with risk, given consideration to the correlation of exposures, and infrequent occurrence of events.

The insurance process, if left unmonitored during lengthy catastrophe-free intervals, could produce increasing concentrations of catastrophe exposure. Thus, insurers need a special process for catastrophe risk management.

III. How Insurers Manage Catastrophe Exposures

Catastrophes present significant financial hazards to an insurer, including the risk of insolvency, an immediate reduction of earnings and statutory surplus, the possibility of forced asset liquidation to meet cash needs, and the risk of a ratings downgrade.[6] Property and casualty insurers typically develop catastrophe risk management strategies that combine determination of risk appetite, measurement of exposures, pricing considerations, processes to limit exposure, and utilization of reinsurance or capital markets to transfer risk to third parties. This section details the five steps used by insurers to address catastrophe:

- Identifying catastrophe risk appetite
- Measuring catastrophe exposure
- Pricing for catastrophe exposure
- Controlling catastrophe exposure
- Evaluating ability to pay catastrophe losses

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[4] Independence and perfect correlation are opposites. Statistically, independence is a condition in which correlation is zero. Significant correlation means "lacking independence."

[5] The occurrence of large natural disasters generally is not correlated with other types of insurance claims. This means that an insurer's required capital benefits from a "covariance effect." The capital an insurer requires to reach a given level of policyholder security is less than the sum of that needed to support catastrophe risks and that needed to support other types of risks.

[6] Rating agencies rate insurers' financial ability to fulfill their promises and publicize the findings. Adverse ratings can be very damaging, even to the extent that investors may be unwilling to hold an insurer's debt or equity. A rating downgrade often results in an immediate loss of business and may imperil the ongoing business if agents refuse to renew or produce new business for the downgraded company.

A. Identifying Catastrophe Risk Appetite

The starting point in managing catastrophe exposures is to understand how much loss, in a period of time, the insurer can absorb without an unacceptable adverse impact. Each insurer's risk appetite is unique and a function of:

- earnings volatility
- market pricing
- availability and cost of reinsurance
- cost of capital
- solvency regulation
- capital allocated to catastrophe exposures
- rating agency evaluations
- tax considerations
- cash flow needs
- financing requirements
- rate regulation
- other lines of business written by the insurer

A company's risk appetite is often expressed as a maximum acceptable reduction to surplus (or income) from a single event or multiple events in a year. Management may alternatively specify a maximum annual loss that can be tolerated within a certain time period, such as "$100 million of loss likely to be exceeded only once in 100 years." Expressions like these give underwriters a maximum guideline for monitoring whether catastrophe risk in the insured portfolio is within acceptable limits.

B. Measuring Catastrophe Exposure

Once a company has established its risk appetite, it must complete an inventory of its existing exposures. In the past this may have been done by evaluating the company's loss potential arising from the aggregate policy limits written in a catastrophe-exposed area. In the past 15 years, and as a result of significant losses from hurricanes and earthquakes, catastrophe

modeling technology has been improved, and with improved technology has come increased rigor in measuring catastrophe risk exposure.[7]

Insurers who express risk appetite as "$100 million of loss likely to be exceeded only once in 100 years" can refer to a model-based loss exceedence probability curve to monitor whether the 1 percent exceedence probability is associated with annual aggregate catastrophe losses at or below its $100 million maximum.

In rigorous terms, we define the term "probable maximum loss" (PML) to be the amount of loss associated with a given exceedence probability over a specified period of time. The term PML must be put into a context of how it is being used. In the example above, $100 million may be referred to as the company's annual aggregate PML from the modeled peril at a 1 percent exceedence probability or a 100 year return time. The company may describe its PML as the amount of aggregate annual loss the company expects to be exceeded no more than once in a specified number of years (e.g., 100, 200 or 500).

Companies with significant earthquake or hurricane exposure commonly use catastrophe models to make a formal, rigorous statement regarding the company's PML. Measuring catastrophe risk concentration using a model can be expensive and sophisticated. However, catastrophe exposure monitoring may be inexpensive and less formal. In a geographic area known to be disaster-prone, simple measures such as the total amount of written premium, number of insured structures, policy counts, or the sum of the limits on insured structures are easily available and can be powerful intuitive measures of risk.

Another common approach is to estimate a subjective PML arising from a described event, type of coverage, or geographic region. The term "probable maximum loss" has been widely used for many years, often without any statistical definition. In this less rigorous setting, PML may often be a subjective estimate obtained by multiplying the aggregated policy limits in the area by a selected percentage loss. Subjective PML estimates typically are used for perils where models may not be available (e.g., volcano, brush fires) to more formally estimate a company's exposure.

Model-based PML estimates, complementing other subjective PML estimates, can be applied to manage catastrophe exposure and allocate capacity in geographic detail or by region. Whether model-based or subjective, a company should regularly update its PML estimates as part of an ongoing monitoring process. In general, the objective always is to be aware of the company's current exposure to catastrophes, both in absolute terms and relative to the company's risk management goals.

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[7] Catastrophe models provide a probability distribution of potential losses based on the company's insured portfolio and the modeled hazards. From such a loss distribution, a number of statistical tools can be derived, including an aggregate annual exceedence probability curve. The modeling process is discussed further in Appendix C.

C. *Pricing for Catastrophe Exposure*

Unlike most businesses, insurance companies do not know the majority of the costs for their product at the time of sale. Most insurance costs do not arise until much later. In fact, many claims may not be reported for months or years after the policy has expired. Depending on the jurisdiction, insurance premiums may be determined by the regulatory process or by the operation of the competitive marketplace. In either case premiums provide for the following costs:

- *Expected loss and loss adjustment expense.* These represent payments that are expected to be paid directly to an insured for first party coverages or on behalf of an insured for third-party coverages plus related claim settlement expenses.

- *Underwriting expenses.* Expenses that are associated with obtaining new business or retaining the insurer's existing book of business including commissions, other acquisition costs, and general expenses (such as salaries, rent, and other items).

- *Premium taxes, licenses, and fees.* These represent premium taxes imposed by the individual states, as well as costs for licenses, fees, and boards and bureau assessments. In some cases provision is made for miscellaneous assessments such as guaranty fund and residual market assessments.

- *Net cost of reinsurance.* The premium required by the reinsurer to accept the catastrophe exposure, minus the expected loss transferred to the reinsurer.

- *Cost of capital.* This represents the profit provision needed to achieve the insurer's required rate of return on capital commensurate with the risk inherent in the exposure profile.

The remainder of this section addresses pricing issues associated with the expected loss and loss adjustment expense component.

It has long been recognized that it is appropriate to separate the expected loss component for property insurance coverages into two parts. One component determines the provision for noncatastrophe losses and the other component develops a provision for catastrophe losses. A company may use various approaches to estimate the catastrophe loss provision.

For most types of noncatastrophe property/casualty coverage, recent historical claim and exposure data form the basis for projections of future costs and revenue. The analysis usually includes one to five years of the most recently available data, although up to 10 years of information may be reviewed for certain types of coverage. The exact number of years of data used is based on the desire to balance responsiveness and stability in rate indications, the historical variability of the underlying frequency and severity of the claims, and the volume of data available for actuarial analysis.

Before insurers utilized models to estimate catastrophe provisions, companies traditionally utilized historic catastrophe experience for an extended period (generally 10+

years). Inherent problems arise when using historical experience to project catastrophe losses, particularly for low frequency events such as hurricanes and earthquakes. Such experience is inherently volatile and historical exposure concentrations are not representative of future policy periods. The available historical industry insurance claims record is for the time period from 1960 to the present for homeowners insurance and 1950 to the present for extended coverages. This time period is generally too short to accurately estimate expected hurricane and earthquake parameters. In addition, as measured by longer-term meteorological data, the period from 1960 to date had an unusually low frequency of intense hurricanes.

Historical insurance data may not reflect current exposures. Changes in land use, population densities, building codes, and construction practices all serve to diminish the relevance of historical data when predicting future catastrophe losses.

The traditional method is further flawed in that the occurrence or absence of individual storms can have a dramatic impact on results. The traditional method is overly sensitive to the occurrence of a single recent event.

Use of historical loss information for earthquakes and hurricanes has largely been abandoned in favor of computer modeling. Traditional rate making approaches (use of historical catastrophe experience for 10+ years) still exist where the catastrophe component is small or catastrophe events are more frequent, (e.g., private passenger automobile comprehensive insurance coverage or homeowners insurance in states where the hurricane exposure is minimal).

Insurers are increasingly using sophisticated computer models to model hurricane and earthquake losses. Models are being developed today for a broader array of perils using the technical expertise of multidisciplinary teams made up of seismologists, meteorologists, other physical scientists, engineers, mathematicians, statisticians, actuaries, and computer technology specialists.

Although the insurance industry is increasingly comfortable with using these models for pricing, not all regulators have reached the same comfort level. Some regulators are concerned with insurers' use of catastrophe models to establish catastrophe rate provisions for several reasons. Four of the principal reasons are the technical complexities of modeling, the proprietary nature of most models, the range of estimates produced by various models, and the perception that model results may be sensitive to changes in estimated parameters.

The actuarial profession has attempted to respond to these and similar concerns about modeling. As noted in Appendix C, actuaries are guided in their use of catastrophe models by Actuarial Standard of Practice 38 *Using Models Outside the Actuary's Area of Expertise* which details the review required by actuaries before they use such tools in their work product.

One of the more extensive reviews of catastrophe model use is that of the Florida Commission on Hurricane Loss Projection Methodology. The Commission was established in 1995 by the Florida legislature to "consider any actuarial methods, principles, standards, models, or output ranges that have the potential for improving the accuracy of or reliability of the hurricane loss projections used in residential property insurance rate filings." The Commission, to date, has established 52 standards that need to be met before a catastrophe model is acceptable

for ratemaking purposes in the State of Florida. The Commission's findings are not binding on the Department of Insurance; however, the findings are admissible and relevant in a rate filing or in any arbitration, administrative, or judicial proceeding.

After its creation in 1996 by the California legislature, the California Earthquake Authority began to issue earthquake policies with rates determined through the use of a catastrophe model. An extensive public hearing was held that examined both actuarial and modeling questions. After recommended changes were made to the model, the commissioner approved rates incorporating model-based estimates.

In addition, Louisiana has developed a set of computer model interrogatories that rate filers and modelers must complete and file with the state. Much of the information is similar to that required in Florida with a focus on Louisiana coastal exposure.

The Catastrophe Insurance Working Group of the NAIC published the *Catastrophe Computer Modeling Handbook* in January 2001. The handbook is a tool that regulators can use in evaluating the appropriateness of the use of catastrophe models in establishing rates. It provides a background on catastrophe models from the perspective of insurers, modelers, consumers, and regulators. The handbook includes a general overview of catastrophe models, a discussion of model input and output and a section on evaluating the models. The handbook also explores issues that have arisen or that may arise from the use of catastrophe models. It suggests areas and concepts regulators should consider and explore to become informed about catastrophe models.

In summary, the general trend is away from a traditional method using a long historical experience period, toward the application of catastrophe models to the insurer's current or anticipated exposure distribution. The shortcomings of the traditional method are clear, and catastrophe modeling has been widely adopted in making rates for hurricane and earthquake. Actuarial standards exist for appropriate application of catastrophe models, and regulators have developed guidelines to evaluate the use of the models in making rates.

D. Controlling Catastrophe Exposure

Once a company has established its risk appetite, measured its existing exposure to loss, and priced the product to the best of its ability, it may recognize a need to limit its risk. This management exercise includes:

- identifying where the company can grow its property portfolio without exceeding capacity limitations
- reducing property exposures where the company has exceeded its capacity for the region
- reducing exposure through reinsurance, capital market alternatives, deductibles, and other efforts to mitigate loss

Companies take different approaches to managing how much of a particular product or aggregate catastrophe exposure it will write in any given area.[8] However, there are common characteristics in all good catastrophe risk management programs. For example, a company that opts to write equal amounts of product in two distinct locations covering a specific peril (e.g., earthquake) will have more capacity than a company that writes double that exposure in one location.

In addition to managing geographical distributions, companies can purchase reinsurance that transfers a portion of the risk to a reinsurer. This does not reduce the company's direct obligation to the policyholder. The company promises to pay all claims irrespective of any reimbursement from the reinsurer. Risk transfer mechanisms are discussed later in this paper.

Expanding on the above, the company may achieve its general objectives by processes such as:

- counterbalancing existing risk accumulation with targeted growth
- limiting the accumulation using quotas or a moratorium on new business
- adopting minimum deductibles, reducing exposure and encouraging preventive mitigation
- reviewing coverage provisions to limit the potential for adverse coverage determinations after a catastrophe[9]
- excluding coverage for certain types of catastrophic perils
- limiting coverage for property that is prone to catastrophic damage

In addition, insurers may participate in programs to reduce or prevent property losses. Loss mitigation programs generally involve both public and private efforts. Building codes are examples of such programs. Recently established programs include Florida's hurricane shutter credits, mandatory Building Code Effectiveness Grading Schedules, and the minimum 5 percent dwelling retrofit credit imposed by the California Earthquake Authority.

Legal limitations on development in hurricane or earthquake-prone areas have not yet been implemented. In fact, commercial and residential development in recent decades has been especially active in locations that are exposed to hurricanes and earthquakes. The Federal Flood Insurance Program makes some attempts to control development in flood prone areas, with mixed success. In the long run, effective mitigation of property losses in catastrophe-exposed

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[8] An expanded discussion of underwriting individual risks is found in Appendix D.

[9] Coverage limits represent the maximum amount payable by an insurer on a partially or totally destroyed building. After large catastrophes the demand for materials and labor may exceed supply causing inflated prices and delays for repair and replacement. Under such conditions, coverage limits in the policy can be very important.

communities may be the most effective measure to prevent or reduce catastrophic exposure accumulation.

E. Evaluating Ability to Pay Catastrophe Losses

Cash demands on the insurer can vary significantly depending on the nature and intensity of the event. Catastrophes producing obvious damage (e.g., hurricanes, tornadoes) result in faster insurer payouts than those with less obvious damage (e.g., earthquakes). Further, the timing of cash needs is a function of the size of the event.

The period between the catastrophic event and the completion of repairs allows insurers time to fund the loss through underwriting cash flow, normal cash flow from investments, asset liquidation, debt financing, or advance funding from reinsurers. Generally, the liquidity (or illiquidity) of an insurer after a catastrophe does not cause insolvency. It is the magnitude of the event and the fact that the company does not have sufficient surplus to pay claims that is the defining factor.

Insurers with catastrophe exposures need to establish contingency plans for dealing with cash demands. Such plans generally include steps to:

- determine the potential size and timing of cash demands for catastrophe claims
- determine the dependability and flexibility of current sources of cash including daily cash flow from insurance and investment operations
- determine the willingness and ability of the company's reinsurer to advance funds
- determine whether the above cash sources might also be impacted by the catastrophic event
- determine if there is a gap between potential catastrophe cash requirements and readily available cash sources
- develop a plan that will bridge the gap when a catastrophe occurs including reductions in other spending, liquidation of assets or tapping equity or debt markets

For an insurer whose catastrophe exposures are small relative to its ongoing cash supply, the need for a plan is less pronounced. Such insurers can usually divert enough cash from insurance operations or maturing investments to pay catastrophe losses. If the plan does include liquidating investments, the insurer gives up some control over the amount and timing of investment gains including:

- liquidating assets for less than book values
- timing of catastrophe claims may complicate tax planning
- premature recognition of capital gains

In any case, asset liquidation reduces the asset base, which in turn reduces the opportunity for future investment income and capital gains. Insurers with catastrophe exposure must strike a balance between preparedness for low-probability catastrophes and the cost of pre-event preparations.

In summary, catastrophe exposures place special demands on insurer capitalization and require a distinct risk management approach. The insurer's total required capital depends on the company's overall risk profile, including any interaction or covariance, versus independence, of the various risks the insurer faces. The catastrophe risk management process for an insurer must be integrated into an overall risk management strategy.

Insurers manage catastrophe risk through a continuous learning process that may be described in five steps. The steps are identifying catastrophe risk appetite, measuring catastrophe exposure, pricing for catastrophe exposure, controlling catastrophe exposure, and evaluating ability to pay catastrophe losses. These steps form an iterative process. Insurers use what is learned in each iteration to improve future decisions.

There is no one procedural template that regulators should expect all insurers to apply to catastrophe risk management. Variations in business practices among insurers change the relative costs and benefits of different approaches to the conceptual framework outlined above. However, the conceptual elements are the same for all property and casualty insurers.

IV. Reinsurance and Risk Transfer

Insurance companies need to limit their risk exposure to an acceptable level because of concerns about solvency and the cost of capital. This section discusses various alternatives available to insurers to transfer catastrophe risk to third parties including buying reinsurance and utilizing financial instruments to transfer risk into the capital markets.

A. Reinsurance Mechanisms

Reinsurance is the traditional method insurers use to reduce or transfer risk.[10] Catastrophe reinsurance provides protection when losses from a single event such as an earthquake or hurricane exceed the buyer's specified retention. Reinsurance companies spread risk differently than the insurance companies they insure and they often have different objectives in quantifying and managing their exposure to catastrophes.

The two most common types of reinsurance arrangements are treaty and facultative. Treaty reinsurance buyers agree with the seller to cede losses from all risks meeting certain criteria. The reinsurer relies on the underwriting of the ceding company. Facultative arrangements are negotiated separately by the primary company on a policy by policy basis with the reinsurer who individually prices and accepts its interest in the policy.

[10] The issues that insurers consider in deciding to purchase reinsurance are outlined in Appendix E.

Generally, coverage is provided either as pro-rata or excess-of-loss. Pro-rata reinsurance cedes both premiums and losses according to the same percentage for each policy written. Excess-of-loss reinsurance is written on a per risk, per occurrence or aggregate excess basis. Catastrophe reinsurance is excess of loss reinsurance and is typically written on an occurrence basis and applies to all losses from a single event, net of other collectible reinsurance.

Because of limited reinsurance capacity and high prices for catastrophe coverage in selected areas of the country, nontraditional or finite[11] risk products were developed to supplement catastrophe reinsurance. These products involve the limited transfer of underwriting risk and typically are intended to provide multiyear smoothing of catastrophe losses. The finite risk products generally cover excess-of-loss or aggregate stop-loss. These excess-of-loss finite risk contracts utilize a fund that grows or is depleted based on actual experience. These contracts typically include a deficit payback or profit sharing feature. Finite risk stop-loss products provide coverage in excess of an aggregate retention amount.[12]

B. Capital Market Mechanisms

After Hurricane Andrew and the Northridge Earthquake reduced the supply of traditional reinsurance, changes in accounting rules greatly diminished the appeal of finite risk reinsurance products. Insurers were forced to look for new sources of capacity to assume some of the catastrophe risk that could not be borne by the insurance and reinsurance industries. Capital markets are a natural place to look for such capacity, as the amount and liquidity of capital in the North American equity and debt markets alone dwarfs the combined surplus of the global insurance and reinsurance industry.

The new products developed to date can be grouped into three categories: insurance-linked notes and bonds, exchange-traded products, and other structured products.

Insurance-linked notes and bonds include "cat bonds" and contingent surplus notes. These are typically structured as a bond issued by an offshore special purpose reinsurance company, which also issues a catastrophe reinsurance contract to the insurer. In some cases, the reinsurance contract will include an index or other parametric feature that restricts recovery to events that cause an agreed level of losses for the entire industry, in order to reduce moral hazard.[13] The premium paid for the reinsurance funds a risk premium payable to the bond

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[11] Finite risk insurance and reinsurance products are customized contracts that generally include a multi-year term, larger premium-to-limit ratios, explicit recognition of investment income and profit sharing features that distribute the benefits of good experience between the parties.

[12] The use of finite risk reinsurance products has been adversely impacted by the adoption of Financial Accounting Standard No. 113 (FAS 113) and EITF 93-6 issued by the Emerging Issues Task Force. FAS 113 significantly reduced risk limiting and payback provisions. The standard also created different accounting treatment for prospective versus retroactive reinsurance that limited the accounting benefits for retroactive contracts. EITF 93-6 eliminated loss-smoothing features since accrual accounting is now required for all reinsurance contracts with deficit payback or profit sharing provisions.

[13] Moral hazard is the risk to the reinsurer that the insurer will change its behavior in a manner that will increase the reinsurer's covered losses.

investors if there are no losses under the reinsurance contract. If there are losses, the bond investors could lose some or all of the interest and, in certain cases, part of the principal.

Advantages of these products are that insurers can access new capacity for catastrophe risk, carry desirable reinsurance accounting benefits, and have a minimal level of credit risk in the event of a loss. For an investor, these products are attractive because the level of return depends solely on occurrence of a catastrophe that triggers payment under the reinsurance contract, and is relatively insensitive to the economic factors (e.g., interest rates, credit defaults) that give rise to systemic risk in other types of fixed income investments. But such transactions are expensive to structure, often require creation of offshore special purpose companies, and can carry some basis risk[14] for the insurer (if the reinsurance includes an index feature). In some cases, these products may be more expensive than traditional reinsurance due to the "novelty premium" demanded by investors for assuming unfamiliar types of risk.

Exchange-traded products include catastrophe options, risk exchanges, and some weather derivatives. Catastrophe options and futures were developed by the Chicago Board of Trade in 1992 and later by the Bermuda Commodities Exchange. Trading of these products ceased in 1999 due to lower than expected demand.

Risk exchanges (e.g., Catex) allow an insurer to swap exposures with other insurers or financial intermediaries. Several markets have been established for trading weather derivatives, and various insurers, intermediaries and trading companies also provide these on an over-the-counter basis. In general, exchange-traded products have the advantages of low frictional cost, minimal information requirements, fast transaction times, low credit risk, and transparency due to observable market pricing. Common disadvantages have been standardized product offerings, lack of liquidity, lack of reinsurance accounting benefits for an insurer, creation of cash calls from exchange-mandated margin requirements, and creation of the same level of basis risk for an insurer from the use of such products.

Other structured products include over-the-counter derivatives and contingent capital products. These are typically customized products developed by a reinsurer, investment bank, or other intermediary to fit the specific goals and objectives of a customer. Because of the time and expense involved in developing a customized product, these are typically used for large and complex transactions. Contingent capital products range from relatively simple bank credit lines to contingent equity puts that give an insurer the right to sell preferred stock at pre-agreed terms after occurrence of a catastrophe event. Advantages of such products are that they are customized to meet a buyer's individual needs and can provide a large amount of contingent capital. Such transactions typically do not carry reinsurance accounting treatment, and they can be expensive to design and place.

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[14] Basis risk is the risk that there may be a difference between the performance of the derivative or index and the losses sustained by the company. If the losses on an insurer's book do not have enough correlation with the indices underlying the contracts, little underwriting risk is eliminated. See Harrington and Niehaus "Basis Risk with PCS Catastrophe Insurance Derivative Contracts."

V. Reinsurer Considerations in Managing Catastrophe Exposures

The steps used by a reinsurer in managing catastrophe exposure are similar to those described above for primary companies. The challenges faced by a reinsurer in managing its exposure are to be able to:

- obtain adequate and detailed information from ceding companies on their catastrophe exposures
- accurately measure the aggregation of potential catastrophe losses across multiple ceding companies (often using less precise data than the primary companies)
- price for the exposure

In order to overcome these challenges reinsurers require high levels of data disclosure from ceding companies, to enable them to underwrite, price products, and manage exposure accumulations. Reinsurers have also become increasingly reliant on models for pricing contracts, as traditional methods based on historical loss experience are unable to accurately price most catastrophe-exposed contracts. This change in pricing practices has created additional demand for data quality and model accuracy.

Increased awareness of catastrophe exposures has forced insurers and reinsurers to improve risk selection methodologies and carefully evaluate how individual risks fit into their overall aggregate exposure and capital allocation plan by gaining a better understanding of the correlations between different elements of the underwriting portfolio.

This analysis is particularly important for reinsurers who concentrate on excess-of-loss forms of reinsurance, as this type of risk transfer gives rise to a highly leveraged exposure to catastrophe losses. The variability in annual loss experience for this type of business is much larger than that of the primary insurance line (e.g. homeowners) underlying the catastrophe exposures.

In pricing for catastrophe exposures reinsurers must recognize that, in some cases, they cannot diversify their peak exposures. As a result, their pricing must directly reflect the cost of the additional capital that is required to support these exposures, in addition to funding for the expected loss and expense.

VI. Public Policy Implications

This paper has discussed insurer catastrophe risk management. Many insurer managements use these approaches or others that are conceptually similar. Accordingly, policy-makers considering actions designed to affect either catastrophe coverage availability or the solvency of insurers exposed to catastrophe claims can use this framework to anticipate the market effect of the proposals they are considering. Generally, policy actions have more than one consequence, and this framework can help to anticipate these secondary (and sometimes unintended) consequences. Note that these comments concern general concepts and do not

specifically address the merits of any current program or proposal. Also note that in these areas, both "too much" and "too little" may have unfortunate public policy implications.

A. How Much Capital?

Catastrophe insurance issues have steadily become more important to policy-makers. An increasing proportion of the population lives and works in areas exposed to windstorm and earthquake, so the issue of financing losses from these perils is becoming ever more significant for society. One challenge for insurer managements and insurance regulators is to provide appropriate assurance that the promises of insurers will be kept, even under catastrophic conditions.

One approach to providing such assurance is to require additional capital or reserves of writers of catastrophe coverages. However, if the safety requirements are excessive, too much capital may be required to support the writing of catastrophe-exposed coverage. In turn, the required return on the additional required capital raises the cost of the catastrophe coverage. Paying for more security than is needed becomes a deadweight burden on economic progress. Of course, inadequate attention to insurer solvency and inadequate capital requirements could cause the insurance product to lose value when it is most needed.

B. "Ring Fenced" Capital

Some policy proposals "ring fence" (i.e., capital for one purpose) capital required to bear catastrophe risk. These proposals grow more expensive as larger and less frequent catastrophes are required to be funded. Dedicated capital for a "1 in 100 year event" must be fully paid for every year by the policyholders for whose benefit it is held. On the other hand, "multi-use" capital is not segregated and can be called on for other purposes, such as to finance claims resulting from other risks the insurer takes on for its clients. Accordingly, part of the cost of the "multi-use" capital is borne by entities other than those exposed to potential catastrophe.

C. Pre-event Catastrophe Reserves

Proposals have been made to allow the tax deductibility of pre-event catastrophe reserves. These pre-event catastrophe reserves are designed to accumulate, over time, a portion of the capital an insurer may require to pay catastrophe claims. This capital is "ring fenced" so that normally it can only be used to fund catastrophe claims. The advantage to the insurer is that this capital is put aside on a pre-tax basis and held in a liability account known as a catastrophe reserve. In noncatastrophe years, the catastrophe reserve reduces federal income tax on the apparent "annual profit" arising from catastrophe-related premium when there are no offsetting catastrophe claims to pay. That federal tax reduction is reversed in catastrophe years when the catastrophe reserve is reduced to pay catastrophe claims.

One issue for policy-makers is what constraint to put on insurers who are establishing a catastrophe reserve. An inflexible formula approach can either trap unneeded capital in the catastrophe reserve or not allow an insurer to accumulate capital commensurate with its

exposure. Too flexible an approach could allow an insurer to vary its reserve increments in accord with its desire to manage its earnings.

Another issue for policy-makers is what constraint to put on the types of catastrophes the reserve fund can be used for. Policy-makers must balance the desire to provide funding for large, infrequent catastrophes with the cost associated with "ring fencing" capital that cannot be used for other purposes. This analysis resembles that for a self-insurance versus risk transfer decision. Large and infrequent risks are good candidates for risk transfer approaches.

Finally, tax policy-makers must consider the catastrophe reserve tax deduction in the context of overall tax policy. A catastrophe reserve tax deduction can help to finance the nation's catastrophe exposure, but a deduction that is "paid for" with a tax increase on other types of insurance coverages will not make the average insurance consumer better off.

D. Availability/Affordability of Programs

Recent increases in our knowledge of the risk of catastrophic claims events have caused changes in both the perceived need for and the perceived cost of providing insurance coverage for catastrophes. Accordingly, there are programs and proposals at various levels of the state and federal governments that attempt to improve the availability and affordability of such coverages.

In evaluating the impact of these programs on the insurance market, it is important to remember that management decides where to write policies based on anticipated profitability. Anticipated profitability on catastrophe-exposed coverages can be reduced if significant price controls are imposed on these coverages, or if the insurer faces underpriced competition from state-mandated programs providing similar coverages.

E. Exit Restrictions

Insurance consumers generally prefer, and benefit from, a stable marketplace. This stability is imperiled when insurers are allowed to exit a market in reaction to an actual catastrophic event, or a newly perceived catastrophic problem. A natural regulatory reaction is to restrict such exits, either in total or to a limited amount per year. However, restrictions can lead to trapped capital, which discourages both existing insurers and potential new insurers from investing in that marketplace. As a result, restrictions on market exits (i.e., mandatory renewals of existing customers) need to be balanced with the desire for a robust market.

F. Insurance Guaranty Funds

As a last resort, policyholders of impaired or insolvent insurers that lack sufficient resources to pay claims resulting from a catastrophe may receive some reimbursement of their insured losses from the state guaranty fund. Over-reliance on guaranty funds may cause some regulators to allow some insurers to charge inadequate premiums. As noted above, inadequately priced insurance can drive responsible insurers out of the marketplace, leaving insurers whom may not have adequate resources to respond when a large natural disaster occurs.

G. Use of Catastrophe Simulation Models

Prohibitions or restrictions on the use of catastrophe simulation models to determine price may cause insurers to limit their exposures in areas where they perceive prices are not adequate. This will make it difficult for consumers to find coverage.

Regulators may find applications of catastrophe simulations models useful in conducting company examinations. Problems identified will give companies who are otherwise unaware of problems a chance to solve them prior to the occurrence of a catastrophe event. This will lessen the likelihood of catastrophes placing unnecessary demands on guaranty funds and other public support mechanisms.

Rating agencies are likely to find increasing value in using models to evaluate company performance and value.

VII. Conclusion

People and businesses want to transfer their risk to an insurer or other entity, if it can be done at a reasonable cost. Insurers and other risk transfer entities can assume such risk most efficiently if claims occur predictably over time, and the people or businesses in the risk pool are independently exposed to loss. Catastrophe events violate the conditions of predictability and independence. As a result, catastrophes present a major risk of insolvency for insurers and other entities that aggregate catastrophe exposure in the normal course of writing property insurance.

There are few regions within the United States that are free of catastrophes and practically every insurance operation writing property exposures accumulates at least some catastrophe exposures. Selling "catastrophe-free" insurance products is generally not an option. Growing a book of property business requires a company to manage its catastrophe exposures.

Managing an insurer's exposure to catastrophic claims can be analyzed as a multistep process:

- identifying catastrophe risk appetite
- measuring catastrophe exposure
- pricing for catastrophe exposure
- controlling catastrophe exposure
- evaluating ability to pay catastrophe losses

These steps are an iterative process. The insurer will use what it learns in going through these steps to improve its decisions in the next round of the same process.

There is no one procedural template that regulators should expect all insurers to apply to catastrophe risk management. Variations in the business practices of each insurer change the relative costs and benefits of different approaches to the conceptual framework outlined above.

Measurement of catastrophe exposure has improved significantly in recent years. Key developments include the refinement of sophisticated windstorm and earthquake simulation models along with better collection of exposure information by insurers.

The increase in catastrophe losses over the past decade has resulted in significant industry efforts by the industry to better manage its catastrophe exposures. This is evidenced by the continuing improvement of sophisticated tools used to measure and monitor catastrophe exposures, increased interest and monitoring by regulators and rating organizations, and proactive exposure management by companies.

Reinsurance is the traditional method used by insurers to transfer risk, but capital markets are a large potential source of new capacity.

Catastrophe risk management for reinsurers is similar to the five step process for a primary company. For a reinsurer, the challenges are to obtain adequate detailed information on catastrophe exposures from ceding companies, to accurately measure catastrophe exposure aggregations across multiple ceding companies, and to price for a highly leveraged exposure to catastrophes.

Insurer catastrophe risk management practices are relevant to certain questions of public policy. Examples include the amount of insurer capital, whether insurer capital needs to be segregated for catastrophe risk, whether to encourage pre-event catastrophe reserves, the tradeoffs between availability and affordability, the extent of governmental involvement in the market place, and potential over-reliance on guaranty funds.

Policy-makers considering actions designed to affect either catastrophe coverage availability or the solvency of insurers exposed to catastrophe claims can use this framework to anticipate the market effect of proposals they are considering. Policy actions often have more than one consequence.

Appendix A

Insurance Industry Products

The insurance industry provides catastrophe coverage through a variety of products. With a few exceptions, insurers do not sell stand-alone catastrophe related products. Catastrophe coverage is provided as part of the standard peril (e.g., fire or wind damage), is granted through an optional endorsement (e.g., earthquake coverage on buildings), or is available from a government program rather than from the private insurance industry (flood coverage on buildings).

Coverage for catastrophe losses does not exist under all insurance contracts. You need to refer to the provisions of each insurance contract that may apply to property under specified catastrophic event scenarios and consider the financial effects on each party involved.

Homeowners and Dwelling Policies[1]

Homeowners insurance contracts generally provide broad coverage for an owner-occupied single family dwelling, other structures associated with it, and the owner's personal property. While the home is under repairs for covered damage, loss of use is covered. Coverage may also be provided for debris removal, and for measures taken to prevent further damage.

Dwelling policies generally cover homes that are ineligible for homeowners coverage, most commonly because the dwelling is not owner-occupied. Homeowners and dwelling policies provide similar coverage for losses due to catastrophes.

Typically, the dwelling coverage in homeowners and dwelling policies is defined by a broad grant of coverage, modified by a list of exclusions. The intention behind some exclusions is to avoid granting coverage for certain catastrophe exposures because 1) insurers would not be able to withstand worst-case potential losses if covered on all policies, and 2) the coverage, if properly priced, would cost more than many people are willing to pay. There are historical reasons why certain catastrophic events are covered while others are not, but that is beyond the scope of this paper.

Homeowners policies generally exclude most or all damage to the property from flood (including hurricane storm surge), earth movement (due to settling, shrinking, expansion, earthquake, volcano, and landslide), pollution, war, and nuclear accidents. The intent of homeowners policies is to grant coverage for the dwelling if there's no applicable exclusion, so there would be coverage for non-excluded damage from hurricanes, tornadoes, or hailstorms.

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[1] We will focus on forms that include property coverage for a building structure. Renters multi-peril insurance covers personal property but not the structure. Homeowners forms are available for condominium owners and cooperative apartment owners, with coverage for building components that are part of the owner's unit. Dwelling policies are more flexible than homeowners policies regarding the property and perils covered, but the most typical situation described here for homeowners and dwelling policies is a dwelling structure covered for "special perils."

Coverage is granted for catastrophe-induced fires, such as fire-following earthquake, wilderness fires, and fires spreading from building to building. Explosion, falling objects, and aircraft are covered, including coverage for some low-probability catastrophes. Riot, labor unrest, and civil commotion are covered; these at times have resulted in catastrophic property loss. Significant coverage is often provided for damage from winter storms (water, freezing, snow, or ice damage). A close reading will also reveal exceptions to certain exclusions, such as coverage for breakage of building glass due to an earthquake.

Commercial Property

The property coverage section of a package or business owners policy provides catastrophe coverage for commercial property. Catastrophe coverage may take the form of coverage through one of the named perils (fire, wind, etc.) or may be specifically excluded from the basic coverage form and made available as an optional endorsement.

Financial effects of a catastrophe on the owners or business occupants of a commercial facility depend on such variables as location, construction, equipment, inventory, and the ability to use alternative facilities during recovery. Aside from direct damage, loss of use of a special facility may cost the owner or occupying business even more than the structure's replacement cost. Larger, more specialized facilities are thus more likely to be engineered, with one objective being to minimize or avoid business interruption due to potential catastrophes. Large, specialized facilities are also more likely to be insured under a "difference in conditions" policy, which extends coverage to an all risk basis, negotiated to meet the limited financial needs of a sophisticated and well-financed commercial insured.

Most small to medium sized structures with no difficult-to-replace equipment, such as stores, offices, or apartment buildings, can be covered by a building and personal property coverage form or similar property coverage included in a business owners package policy. These policies can be modified by endorsement to add or extend coverage for property and causes of loss not included in the basic form, making general statements about coverage for catastrophes difficult or impossible to make.

Automobile Insurance Policies

Coverage for catastrophes is provided through the comprehensive coverage portion on personal automobile policies. Comprehensive coverage applies to any kind of damage to the vehicle, except for collision and certain listed exclusions. Comprehensive coverage is purchased on approximately three-fourths of insured personal autos.

Commercial automobiles and mobile equipment are highly diverse, and vary greatly in their vulnerability to catastrophes. Small commercial entities often buy insurance coverage for damage to their vehicles and equipment, but large commercial entities are much more willing to retain the exposure.

When purchased under a comprehensive business auto form, coverage for damage to commercial autos is materially the same as the comprehensive coverage for personal autos. Coverage may alternatively be on a more restricted "specified causes" basis, but in both forms there would be coverage for fire, explosion, windstorm, hail, earthquake or flood. Mobile equipment would be covered under an inland marine policy. Distinguishing between commercial autos and mobile equipment is an intricate exercise, and since inland marine catastrophe coverage is similar in breadth to auto comprehensive we need not outline the distinction here.

Catastrophes contribute measurably to the cost of auto comprehensive insurance, but are far outweighed in auto insurance by injuries and vehicle damage from crashes. The exposure to personal autos from natural disasters is not of a magnitude that could jeopardize most insurers' viability.

Earthquake Policies

Prior to about 1985, earthquake coverage on residential property was not widely purchased, but when it was, the general practice was to attach the coverage by endorsement to a homeowners or dwelling policy. After several earthquakes in California, demand for the coverage increased, and in 1985 it became mandatory in California for an insurer to periodically offer earthquake coverage to holders of such policies.

By the end of 1993, about 30 percent of California homeowners policies included earthquake coverage. The Northridge earthquake in January 1994 raised serious questions about whether insurers could pay earthquake claims from any major earthquake. The mandatory requirement to offer earthquake coverage indirectly caused unavailability of homeowners coverage in California. Several major reforms were necessary to revive the homeowners market, including legislation enabling companies to write separate earthquake policies with lower coverage limits and higher deductibles than the associated homeowners policy. Also, the voluntary state-run California Earthquake Authority (CEA) was created to gradually lift financial responsibility for earthquake coverage on California residential property from homeowners insurers. The CEA is discussed in greater detail in Appendix B.

Several companies have entered the California earthquake insurance market selling earthquake insurance without requiring an associated homeowners or dwelling policy on the same property. Thus options have evolved in California to place earthquake insurance with a different carrier than the homeowners or dwelling insurer. Further examples will be given in Appendix B, but briefly, when an insurer excludes specific catastrophic losses from coverage, another source may offer separate catastrophe-only coverage.

Inland Marine

The concept of "all risks" coverage originated with marine insurance, which was historically subdivided for legal purposes into "ocean marine" versus "inland marine." Inland marine insurance covered property that was involved in communication or transportation.

Examples of commercial inland marine exposures at fixed locations include bridges, tunnels, high-tension wires, and radio towers.

Coverage in most cases is tailored to fit the particular exposure, but we might infer that the coverage is broad enough to include a long list of catastrophic perils, but with the likely exclusion of war risks and nuclear hazards. Inland marine insurance may also cover goods in transit, or scheduled items of personal property. Again, the coverage is broader than would be typically available if the property were associated with a fixed location. In particular, there would be inland marine coverage for items lost or damaged by earthquake or flood.

Other Property Insurance

The following coverages are briefly discussed because they potentially present catastrophic exposures to individual companies often arising from an individual risk. They do not represent catastrophe exposures on an industry scale.

Boiler and machinery insurance protects against catastrophic failure of industrial equipment. For example, a steam boiler that bursts may, like an explosion, destroy the entire facility housing it and perhaps nearby exposed facilities as well. The basic goal of boiler and machinery coverage is to virtually eliminate catastrophic damage to property. This is accomplished by a rigorously enforced safety regimen. A boiler and machinery insurer may at times incur a very large loss under a single policy.

Ocean marine insurance covers maritime activity, which can range from pleasure yachts up to oil tankers and offshore drilling operations. U.S. insurers do not typically insure a great amount of this business, but will at times bear some share of financial burden in a maritime catastrophe. It is worth noting that a storm making landfall may cause ocean marine losses at sea or in port, compounding insured loss from the storm under homeowners and commercial property policies.

Aircraft insurance, from the standpoint of catastrophes, is much like ocean marine insurance.

Workers Compensation

Workers compensation insurance responds with a schedule of benefits fixed by law, to injuries and some diseases arising out of work activities. Rather infrequently, work activity results in injury or disease for multiple employees, but when that happens there is no policy limit on the insurer's obligation.

When multiple employees are injured while at work, property damage may only be incidental, but the event may be a catastrophe from the viewpoint of the employer, the community and the workers' compensation insurer. For example, an earthquake during working hours could cause numerous injuries that are covered by workers compensation insurance, and could accumulate to substantial losses.

Architect's or Engineer's Errors and Omissions Insurance

When a building collapses during an earthquake, or for some other reason, one possibility is that the architect or engineer failed to perform the work as agreed, or performed the work without appropriate recognition of the risks. The financial consequences could encompass loss of the building and contents, as well as bodily injury to the occupants. If policy limits are sufficient, the insurer could view its exposure to a single E&O claim as a potential catastrophe. However, if this claim were to coincide in time with other catastrophe claims, for example if the building were lost during an earthquake or a hurricane, the E&O claim would exacerbate the catastrophe for this particular insurer.

General Liability Insurance

These contracts usually include promises to defend the insured and pay any covered legal damages. As with the architect's or engineer's errors and omissions insurance, natural or man-made disasters may prompt persons who are injured or whose property is damaged to seek recovery from any party perceived to have negligently contributed to the loss. Indeed, after making loss payments to their policyholders for damaged property or medical costs, insurers themselves will often seek recovery from a negligent party. If that party is insured, their insurer is called upon to defend and/or pay.

In addition to events doing great harm at a particular place and time, general liability insurers experience a subtler sort of catastrophe. For example, industrial practices may be discovered to have very harmful effects after years of product distribution and/or waste disposal. Insurance coverage may be found through legal testing of the facts and the policy language, interpreting insurers' intentions, and expectations years or decades earlier. These mass tort exposures can be viewed as analogous to a catastrophe in some respects. In this paper, we acknowledge the existence of such catastrophes, but the focus is restricted to events that damage property at a particular time and place.

Appendix B

State and Federal Programs

Not every catastrophic exposure can be transferred to an insurance carrier through the purchase of an insurance contract. In many cases the state and federal governments have stepped in to provide alternative solutions. This appendix deals with a brief description of various state and federal solutions available in catastrophe prone areas.

State Programs

Arkansas Earthquake Authority

The purpose of the Arkansas Earthquake Authority (Authority), created in 1999, is to operate a Market Assistance Program (MAP) to assist applicants in obtaining residential earthquake coverage and to provide a mechanism to issue policies if a market for earthquake insurance does not exist. The Authority would not begin issuing policies without a legislative vote and as long as at least one carrier is willing to write monoline residential coverage.

If triggered, the Authority can issue residential earthquake insurance up to $100,000, and an insurer would not be able to transfer a substantial number of policies to the Authority without a hearing in which the Commissioner agrees.

Initial operating capital to set up the Authority (if triggered) would require contributions from all authorized insurers of $500 or $1,000 plus 2.5 percent of their net direct written premium. Post event assessments would be capped at 5 percent of the insurer's net direct property premiums (excluding commercial and crop hail) which could be recouped as surcharges, exempt from premium taxes. Post event assessment totals would not exceed $250 million.

The Authority is run by an appointed board of directors which has the authority to hire an administrator, enter into contracts, issue bonds, and purchase reinsurance. Rates must be set in an actuarially sound manner, take into account geographical variation, retrofitting, and other mitigation efforts. Authority rates cannot be competitive with the voluntary market.

California Earthquake Authority

To ensure the availability of residential earthquake insurance, the California legislature established the California Earthquake Authority (CEA) as a privately financed, publicly managed entity in 1996. Today the CEA is the world's largest residential earthquake insurer, issuing over 914,000 policies in 2000 and representing over 70 percent of the California residential earthquake market.

By law, insurers writing homeowners policies in California must either offer earthquake coverage or participate financially in this program. When the CEA first began, over $0.7 billion in capital was raised through the contributions of insurers who wished to participate in the program. Today, the CEA has approximately $0.8 billion in cash and invested assets available for paying claims and additional claims paying capacity up to $6.9 billion. This additional capacity is provided through a combination of member company assessments, reinsurance, and the ability to issue debt.

By statute, member companies may not be assessed more than their market share of $5.0 billion during the lifetime of the CEA. Since the current market share of the CEA is about 70 percent, the amount currently available through assessments is $3.5 billion. Similarly, the maximum debt that may be issued at any given time is the CEA's current market share multiplied by $1.0 billion or $0.7 billion. The capacity provided by reinsurance is not dictated by statute and is currently almost $2.7 billion.

The CEA offers earthquake policies to homeowners, mobile home owners, condominium owners, and renters. The basic homeowners policy provides dwelling coverage at its stated value, as well as $5,000 for contents and $1,500 for loss of use. A base deductible of 15 percent is applied to dwelling losses and no claims for contents are paid until that dwelling deductible has been pierced. The deductible does not apply to loss of use. Supplemental coverage may also be purchased to provide higher contents and loss of use limits, or to obtain a lower deductible (10 percent). To encourage retrofitting, a 5 percent premium discount is also offered for qualifying properties.

The Florida Windstorm Underwriting Association

In 1970, the Florida Legislature created the Florida Windstorm Underwriting Association (FWUA) as a residual market to cover wind risk in the Florida Keys. The FWUA has since expanded to provide windstorm-only coverage in selected eligible geographic areas (now including 29 of 35 coastal counties in Florida) for risks unable to obtain windstorm coverage in the voluntary market. Among the criteria for eligibility is the area's adoption of the Standard Building Code published by the Southern Building Code Congress International (SBCCI). The FWUA now provides premium discounts of up to 50 percent to customers who make and verify certain disaster-prevention improvements to their homes to meet specific FWUA guidelines.

Following Hurricane Andrew until the end of 1998, the number of FWUA policies in force grew significantly. Beginning in 1999, the number of policies decreased. As of April, 2001, the FWUA had 426,813 policies, representing $93.4 billion in exposure. That compares to 465,008 policies with $90.3 billion in exposure on December 31, 1999, and is about 12 times the estimated $7.5 billion in loss exposure before Andrew. In April 2001, about 65 percent of FWUA policies and dollars of exposure were concentrated in Dade, Broward, Monroe, and Palm Beach counties.

The FWUA's funds come from premiums from policyholders, regular assessments of insurers, and emergency assessments on policyholders collected by insurers. The FWUA has about $5 billion in claims-paying capacity. In the event of a catastrophe, the FWUA has issued

$1.75 billion in pre-event notes, has made arrangements to access the Florida Hurricane Catastrophe Fund (FHCF), and has a $1.0 billion line of credit. If premiums and reinsurance recoveries (including the FHCF) are insufficient to pay claims, the FWUA can assess private property insurers up to 10 percent of the statewide property premium volume or 10 percent of the deficit, whichever is greater, based upon their respective Florida market shares adjusted for voluntary writings. Insurers may recoup these assessments through policyholder surcharges. Deficits in excess of the caps are funded through bonds whose debt service is supported by direct surcharges on all policyholders in the state collected by insurers.

The Florida Hurricane Catastrophe Fund

Following Hurricane Andrew in 1992, some insurers went insolvent, some became financially impaired, and others reduced their exposure to hurricane losses as catastrophe reinsurance capacity contracted. In order to ensure a viable private sector market for property insurance, the Florida Legislature passed a bill in November 1993 that provided for a state trust fund, the Florida Hurricane Catastrophe Fund (FHCF), under the control of the State Board of Administration. After passage of the enabling legislation, Florida succeeded in obtaining a federal tax exemption status. This exemption enables the FHCF to retain millions of dollars that insurers would otherwise pay in federal income taxes.

Florida's law requires each property insurer doing business in the state to pay premiums to the FHCF based on the insurer's hurricane exposures and the coverage level it selects (45 percent, 75 percent, or 90 percent). In return, the FHCF will pay each insurer for 45 percent, 75 percent, or 90 percent of its losses from each covered event in excess of the insurer's retention. As the coverage level decreases, the retention level remains constant.

In 2000, the FHCF had 276 participating insurers, down from its peak of 378 in 1994. (The law was changed in 1995 to eliminate commercial nonresidential insurer participation.) The FHCF had a projected $3.7 billion cash balance for year-end 2000 with borrowing capacity for another $7.3 billion in the form of revenue bonds. This gives the FHCF a total estimated capacity of $11 billion to pay hurricane claims which exceed a company's loss retentions on a per storm basis. The revenue bonds are financed by levying an emergency assessment of no more than 4 percent of all Florida property and casualty premiums, except workers compensation. Insurers can recoup the assessments through special rate filing procedures.

To stabilize the state's reinsurance capacity, Florida lawmakers passed a bill in 1999 which limited the capacity of the FHCF to $11 billion for an initial season until there is enough bonding capacity and cash balance to fully recharge the FHCF for the next hurricane season. The $11 billion limitation was specifically designed to prevent the removal of larger amounts of private reinsurance from the property market which would have resulted in the FHCF continued to grow in capacity year after year. As an additional measure to stabilize the state's reinsurance capacity, the bill provided for an additional 2 percent emergency assessment which could be used to finance bonds or other debt, thus adding back capacity in the event that the previous season FHCF reimbursements have reduced the FHCF capacity below $11 billion for the current contract year. This is commonly referred to as "subsequent season" coverage with the FHCF having an estimated "subsequent season" reimbursement capacity of $5.5 billion in 2000. The

assessment base would be the prior-year direct written premiums for all property and casualty business in Florida, except for workers' compensation.

Florida law authorizes the FHCF to appropriate at least $10 million each fiscal year to improve hurricane preparedness, reduce potential hurricane losses, provide for mitigation research, assist the public in financing appropriate mitigation upgrades, or protect local infrastructure from potential hurricane damage. On June 9, 1999, Governor Bush signed into law provisions creating the Hurricane Loss Mitigation Clearing Trust Fund. The law authorizes the legislature to transfer at least $10 million annually from the FHCF to this loss mitigation trust fund.

Florida Residential Property & Casualty Joint Underwriting Assoc.

After Hurricane Andrew, the Florida Legislature created the Florida Residential Property & Casualty Joint Underwriting Association (FRPCJUA or the JUA) as an insurer of last resort. Statewide, the JUA writes homeowners insurance, as well as fire and extended coverage insurance on both personal and commercial structures serving as residences. Coverage excludes windstorm and hail in areas where property owners can get coverage through the FWUA.

In each county, the JUA sets its average rates for personal lines policies no lower than the average rates charged by the insurer among Florida's 20 largest insurers (by market share for that line) that had the highest average rates in that county for the preceding year. For mobile home coverage, the JUA sets its average rates in each county no lower than the average rates charged by the insurer among Florida's five largest insurers of mobile homes that had the highest average rate in that county in the preceding year.

At its peak, the JUA became the state's second largest homeowners insurer. The JUA peaked at 936,837 policies in September 1996 and $98.2 billion of coverage A and C exposure in October 1996. Since then, the JUA's board of directors, the insurance commissioner, and key state legislators have sought to transfer JUA policies back to the voluntary market. The JUA implemented incentives for private insurers to assume or "take out" JUA business and receive certain exemptions from JUA assessments. As of April 2001, the JUA's personal lines policy count had dropped to 70,606 statewide and its coverage A and C exposure had fallen to about $11.2 billion.

The JUA's funds come from premiums from policyholders, regular assessments of insurers, and emergency assessments on policyholders collected by insurers. The JUA has approximately $1.88 billion in claims-paying capacity, including a $570 million line of credit and an anticipated $270 million reinsurance recovery from the FHCF. Like the FWUA, the FRPCJUA can assess private property insurers up to 10 percent of the statewide property premium volume or 10 percent of a deficit, whichever is greater, based upon their respective Florida market shares adjusted for voluntary writings. Insurers may recoup these assessments through policyholder surcharges. Deficits in excess of the caps are funded through bonds whose debt service is supported by direct surcharges on all policyholders in the state collected by insurers.

The Hawaii Hurricane Relief Fund

This Hawaii Hurricane Relief Fund (HHRF) was created in 1993 after most insurers excluded losses from hurricanes following Hurricane Iniki. The HHRF was intended to be a stopgap measure. Subsequently, many insurers have reentered the market and the HHRF stopped writing new policies as of December 1, 2000. At the time there were about 80,000 policies written by the fund.

Other State Market Assistance Programs (MAP)

In Texas, the insurance department has set up a MAP for 427 zip codes where insurance may not be readily available, including hail-prone regions. Insurers may offer higher deductibles for claims associated with wind, hurricane, and wind-driven rain up to 5 percent of a home's insured value with premium discounts of up to 16 percent. Data for 1996 show that Texas had the highest average homeowners premium ($855) in the nation.

The insurance department of New York State has set up a Coastal Market Assistance Plan (C-MAP) for coastal homeowners having trouble finding insurance. This MAP is a clearinghouse and referral mechanism that helps insurance agents to match up homeowners with companies willing to issue policies for coverage that might be difficult to obtain.

FAIR Plans, Beach Plans, and Windstorm Pools

Serious riots and civil disorders in many states from 1965 to 1968 led to diminished insurance availability in some urban areas. Many states addressed availability problems in urban areas by creating FAIR (Fair Access to Insurance Requirements) plans.[1]

Each state with a FAIR plan has formed a pool or syndicate to make property insurance available to property owners who cannot obtain coverage in the regular market. FAIR plan insurance is not intended to replace coverage normally available, but is intended to provide fair access to insurance based on the physical characteristics of properties. FAIR plan insurance seeks to overcome rejection of coverage based solely on a property's location. To guarantee that insurance is available to those who qualify, 28 states, Puerto Rico, and the District of Columbia have established such plans. Twelve hurricane-prone jurisdictions have FAIR plans. They are: Delaware, the District of Columbia, Georgia, Hawaii, Louisiana, Maryland, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, and Virginia.

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[1] In general, FAIR plans can deny or cancel coverage only if one or more of the following conditions apply: one or more private insurers have not already denied coverage to the insured; the property is in poor physical condition, including unrepaired fire damage; the insured practices poor housekeeping, including overcrowding and the storage of rubbish or flammable material; the property is in violation of law or public policy; the property does not conform to appropriate building or safety codes; or the insured has failed to pay premiums.

Similarly, some states have addressed the insurance availability problems in coastal areas by creating beach plans or windstorm pools.[2] Alabama and Louisiana have beach plans that provide fire and extended coverage insurance. Louisiana's plan also provides homeowners multiple peril insurance and windstorm and hail only policies for monoline dwelling or commercial properties. Mississippi, North Carolina, South Carolina, and Texas have plans providing only wind and hail coverage. Insurance from FAIR plans, beach plans, and windstorm pools is often more costly and less comprehensive than the coverage that private insurers offer.

Federal Programs

For a number of catastrophe exposures state solutions cannot adequately address the broad exposure across geographic boundaries or where the potential magnitude of losses would exhaust state program resources. In several cases, the federal government provides mechanisms to address the exposure or has proposed legislative solutions to support industry.

Crop Insurance

The agricultural industry and individual farmers have a unique and substantial exposure to the weather. Insurance protection for droughts, for example, is critical for many individual farmers to protect their incomes and property. Due to the potential widespread and severe nature of weather related events, insurance coverage through the private insurance industry for weather related damage to crops is limited. While there is a private insurance market available, the coverage provided through the federal program offers broader coverage.

In order to make crop insurance widely available, the federal government provides Multi-Peril Crop Insurance (MPCI). MPCI is a voluntary program that provides protection to the agricultural industry for either or both the percentage of normal crop yield and the market price. MPCI works in conjunction with private insurers and agents, who sell and service crop coverages and frequently enhance the basic MPIC coverages on a private basis. The federal government reinsures the basic MPIC coverages, thereby providing virtually unlimited capacity and financial security in the event of a widespread weather-related catastrophic event. This approach also provides the federal government with flexibility in balancing any subsidies for the premiums for the voluntary basic coverage with the potential need for other governmental financial assistance in the event of a weather-related catastrophic event.

Federal Flood Insurance Program

The National Flood Insurance Program (NFIP) was created by Congress in 1968 to respond to the rising cost of damages caused by floods and to assist with relief for flood victims. The program is managed by the Federal Emergency Management Agency (FEMA). The federal

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[2] These are: the Alabama Insurance Underwriting Association, the Louisiana Insurance Underwriting Plan, the Mississippi Windstorm Underwriting Association, the North Carolina Windstorm Underwriting Association, the South Carolina Wind and Hail Underwriting Association, and the Texas Windstorm Insurance Association.

agency has identified flood prone areas and produced flood hazard boundary maps, flood insurance rate maps and flood boundary, and floodway maps.

The NFIP works with participating property and casualty insurers to write coverage in certain areas that may be prone to floods. The program also helps state and local governments develop floodplain management standards and building codes for structures.

Nuclear Facilities

The commercial nuclear power industry in the United States has the unique potential of a nuclear incident creating catastrophic loss. The industry also has a long-term investment in power generating infrastructure, which by its nature cannot be wound down quickly. The nuclear industry therefore has a critical need for adequate, dependable, third-party liability insurance.

Virtually all property insurance policies, whether provided to individuals or businesses, include policy language to exclude coverage for loss by nuclear reaction, radiation, or radioactive contamination, regardless of the cause. Hence, to ensure protection for these individuals and businesses, the federal government also has an incentive to ensure the availability of adequate and dependable third-party liability coverage for the nuclear power industry.

This awareness led to the Price-Anderson Act, which requires commercial nuclear power plant operators to provide financial protection to the public in an amount equal to the maximum liability insurance capacity available from private sources. Currently this limit is $200 million.

To meet the Price-Anderson requirement and ensure that insurance capacity would remain available to operators of nuclear power reactors, a joint underwriting association, American Nuclear Insurers (ANI) was formed. It is an unincorporated association of approximately 60 member insurance companies that pool their financial assets to provide property and liability coverage to the nuclear industry, both in the United States and worldwide. Other counties with significant commercial nuclear power generation have similar organizations, or pools, and frequently these organizations provide reinsurance to each other to increase capacity. Specialized loss prevention engineering services are also an important function of the ANI.

The approach taken by the federal government has the advantage of minimizing any federal subsidies and ensures that the costs of providing protection to the public are borne by the commercial nuclear power industry.

Appendix C

Catastrophe Modeling

Catastrophe simulation models employ sophisticated stochastic simulation procedures and powerful computer models of how natural catastrophes behave and act upon insured exposures. They can overcome the issues of having to adjust historic losses by creating tens of thousands of potential combinations of variables that describe catastrophe events and estimate the impact of these simulated events on insured exposures. Figure 1.1 below illustrates the component parts of catastrophe models.

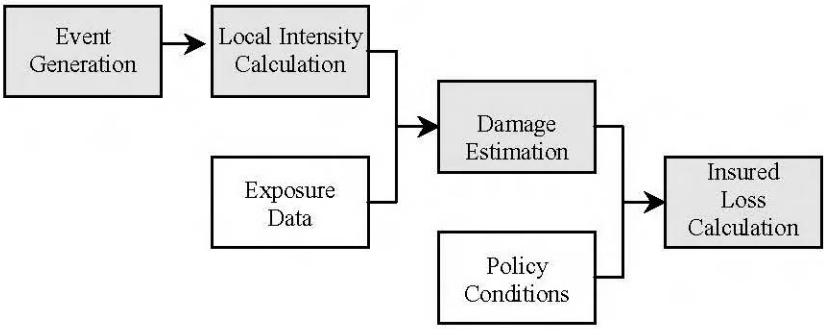


Figure 1.1: Catastrophe Model Components (in gray)

Event Generation Module

The event generation module answers the questions of where, how big, and how often catastrophe events occur. Catastrophe events are extremely complex and their characterization requires the use of large numbers of variables. The event generation module determines the frequency, magnitude, and other characteristics of potential catastrophe events by geographic location. This requires, among other things, a thorough analysis of the characteristics of historical events. The available scientific data pertaining to these variables come from many different sources.

After rigorous data analysis, researchers develop probability distributions for each of the variables, testing them for goodness-of-fit and robustness. The selection and subsequent refinement of these distributions are based not only on the expert application of statistical techniques, but also on well-established scientific principles and an understanding of how catastrophic events behave.

The probability distributions are used to produce a large catalog of simulated events. By sampling from these distributions, the model generates simulated "years" of event activity. Note that a simulated year represents a hypothetical year of catastrophe experience that could happen

in the current year. The models allow for the possibility of multiple events occurring within a single year. That is, each simulated year may have no, one, or multiple events, just as might be observed in an actual year. Tens of thousands of these scenario years can be generated to produce the complete and stable range of potential annual experience of catastrophe event activity, and to ensure full coverage of extreme events, as well as full spatial coverage.

Local Intensity Module

Once the model probabilistically generates the characteristics of a simulated event, it propagates the event across the affected area. For each location within the affected area, local intensity is estimated. This requires, among other things, a thorough knowledge of the geological and/or topographical features of a region and an understanding of how these features are likely to influence the behavior of a catastrophe event. The intensity experienced at each site is a function of the magnitude of the event, distance from the source of the event, and a variety of local conditions. Researchers base their calculations of local intensity on empirical observation as well as on theoretical relationships between the variables.

Damage Module

Scientists and engineers have developed mathematical functions called damageability relationships, which describe the interaction between buildings, both their structural and nonstructural components as well as their contents, and the local intensity to which they are exposed. Damageability functions have also been developed for estimating time element losses. These functions relate the mean damage level as well as the variability of damage to the measure of intensity at each location. Because different structural types will experience different degrees of damage, the damageability relationships vary according to construction materials and occupancy. Total damage is calculated by applying the appropriate damage function to the replacement value of the insured property.

Insured Loss Module

In this last component of the catastrophe model, insured losses are calculated by applying the policy conditions to the total damage estimates. Policy conditions may include deductibles by coverage, site-specific or blanket deductibles, coverage limits and sublimits, loss triggers, coinsurance, attachment points and limits for single or multiple location policies, and risk specific reinsurance terms.

Model Output

After all of the insured loss estimations have been completed, they can be analyzed in ways of interest to risk management professionals. For example, the model produces complete probability distributions of losses, also known as exceedence probability curves (see Figure 1.2).

Output includes probability distributions of overall loss and gross insured and net insured (net of reinsurance recoveries) losses for both annual aggregate and annual occurrence losses. The probabilities can also be expressed as return periods as shown in the upper right corner of Figure 1.2. For example, the loss associated with a return period of 10 years is likely to be exceeded only 10 percent of the time or, on average, in one year out of 10.

Output may be customized to any desired degree of geographical resolution down to location level, as well as by line of business, and within line of business, by construction class, coverage, etc. The model may also provide summary reports of exposures, comparisons of exposures and losses by geographical area, and detailed information on potential large losses caused by extreme events.

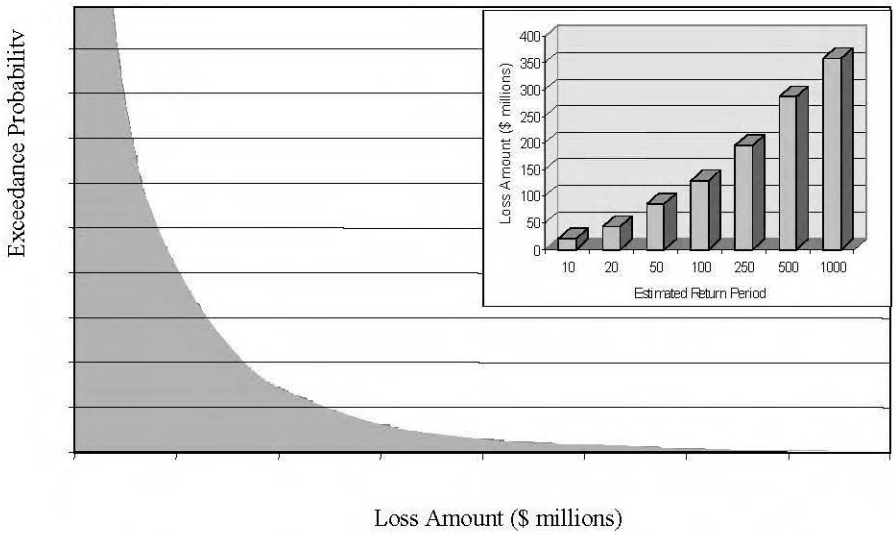


Figure 1.2: Exceedence Probability Curve (Occurrence)

Validation of Catastrophe Models

Scientists and engineers validate the models at every stage of development by comparing model results with actual data from historical events. The simulated event characteristics parallel patterns observed in the historical record and resulting loss estimates correspond closely to actual claims data provided by insurers.

The construction of these models relies on the expertise of many scientific disciplines such as seismology, meteorology, civil engineering, statistics and actuarial analysis. Thus the expertise required to construct these models is broader than the traditional actuarial domain. Actuaries are guided in their use of catastrophe models by Actuarial Standard Of Practice 38 - *Using Models Outside the Actuary's Area of Expertise* which details the review required by actuaries before using such models in their work product.

Currently, U.S. catastrophe models are only commercially available for hurricane, earthquake, and certain kinds of windstorm.

Appendix D

Underwriting Individual Risks

When an insurer decides whether to issue a property insurance policy, catastrophe exposure is rarely the primary focus. Rather, underwriters review the property exposure and the coverage desired, applying underwriting procedures and practices that have evolved largely in the context of noncatastrophe loss experience.

In some ways, solid individual policy underwriting helps to underwrite for catastrophic losses as well. For example, insurers like to cover well-maintained property for a number of reasons. Well-maintained property tends to perform better than most under extreme weather or seismic disturbance. In some other ways, catastrophe exposure requires a special approach. An example of this could be masonry construction, which is generally good in a fire, windstorm and hail, but performs poorly in an earthquake.

Thus, underwriters need to consider any catastrophe hazards where insured property is located. The insurer may have decided whether to restrict attention to catastrophe hazards within the scope of intended coverage, or to consider potential insurance implications of excluded hazards. In either case, the underwriter will apply underwriting practices to the individual contract, based on polices and procedures of the insurer. If the property is vulnerable and can't (or won't) be protected, such hazards deserve increased emphasis. For example, the location of real property is information required by the underwriter.

Underwriters can infer catastrophe exposure based on location and other information collected by the insurer. Inferring damageability, however, depends on detailed knowledge of the property's construction and occupancy. Underwriters would like assurance that design and construction are appropriate considering local conditions, but obtaining ideal information has high costs. For example, think of a business interruption policy that will pay if a key manufacturing component fails. The insurer may ask many questions about the equipment and the financial consequences of its failure, but may not ask about the construction of the facility housing it. In a hurricane or earthquake, building failure may cause a covered equipment failure, but the underwriter has no hard information about the building's vulnerability. The underwriter will still underwrite, but the point is that a balance must be achieved between cost and detail.

For large or unique properties, structural engineering analysis may be cost-justified, and may be best done prior to construction. Engineered facilities are built to withstand quantified levels of stress. The plans may identify the components most likely to fail, and the financial effects of facility failures may be simulated under any foreseen catastrophic scenarios. In any case, very detailed plans make it possible to organize a thorough but efficient engineering review. An engineered retrofit may even be cost-justified.

For more standard, perhaps medium-sized commercial properties, it may still be cost-beneficial to inspect the property, suggesting or requiring specific loss control measures. For homes, it may be cost-justified to inspect no more than the exterior, and loss control efforts may be limited to a customer newsletter or perhaps premium credits for common protective features.

In principle, the underwriter wants to insure individual exposures that are not overly exposed or vulnerable within their pricing groups. To the extent that the market subdivides pricing groups and prices them accurately, underwriting selection practices would optimally respond by making coverage available to all. In any case, an underwriter who manages to select individual risks in ways that promote profitable growth is valued. In the long run, the incentive exists to make price or selection adjustments to compensate for elevated exposure to all kinds of loss. Insurers rely on actual experience to monitor how well they are doing. In the short or medium term, including actual catastrophe insurance experience in the analysis can be misleading.

The following illustrates the process a company must go through to establish guidelines and underwrite individual risks.

1) Establish company's "appetite" for the largest loss at one location
2) Establish a definition of "location"
3) Identify and set limits on risks more likely to have a loss
    a) For these "higher loss potential" risks, consider
        i) limiting the "value-at-one-location"
        ii) authority of underwriters
        iii) establishing higher minimum deductibles
        iv) price the risk consistent with the higher exposure
        v) require controls on the exposures and hazards inherent in these risks
4) Underwrite the individual location to establish a likelihood of loss, and the maximum loss likely at the location, for each covered cause of loss
    a) Determine how the risk fits into the exposure limits that have been set for the corporation. The following information should all be considered in the risk acceptance and pricing decision:
        i) Consider geographic location and meteorological conditions, proximity to fault lines, subduction zones, tectonic plate weak zones, and other geographic features such as slope, soil type and consistency, distance from water, elevation from water, adequacy of drainage (natural and man-made)

ii) Determine the values requested to be insured and make a judgment as to whether those values are realistic

iii) Determine the **COPE** of the risk

(1) **C**onstruction: How well does it burn? How "brittle" is it? How well is it connected together and to the ground? How old is it and how well maintained? Is there any deterioration?

(2) **O**ccupancy: How combustible are the contents of the building? How susceptible are they to loss by fire? Smoke? Water? Breakage? How well are the common and special hazards controlled? What is the economic activity at the location? How is it conducted? Hours of occupancy? How does the activity depend on the various components of that activity (are there bottlenecks)? How does the activity depend on other locations?

(3) **P**rotection: Are there sprinklers, other automatic fire suppression systems? Fire extinguishers? Do employees know how to use fire suppression equipment? Is it maintained? Adequate? What is the location's proximity to a fire hydrant? What is the quality of the flow and supply of water? What is the location's proximity to a fire department, and how well does the fire department respond to fires? How is the fire department notified of a need for their presence?

(4) **E**xposure: Does the economic activity and the methods for conducting that activity create a higher chance that there will be a loss? Do the surroundings create higher chances for a loss at the insured location? Do ecological, geographic, or meteorological conditions around the location create higher chances for loss?

b) Catastrophe characteristics of the risk will differ by type of catastrophe exposure

c) Adequacy of price level

i) Adequacy of overall rate structure and by geographical location

ii) Adequacy of catastrophe load

iii) Market conditions

iv) Individual risk premium modification plans

(1) Commercial policies only

(2) Credits for favorable hazard characteristics

(3) Debits for unfavorable hazard characteristics

v) Multiple location premium and dispersion credit plans

(1) Commercial policies only

d) Usage of deductibles/limits

e) Physical inspection of risk

i) Meet underwriting guidelines

5) Consideration of reinsurance on the individual risk

Appendix E

Why Insurers Purchase Reinsurance

Each insurance company utilizes a unique set of criteria in designing and implementing its reinsurance program. Such a program will be created to meet the individual goals and objectives of the company, and will be adjusted as these goals and objectives change over time. In addition to catastrophe protection, motivations for buying reinsurance include risk sharing, reciprocity, obtaining capacity to write large risks, stabilizing experience, financing growth, accessing underwriting expertise and removing blocks of unwanted business. This appendix will provide further discussion of some common considerations including stability, capital strength, cost of capital, balance sheet protection, liquidity, perceived exposure, regulatory and rating agency considerations.

Stability

Stable earnings and the ability to write business are essential ingredients in all insurance company business plans. Reinsurance is used to enhance earnings stability by balancing the benefits of recoveries when losses occur against the cost of reinsurance during periods when there is little in the way of recoverable losses. Reinsurance is used to give insurers the capacity to grow, to write large property risks, to provide high liability limits, and write property business in catastrophe-prone areas. All forms of reinsurance provide some elements of stability and capacity to the reinsurance buyer.

Tracking, reporting, explaining, and accepting results all are easier if the income statement behaves in a predictable manner. Companies are inclined to reduce income statement uncertainties by transferring risk, if the cost is reasonable. However, there are problems with predictable losses that take years to settle, or losses that may be predictable in the long run, but are unpredictable on a year-to-year basis. An estimation error in either situation can result in volatile earnings patterns.

Company Capital Strength

Capital allows an organization to absorb risk. Large companies generally have greater capacity to absorb risk than small companies. However, this is an oversimplification because it is possible for a company that is very large in terms of assets or premium to have a relatively small or dwindling capital base.

Large companies with geographically dispersed and homogeneous books of business have the capacity to take on risk by writing more business without transferring part of it to another organization. Small companies need to pass on part of the risk associated with growth or

forego that growth. Thinly capitalized companies with substantial premiums in force and/or loss reserves may need to transfer risk in order to sustain their current scale of operations or to continue growing.

Cost of Capital

Motivations driven by the cost of capital are more complex. If capital is becoming cheaper and more plentiful, organizations generally will have more capacity to absorb risk and there will be less need to transfer risk from one organization to another. In such a market, organizations that are experiencing capital constraints will find it very attractive to transfer risk to organizations that are hungry to take it on. Conversely, a market with higher costs of increasingly scarce capital will find many organizations looking to shed risks they no longer can handle. Organizations with strong capital bases coming into such a market will be able to charge a premium for taking on unwanted risk. In additions, insurers often use reinsurance to supplement their capital base.

When reinsurance is perceived as being inexpensive, insurance companies will expand their reinsurance programs accordingly by increasing limits, reducing retentions, and otherwise acquiring more liberal coverage terms and conditions. In addition, insurance companies will be inclined to issue policies covering more risky exposures because they can pass them on to reinsurers.

Expensive reinsurance, by contrast, results in the opposite effect, with risk bearing generally being pushed back from the reinsurer to the insurer to the insured or uninsured as the case may be.

Balance Sheet Protection

Catastrophes, which may be predictable only over periods of time measured in hundreds of years, present significant challenges. One possible way for an organization to self-fund for such losses is to pre-fund incrementally over an extended period of time. In practice, many primary insurers and reinsurers have done this by accumulating retained earnings. This strategy has not been effective for many reasons, including the fact that catastrophes tend to occur before an insurer has surplus large enough to be fully pre-funded. Stock insurers may pursue pre-funding through the equity markets. A third, and more common possibility, is to buy reinsurance, in effect relying on the reinsurance market to solve the problem. In any case, insurers want to defend their balance sheets against substantial cash demands that must be met in a short period of time after catastrophes occur.

Liquidity/Asset Management

The risk of a sudden large cash demand causing forced sale of assets is real. Undesirable affects can include unplanned taxes on realized investment gains, realized investment losses on

untimely sales, and deviation from the asset management plan. Every insurance company has a strong incentive to eliminate these possibilities. The current tax system offers a partial cushion against this risk. The tax benefit of an underwriting loss may be partly balanced by the tax on investment gains. In the case of realized losses on untimely asset sales, tax benefits soften the damage from dual investment and underwriting losses. One can see that asset management, investment decisions and tax planning are complex and are directly affected by changes to accounting rules or tax law. Purchasing reinsurance simplifies these issues and helps an insurer avoid or control asset management and tax problems.

Perceived Exposure

Actual exposure to loss and insurance companies' understanding thereof do not evolve in perfect harmony. This was made painfully obvious by hurricane Andrew and the Northridge Earthquake. The sudden awareness of a gross underestimation of risk leads to shedding of risk, to the extent and at a rate allowed by regulation, and an explosion in demand to fund or transfer the risk that remained.

Insurance rates increased and property owners scrambled to find coverage giving rise to overpopulation of involuntary market plans and creation of the Florida Hurricane Cat Fund and the California Earthquake Authority.

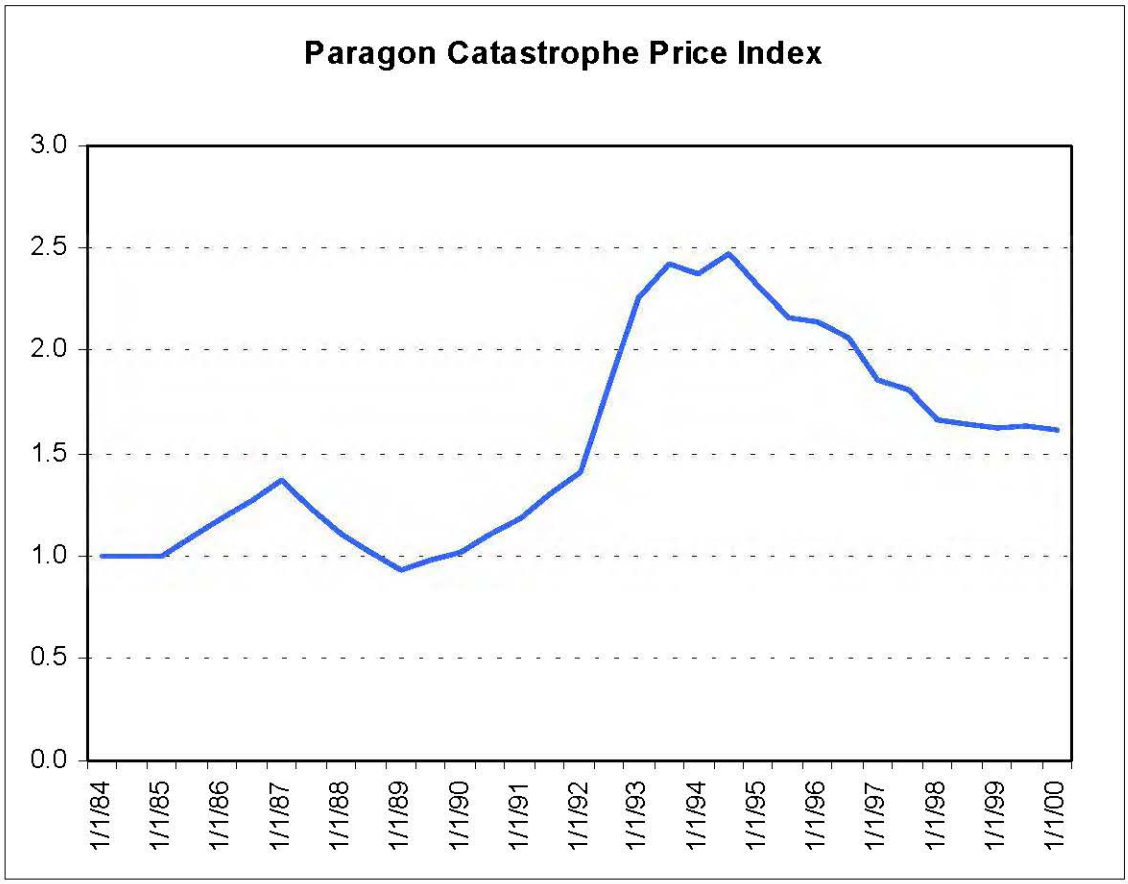
Misconceptions about exposure are possible for any type of catastrophe, but location and concentration of exposures are key variables. The state of science and engineering are also key variables. Weather is better understood than seismicity. Also, there are more frequent opportunities for engineers to survey weather-related damage than damage to insured property from earthquake. Events that reveal significant misconceptions of risk result in abrupt changes in the motivations to bear and transfer it.

The influence of Hurricane Andrew (1992) and the Northridge Earthquake (1994) on catastrophe risk perceptions is apparent in the increased ratio of ceded premium to direct and assumed premium for property lines immediately following these events.

Reinsurance Ceded Rate									
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
17.3%	17.2%	17.6%	18.6%	20.7%	21.5%	19.9%	19.1%	18.0%	19.6%

Source: Industry Schedule P for Property Lines of Business

The market impact of Hurricane Andrew is much more dramatically illustrated by the Paragon Catastrophe Price index[1]. As a result of Andrew, the price of catastrophe reinsurance nearly doubled, driving the index from 1.4 to 2.4.



[1] The Paragon Catastrophe Price Index is a relative measure of composite domestic U.S. property catastrophe prices. It compares the average market price at each renewal date with the average market price of one year prior. A standardized industry distribution reflecting variation in region, company size, limits, and retentions is used to compare the price of reinsurance over time. The index reflects overall market prices separate from shifts in actual reinsurance purchased. Weights used to compute the index are adjusted periodically and will reflect changes in the distribution of market purchases over an extended period of time. Paragon Reinsurance Risk Management Services, Inc. is a wholly owned subsidiary of E.W. Blanch Holdings, Inc.

Regulatory Considerations

Regulators have a responsibility for solvency oversight and may encourage companies to buy reinsurance in the interest of policyholder protection. Regulators may consider an insurer's catastrophe exposure during their financial solvency examination process.

Rating Agency Considerations

The rating of an insurance company is vital to its growth as it directly influences the creditworthiness that stockholders and policyholders place on the company. Therefore, most insurers take all necessary actions to retain and upgrade their ratings. The increasing level of concern about catastrophe exposures has also led rating agencies to pay greater attention to how insurers manage their catastrophe risk. Rating agencies use their own analytical models to assess an insurer's ability to manage its catastrophe exposure. Property insurers who are not taking appropriate steps to manage their catastrophe exposures, including appropriate use of reinsurance, may be subject to rating downgrades.

EXHIBIT 4

Risk Transfer Testing of Reinsurance Contracts: Analysis and Recommendations

CAS Research Working Party on Risk Transfer Testing

Abstract

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

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

1. INTRODUCTION

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

1.1 Context

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

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

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

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

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

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

In this paper we seek to respond to all four of the questions posed by COPLFR. The members of the working party believe the time has come to be explicit about the shortcomings of the "10-10" test that has come into common use and to advocate its replacement with a better framework. Accordingly, in this paper we include an extensive critique of the "10-10" test and describe two frameworks, one in detail and the other in

summary, that would be significant improvements over "10-10". We also identify methods for determining whether individual reinsurance contracts should be subject to detailed testing.

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

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

1.2 Disclaimers

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

In the course of the paper, in order to make our ideas as clear as possible, we present a number of numerical examples that require assumptions about the distribution of losses and

appropriate threshold values for the risk transfer tests we describe. We recognize that any loss model we choose is an approximation to reality at best and might even be a poor one, and that with respect to the decision about appropriate risk transfer threshold values, other constituencies, including regulators, accountants and outside auditors have a key role to play. In making such assumptions for purposes of illustration, we are not necessarily endorsing any particular loss model or threshold value.

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

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

1.3 Organization of Paper

The paper is structured in nine sections.

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

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

In Section 3 we present a detailed critique of the "10-10" test itself and how it has been applied in practice. We first describe the emergence of the "10-10" approach as a method of testing contracts for "significant" risk. Then we illustrate the application of the "10-10"

benchmark to three reinsurance contracts that clearly contain risk, including a property catastrophe contract and two quota shares of primary portfolios. All the tested contracts "fail" the "10-10" test, implying that the test is flawed. In the context of one of the examples we also emphasize the importance of taking parameter uncertainty into account in the risk assessment. Finally, we point out some unintended consequences of "10-10", namely that it implicidy imposes price controls on reinsurance contracts. We conclude that "10-10" is inadequate as a measure of risk and therefore unsuitable as a universal test for determining the "significance" of risk transfer. At best, one may argue that "10-10" is a sufficient test for risk transfer. It is not, however, a necessary condition.

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

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

Section 6 discusses the identification of contracts subject to the "significant" risk requirement, but which do not require individual testing, and thus addresses the third question. The NAIC is considering a requirement that the CEO and CFO attest that a risk transfer analysis has been completed for all reinsurance contracts, except those for which it is "reasonably self-evident" that significant risk has been transferred. We seek to put some definition to "reasonably self-evident". In this section we illustrate the application of the

ERD ≥ 1% test to several classes of reinsurance contracts with certain structural features. We show, using conservative assumptions, that 1) standard catastrophe excess of loss treaties, 2) contracts covering individual risks and 3) certain other excess of loss reinsurance structures, could all be "pre-qualified" as meeting the "significant" risk requirement (unless there is reason to believe they include other features that might affect the amount of risk transferred). We also describe an additional approach that could potentially be used to further expand the set of such contracts.

Section 7 discusses the possible evolution of risk measurement beyond the application to risk transfer testing that is the focus of this paper. This section offers an alternative way to address the first two questions. It briefly presents a framework proposed based on *right tail deviation* (*RTD*) that tightly links risk transfer testing and risk loading. We present two examples. While the *RTD*-based approach has theoretical appeal, it has the drawback of being more complex and thus less understandable to a non-actuarial audience than the *ERD* approach.

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

Section 9 provides suggested priorities for areas of further research.

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

1.4 Background

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

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

with respect to statutory accounting. Our references to FAS 113 should be understood to refer collectively to FAS 113 and SSAP 62.

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

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

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

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

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

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

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

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

The trivial case is a quota share or other proportional contract with a flat ceding commission equal to the ceding company's expense ratio, where there are no features such a sliding scale commission, profit commission, loss ratio corridor or aggregate loss ratio limit. In such a case, the comparison between the ceding company's position and that of the reinsurer is obvious. The contract clearly transfers not only "substantially all" the risk to the reinsurer but literally all of it. Facultative reinsurance is often written on this basis, but more often than not, quota share treaties include one or more of the features identified above.

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

to be able to compare the downside risk in the ceding company's unreinsured policies with the downside risk of the reinsurer.

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

Method 1 – Comparison of All Underwriting Downside Scenarios

Compare the cedent's underwriting margin over a range of loss ratios on the original unreinsured portfolio to the reinsurer's underwriting margin over the same range of loss ratios. The cedent's underwriting margin is defined as 100% less its unreinsured loss ratio less its actual expense ratio on the unreinsured portfolio[2]. The reinsurer's underwriting margin is defined as 100% less its assumed loss ratio less the ceding commission[3]. If the cedent's margin equals or exceeds the reinsurer's margin for the loss ratios that imply an underwriting loss, then clearly the reinsurer has assumed "substantially all" of the insurer's downside risk. Even if the cedent's margin is less than the reinsurer's margin, if that difference is small (as it is in Example 2.1), then the "substantially all" test may be met. Note that unless there are significant cash flow differences between the ceding company and the reinsurer, it is not necessary to conduct a full analysis of cash flows, since they will affect both parties in the same way.

Method 2 – Comparison of Cedent and Reinsurer Expected Underwriting Deficits

Compare the expected underwriting deficits (*EUD*) of the cedent and the reinsurer. The *EUD* can be calculated either directly as the pure premium of an aggregate excess of loss

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

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

cover attaching at the breakeven loss ratio or as the product of the frequency and severity of underwriting loss, (*Freq*(*UL*) and *Sev*(*UL*), respectively) [4].

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

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

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

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

The results of Method 1 are given in Table 1 and the accompanying Chart 1. The table compares the ceding company's expense ratio and underwriting margin on the unreinsured portfolio over a wide range of loss ratios to the reinsurer's ceding commission expense and underwriting margin at the same loss ratios. The accompanying chart compares the ceding company's margin and the reinsurer's margin graphically. From Table 1 and Chart 1 we see that above an 80% loss ratio (the ceding company's breakeven on the unreinsured portfolio), the ceding company's margin and reinsurer's margin are virtually undistinguishable, which

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

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

indicates the reinsurer has assumed "substantially all of the insurance risk" of the reinsured policies.

TABLE 1

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

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

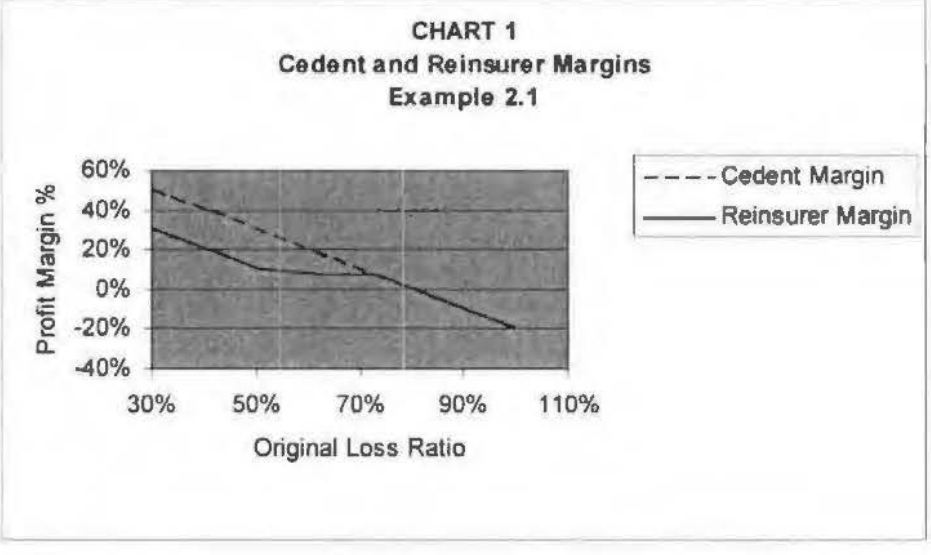


Table 2 summarizes the Method 2 comparison of expected underwriting deficits. It shows the insurer's and reinsurer's comparative underwriting downside risk by examining their respective *Freq(UL)*, *Sev(UL)* and *EUD*. In this example, the ceding company's frequency of underwriting loss is 11.28% vs.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

TABLE 2

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

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

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

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

While this approach works most naturally for quota share contracts, it can potentially be applied to excess of loss treaties as well. In that case, the reinsurer's *EUD*, calculated in the same way as above in the quota share case as a ratio to the ceded premium, should be compared to the cedent's *EUD* on the portion of the original subject portfolio which is exposed to the same risks as the excess of loss reinsurance contract. If the reinsurer's *EUD*

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

is close to or greater than the cedent's, then the reinsurer can be judged to have assumed "substantially all" the cedent's insurance risk in this context. For example, suppose the portion of original insurance risk assumed by a catastrophe reinsurance contract covering a portfolio of business has a 1% probability of a claim of a certain size. In that case the reinsurance of that portion of the risk also requires no more than a 1% probability of loss of the same size, because the *EUD*s of the ceding company and the reinsurer are the same with respect to the original catastrophe exposure.

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

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

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

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

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

3.1 "10-10" and its Shortcomings

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

The "10-10" benchmark arose as an informal method for testing whether purported reinsurance contracts contained sufficient risk transfer to meet the requirements of FAS 113 under the reasonable chance of significant loss criterion. It was not intended to be a universally applicable risk transfer test. Indeed, it has long been recognized that many reinsurance contracts having the characteristics of low underwriting loss frequency but high severity (such as property catastrophe excess of loss reinsurance) fail "10-10" on the basis that the probability of a 10% loss is less than 10%. In addition, if they do not meet FAS 113 risk transfer requirements by virtue of transferring "substantially all" risk, ordinary quota share reinsurance of many primary insurance portfolios (e.g., low limits private passenger auto), which have the characteristics of high frequency of underwriting loss but relatively low severity, may also fail. Until recently that was not seen as a problem because experienced practitioners understood the target of FAS 113 to be highly structured contracts that limited the transfer of insurance risk. As a consequence, traditional reinsurance contracts were typically not even tested.

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

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

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

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

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

This interpretation goes a long way toward eliminating the apparent inconsistency of according reinsurance accounting to some contracts that do not satisfy an invariant probability threshold of 10%. That property catastrophe contracts are typically accorded

reinsurance accounting treatment even though they often do not meet a "reasonable possibility" requirement, defined as 10%, implicitly reflects this kind of interpretation.

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

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

3.2 Illustration of the Shortcomings of "10-10"

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

We begin with the property catastrophe example.

Example 3.1: Property Catastrophe Excess of Loss Reinsurance

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

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

TABLE 3

Catastrophe Loss Distribution for Example 3.1

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

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

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

Example 3.2: Primary Quota Share Reinsurance

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

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

To measure the risk transferred we need to model the prospective underwriting result. Because the underwriting result is the breakeven loss ratio minus the actual loss ratio, the key to modeling the underwriting result is the probability distribution of the prospective loss ratio x. There are a number of reasonable actuarial methods for modeling prospective loss ratios[9]. In actuarial pricing applications the principal focus is on the mean of the prospective loss ratio distribution. Not much attention is paid to the full distribution. In contrast, risk transfer analysis requires the full distribution. This means there are pitfalls associated with using the output from the pricing analysis for the risk transfer analysis without full consideration of the issues affecting the full loss ratio distribution.

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

The historical experience has been poor. Given the ceding commission of 25% and ignoring brokerage and internal expenses (as per FAS 113), the reinsurer's present value breakeven loss ratio is 75%[11]. Three of the five years have estimated ultimate loss ratios significantly greater than 75% and in two of the years the loss ratio is over 75% even on a reported basis. The good news is that the ceding company has taken action to increase rates significantly, which results in estimated on-level loss ratios that are much lower than the actual historical loss ratios. The on-level mean of 70.67% compares very favorably with the

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

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

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

historical mean of about 80%. Moreover, the on-level loss ratios are not very variable as indicated by the standard deviations of 7.45% with respect to x and 10.88% with respect to $\ln x$.

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

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

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

Let's assume the underlying random process governing the prospective loss ratio is lognormal. Then the "best fit" distribution, given the on-level loss ratio experience, is defined by parameters $\mu = \bar{x}$ and $\sigma = s$. From this it is easy to determine whether the present value underwriting loss corresponding to $VaR_{90\%}$ exceeds 10%. If B is the present

value FAS 113 breakeven loss ratio and FV and PV represent "future value" and "present value" operators, respectively, then from the characteristics of the lognormal distribution we know that

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

which implies

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

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

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

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

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

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

- The ultimate loss estimates might be wrong;
- The rate level history might be inaccurate;
- The prospective rate changes assumptions might be wrong;
- The historical claim trend estimates might be inaccurate;
- The prospective claim trend assumptions might be wrong;
- The experience period might be too short to include rare but very large losses;
- The prospective loss ratios might not be lognormally distributed;
- The lognormal assumption is right, but the "best fit" distribution is not the actual;
- Cash flow timing assumptions, particularly regarding claims, might be wrong;
- The prospective exposure mix might be different from expected;
- For multi-year reinsurance contracts, the level of parameter uncertainty from all sources increases as the length of the coverage period increases.

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

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

While it is beyond the scope of this paper to discuss specific methods for estimating the impact of parameter uncertainty, for the sake of illustration, suppose the effect of reflecting parameter uncertainty in the current example is to increase σ in the lognormal model to 15%. If we constrain μ such that $E(x)$ remains unchanged, then $\mu = -0.3571$ and formula (3.1) yields $VaR_{90\%} = 5.76\%$, which still fails to meet the "10-10" threshold for

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

"significant" risk transfer. In this case, an adjustment to try to take account of parameter uncertainty is not sufficient to show "significant" risk transfer in the contract, at least if we use "10-10" to measure it.

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

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

Assume we are considering a quota share treaty on a second primary insurance portfolio. As in Example 3.2 the treaty ceding commission is 25%, which implies a FAS 113 breakeven present value loss ratio of 75%. Suppose this portfolio has the distributional and volatility characteristics commonly attributed to the S&P 500 equity index and an on-level loss ratio of 70%. This implies an assumption that the prospective loss ratio is lognormally distributed[13] with a mean of 70%. Let's also assume the claim payments lag premiums by one year. In order to pass the "10-10" test, which requires a present value loss ratio of at least 85% at the 90th percentile, if the risk free interest rate is 5%, the minimum value of the lognormal σ parameter is about 21%[14].

Actual annualized volatility in the price of the S&P 500 index exchange traded fund (symbol SPY) between early May 2004 and early May 2005 was 10.64%.[15] On May 4, 2005, the broadly based CBOE Volatility Index (VIX), a measure of the expected annualized volatility in the S&P 500 stock index implied by the market pricing of index options, closed at 13.85%. The market was using a higher estimate of future volatility for pricing purposes than that observed in the recent past, which might reflect an adjustment for parameter uncertainty or simply the opinion that volatility would increase. Both estimates of σ fall

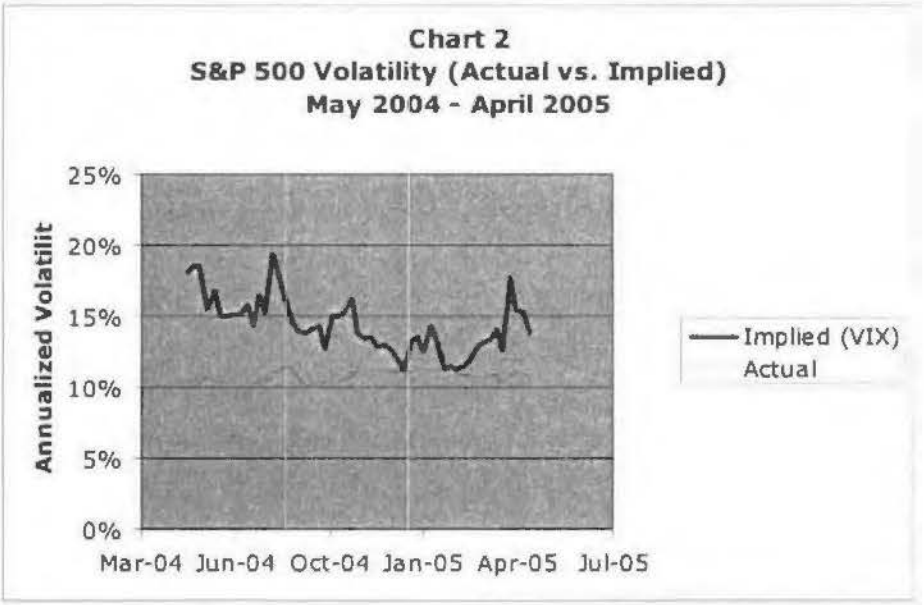
[13] For a discussion of the basis for this assumption, see Appendix B.

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

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

below the threshold of 21% required to pass "10-10", implying that a "quota share" of the S&P 500 index[16] would fail to meet the FAS 113 requirement for significant risk transfer!

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



Source: Yahoo! Finance

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

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

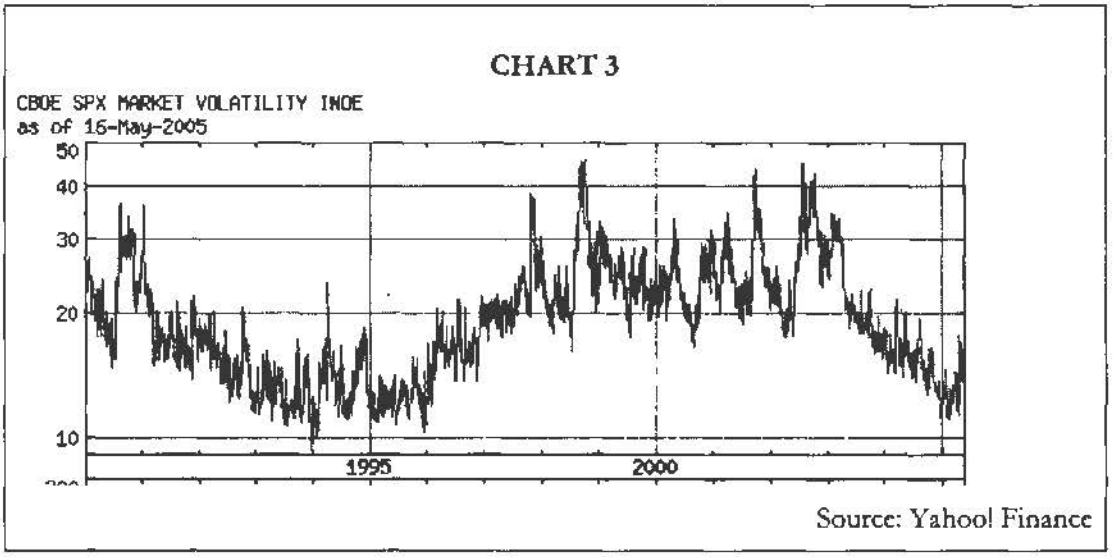


Chart 4 shows the probability of a present value loss of 10% or more on the quota share of this example, given σ = VIX values as of the last trading day of each year from 1990 through 2004 plus May 4, 2005. It shows that the probability exceeds 10%, given the VIX values at the end of 1990 and those for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

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

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

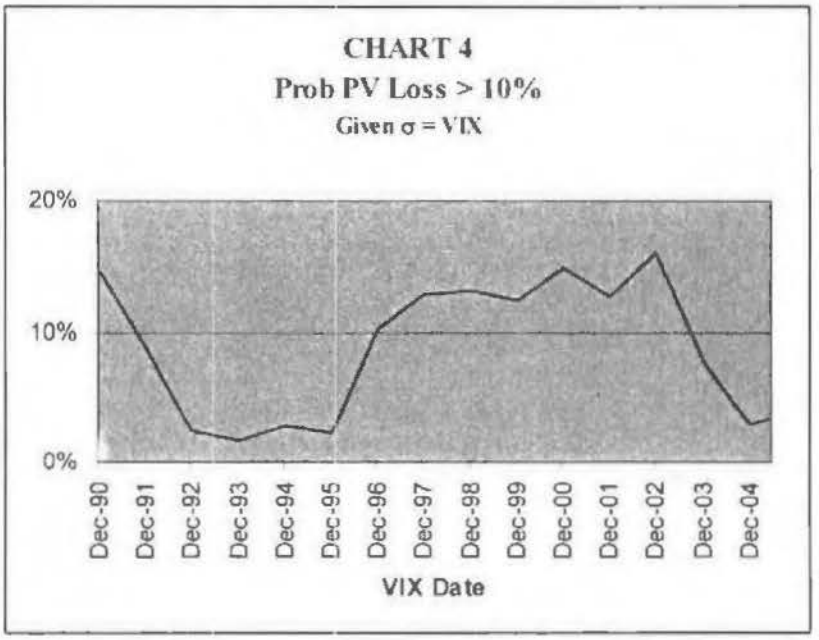


Table 5 illustrates the "10-10" analysis for a quota share of a portfolio whose loss ratio has the volatility characteristics of the S&P 500, for two volatility scenarios: 9% (representing the low end of the VIX range since 1990) and 13.85% (representing the VIX value on May 4, 2005). The ceding commission is 25%. The table shows (a) the loss at the 90th percentile of the present value underwriting result distribution, and (b) the probability of a present value loss of 10% or more, for σ = 9% and 13.85%. Both of these volatility scenarios fail to meet the "10-10" threshold for significant risk transfer.

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

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

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

TABLE 5 "10-10" Risk Transfer Analysis for Quota Share in Example 3.3 Given Portfolio with Volatility of S&P 500			
VIX	σ	(a) 90th Percentile P.V. Underwriting Loss	(b) Probability of ≥ 10% P.V. Underwriting Loss
Low	9.00%	(0.49%)	0.30%
May 2005	13.85%	3.85%	3.41%

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

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

There is a further troubling implication of "10-10". It implicitly imposes price controls on reinsurance contracts at such a low level that, if that benchmark were to be enforced as a rule, reinsurance capacity for certain types of business is likely to be reduced, if not eliminated entirely.

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

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

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

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

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

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

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

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

For example, given $\sigma = 9\%$ and assuming no claim payment lag (and hence no investment income), the reinsurer's minimum permissible loss ratio is 98.4%. That implies a maximum allowable margin before brokerage and internal expenses of 1.6%. The maximum permissible loss ratio rises as the claim payment lag increases. The effect of the $VaR_{90\%} = 10\%$ constraint is that all the investment income earned as a result of the claim payment lag is credited to the cedent, and the present value of the reinsurer's margin remains at 1.6%. For example, given a three-year payment lag and a 5% interest rate, the breakeven loss ratio is 115.8% and the minimum permissible loss ratio is 113.9%, which leaves a future value margin for the reinsurer of 1.9%. The present value of that 1.9% is 1.6%. Clearly, given brokerage costs and internal expenses, no reinsurer could afford to write business at such a meager margin.

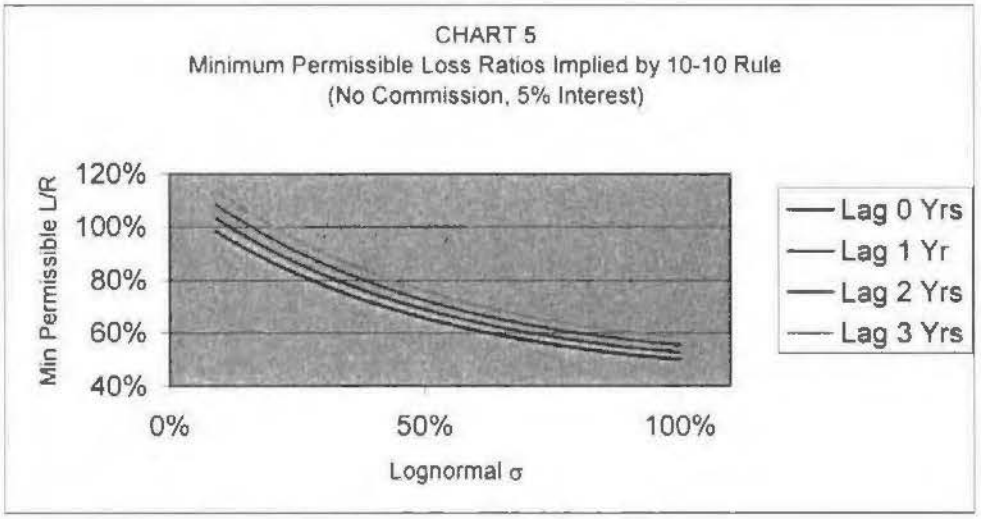
TABLE 6

Minimum Permissible Loss Ratio
Implied by "10-10"

Contracts with No Ceding Commission
Interest at 5% per annum

By σ and Claim Lag

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



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

3.4 Section Summary

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

4. TOWARD A BETTER TEST

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

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

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

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

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

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

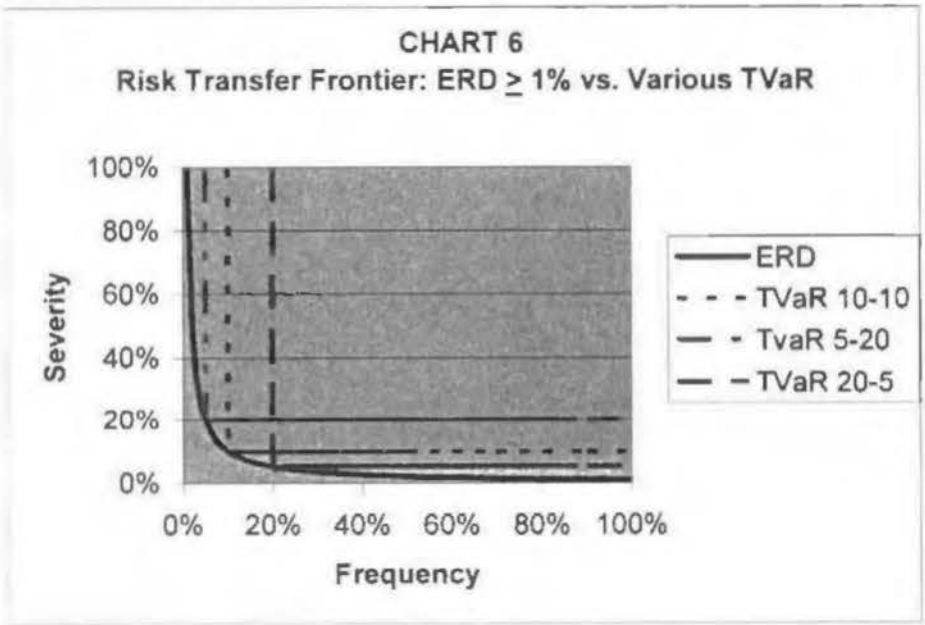
where A represents the threshold above which a contract is considered to have provisionally "passed" the "significant" risk transfer test and below which is it is considered to have "failed". $Freq$ and Sev refer to the frequency of present value loss and the average severity of such loss, respectively.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

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

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

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

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



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

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

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

5. ILLUSTRATION OF THE *ERD* TEST

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

Example 5.1: Property Catastrophe Excess of Loss Reinsurance

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

TABLE 7

ERD / Max Downside

For Standard Cat XL Contracts

By Rate on Line

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

* Ratio to expected premium

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

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

Example 5.2: Primary Quota Share Reinsurance

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

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

In this example we test the same quota share that was the subject of Example 3.3. That quota share covered an insurance portfolio with the same loss ratio volatility as an S&P 500 index investment. The ceding commission is 25%. The frequency, severity and *ERD*

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

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

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

characteristics of such a portfolio are summarized in Table 8 for the two volatility scenarios modeled in Example 3.3. For volatility of 13.85% the $ERD \geq 1\%$ standard is met. However, at the historically low volatility of 9%, a portfolio with S&P 500 volatility characteristics has an *ERD* of only 0.28% and thus fails the $ERD \geq 1\%$ standard by a wide margin. That creates a conundrum – is it ever reasonable to consider the S&P 500 to be without risk? If not, a 1% threshold for *ERD* is too high.

TABLE 8

ERD Risk Transfer Analysis for Quota Share in Example 5.3 Given Portfolio with Volatility of S&P 500

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

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

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

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

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

effect of a loss ratio corridor depends on the characteristics of the reinsured business, and in some circumstances such treaty feature is entirely appropriate.

TABLE 9

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

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

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

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

Note that in the case of $\sigma = 10\%$, the *ERD* associated with a contract with no loss ratio cap is also 0.41%, indicating that the cap at 95% has no significant effect on the risk transferred to the reinsurer. On that basis, the contract with a 95% cap transfers

"substantially all" the risk in the underlying portfolio, and even though it does not transfer "significant" risk, it meets the risk transfer requirements of FAS 113.

TABLE 10

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

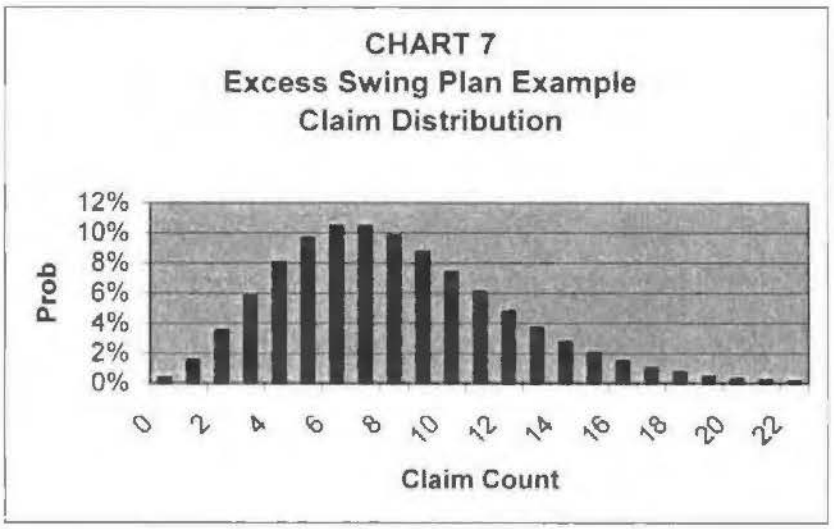
σ	*Freq*	*Sev*	*ERD*
10%	11.0%	3.8%	0.41%
15%	19.5%	6.5%	1.27%
20%	24.5%	8.9%	2.18%
25%	27.6%	10.7%	2.94%
30%	29.4%	12.0%	3.53%
40%	31.1%	13.8%	4.29%
50%	31.4%	14.9%	4.69%

Example 5.6: Excess Swing-Rated Reinsurance

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

incentives, both positive and negative, to the ceding company to minimize excess claims. Ceding companies often find these plans attractive because they believe their realized rate will be significantly less than under a flat-rated plan.

While minimizing risk transfer is not usually the driving force behind the structuring of a swing plan, such a structure typically does transfer less risk than a flat-rated excess of loss treaty covering the same business. To illustrate this, suppose the expected excess losses are $4 million. If the total premiums on the subject portfolio are $50 million, this can be expressed as a loss cost of 8%. For the sake of discussion let's assume the excess claim count can be modeled using a negative binomial distribution with an mean of 8 claims[27] and that only total limit claims are possible. The claim distribution is shown graphically in Chart 7.



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

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

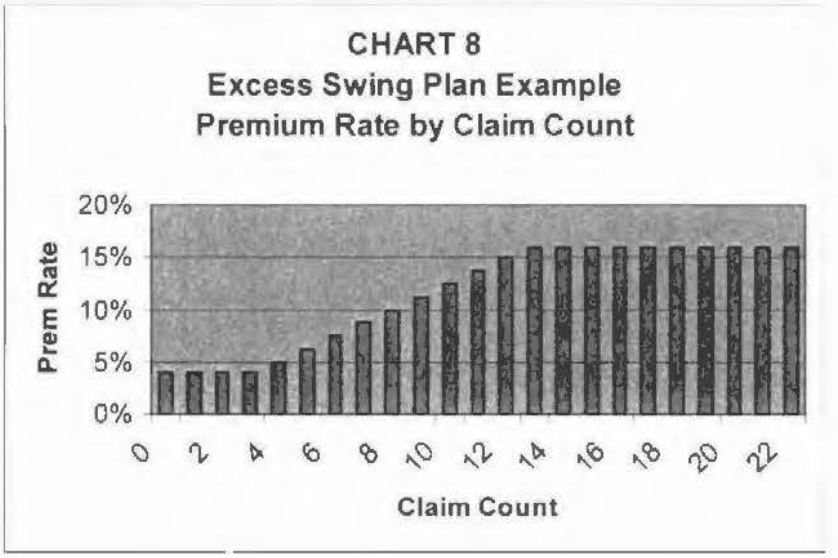


Table 11 summarizes the *ERD* analysis for both the flat-rated and swing-rated plans, assuming that there is a negligible claim payment lag. It shows that the swing plan has an *ERD* of 0.97%, just under the 1% threshold for significant risk. With some minor restructuring this contract would be able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

TABLE 11

ERD Risk Transfer Analysis

Swing-Rated vs. Flat-Rated Excess

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

Example 5.7: Individual Risks

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

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

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

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

TABLE 12

ERD / Max Downside
For Individual Risk Contracts

By Rate on Line

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

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

5.1 Section Summary

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

since 1990. Volatility parameters below about 13% produce *ERD* results (in the quota share we tested) that suggest insignificant levels of risk. This is an anomalous result because it suggests that under some circumstances an investment related to the S&P 500 index should not be considered risky, a conclusion that does not seem reasonable.

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

1. The *ERD* methodology described here, with a 1% threshold for significant risk transfer, is numerically comparable to the "10-10" benchmark;
2. The *ERD* methodology is qualitatively superior to that benchmark; and
3. If the 1% *ERD* method were adopted as a de facto standard replacing the "10-10", we would consider that a significant improvement.

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

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

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

Example 6.1: Individual Risk and Catastrophe Excess of Loss Contracts

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

Example 6.2: Other Excess of Loss Contracts

By virtue of analysis similar to that for individual risk and catastrophe excess of loss contracts, it is possible to add a further large subset of excess of loss contracts (treaty and facultative) to the category of contracts that do not require individual testing. Table 13 summarizes the *ERD* analysis for excess of loss contracts with no ceding commission and rates on line ranging from 1% to 500% and aggregate limits no less than one full limit or 200% of premiums, whichever is greater. The term "rate on line" is most frequently used in connection with catastrophe excess of loss treaties and other excess contracts where the ratio of premium to limit[28] is far less than 100%, so a rate on line of 500% might be surprising. However, it is common for "working layer" excess of loss contracts to be priced with the expectation that there will be between several and many claims during the coverage period. Under typical pricing assumptions, a 500% rate on line implies the expectation that excess claims will be equivalent to about three total limits losses.

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

On the basis that every rate on line in Table 13 from 1% to 500% passes the *ERD* test even without the supplemental downside requirement coming into play, we suggest that any excess of loss contract having this structure (and no loss sensitive or other features that might call the contract's status into question) be deemed to meet the requirements for

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

TABLE 13

Expected Reinsurer Deficit / Max Downside

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

By Rate on Line

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

* Ratio to premium

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

"significant" risk transfer. Excess of loss contracts with no aggregate limit clearly fall into this category as well. All such contracts are subject to the "significant" risk transfer

requirement. However, because we have, in effect, pre-qualified them as a class, the requirement to demonstrate significant risk transfer can be waived.

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

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

Table 14 shows maximum permissible present value margins and corresponding minimum permissible loss ratios implied by $ERD \geq 1\%$ for claim lags of zero, one year, two years and three years with respect to contracts for which the prospective loss ratio can be modeled using a lognormal distribution[29]. The results are shown for σ values ranging from 9% to 100%. Note that for each value of σ, the permissible loss ratios increase in nominal terms with the claim lag, but the present values are all the same. The allowable margins for the σ values at the low end of the range might make reinsurance of such low risk portfolios impossible unless the reinsurance is structured to meet the "substantially all" risk transfer test. For example, the maximum permissible present value margin for $\sigma = 9\%$ of only 7.1%, while much higher than the 1.6% permitted under "10-10"[30], does not allow a reinsurer much, if any, upside potential, after deducting brokerage and internal expenses. That is one reason to consider the possibility that an *ERD* threshold of 1% might be too high. On the other hand, in light of our discussion in Section 3 about parameter uncertainty, it might turn out to be the case that realistic prospective estimates of σ will, in practice, generally exceed the low end of the range, making this concern irrelevant.

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

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

TABLE 14

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

Contracts with No Ceding Commission
Interest at 5% per annum

Tabulated by σ and Claim Lag

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

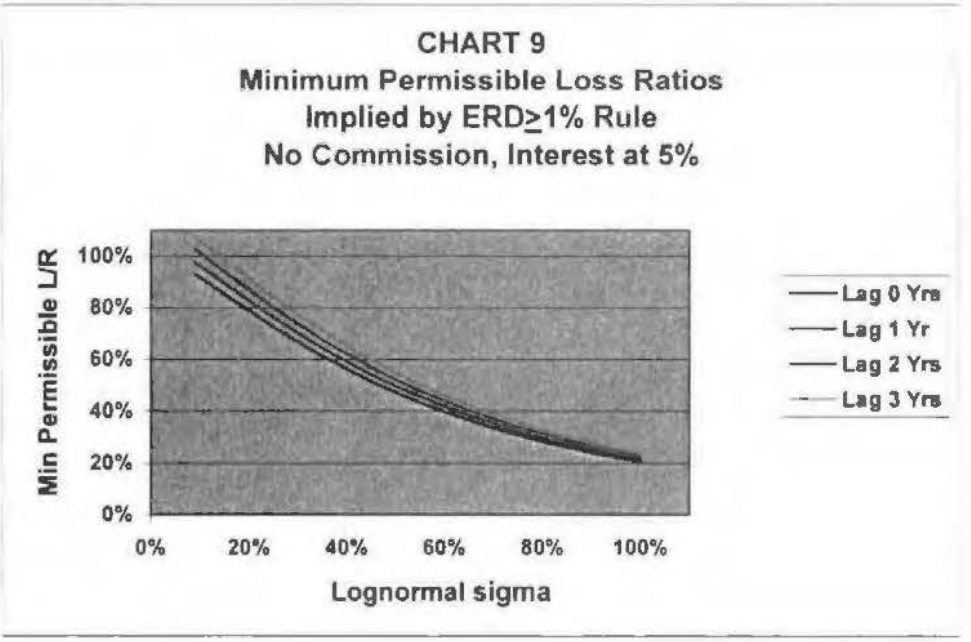
The maximum margins implied by $ERD \geq 1\%$ for larger values of σ seem more reasonable. For example, for $\sigma = 30\%$, the allowable present value margin is 33.2%, which is a more reasonable ceiling[31].

The implication of this for our present discussion is that if a contract with no ceding commission is priced to an expected loss ratio that is greater than the minimum permissible loss ratio shown for the relevant σ and claim lag (and the other assumptions are reasonable), then the contract will meet the $ERD \geq 1\%$ standard that indicates significant risk transfer. We present this as an illustration of how the subset of contracts that do not

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

require detailed testing for significant risk transfer could be expanded beyond the catastrophe excess of loss, individual risk and other excess of loss contracts we identified earlier. Any contract that is priced to an expected loss ratio that exceeds the minimum permissible loss ratio would be exempt from individual testing. Additional research is necessary to fully realize this approach.

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



Example 6.4: Contracts with Immaterial Premiums

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

7. POSSIBLE EVOLUTION OF RISK TRANSFER MEASUREMENT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Compute expected loss of the contract under the untransformed distribution $F(x)$;
2. Note the premium for the deal (however computed—allows for market pricing);
3. Compute RTD for the deal using the transformed distribution and formula (7.3);

4. Define the *maximum qualified premium* as some multiple of *RTD* (Wang suggests 3-5x[32]);
5. The "significant" risk transfer threshold is defined as "*maximum qualified premium* ≥ *premium*"[33].

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

Example 7.1: Property Catastrophe Excess of Loss Reinsurance

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

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

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

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

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

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

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

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

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

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

First, let us consider the two pieces separately. The low risk portfolio has an untransformed expected loss of $8 million and a transformed expected loss of $8.1 million. The maximum qualified premium is only $0.4 million, leaving $7.6 million unqualified. This piece falls far short of the "significant" risk standard.

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

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

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

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

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

8. SUMMARY

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

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

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

- Proportional facultative reinsurance with effective ceding commissions no less than cedent expenses;
- Proportional treaties with effective minimum ceding commissions no less than cedent expenses;
- Proportional facultative or treaty reinsurance for which it can be shown that the reinsurer's *EUD* is essentially the same as the cedent's *EUD* on the unreinsured subject portfolio, irrespective of whether the contract includes a loss ratio corridor, loss ratio cap or other risk mitigating feature;
- Excess of loss facultative or treaty reinsurance for which it can be shown that the reinsurer's *EUD* is essentially the same as the cedent's *EUD* on the portion of the

original subject portfolio that is exposed to the same risks as the excess of loss contract;

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

To address the question of how to measure "significant" risk transfer, we have proposed an *ERD* test as an improvement over the "10-10" test, which arose in the 1990s as a way to test "finite risk" reinsurance contracts for compliance with FAS 113. The "10-10" test was not originally intended to be applied to traditional reinsurance contracts, and usually it was not. In the wake of recent real and alleged reinsurance accounting abuses, there is an increasing sentiment that a wider class of reinsurance contracts beyond those classified as "finite" need to be tested for significant risk transfer. Because it has come into widespread use, the "10-10" test has become the de facto standard for reinsurance risk transfer testing, despite the fact that it has never been endorsed by any professional body nor subjected to serious critical scrutiny.

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

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

We have also shown that low frequency-high severity reinsurance contracts (such as catastrophe excess of loss treaties) and high frequency-low severity contracts (such as traditional primary quota share treaties) pass the *ERD* test, provided loss mitigating features

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

such as loss ratio caps and/or corridors do not remove too much risk from the contracts (in which case a "failure" is entirely appropriate).

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

To address the concern in some quarters that the *ERD* test is not always stringent enough with respect to the potential for a large loss by the reinsurer, we have suggested consideration of a supplemental requirement that the reinsurer face a minimum downside potential of 15% or 20% of premiums.

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

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

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

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

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

9. SUGGESTED PRIORITIES FOR FURTHER RESEARCH

The *ERD* test proposed in this paper should be seen as an example of a reasonable framework for assessing the significance of risk transfer in reinsurance contracts. We have demonstrated that it is a clear improvement over "10-10", but we do not claim that it is the only reasonable approach. Indeed, we briefly described another promising, albeit more

complicated, method, namely, Wang's *RTD* framework. There may be others. We urge the CAS to encourage further research on this subject, perhaps through a call for papers.

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

9.1 Immediate "Level 1" Research – Consensus on Thresholds

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

2. Determination of an appropriate "pass" threshold framework for the *ERD* test presented in Section 4. In particular, is the 1% threshold illustrated in this paper appropriate, or would some other threshold be more appropriate? In addition, should there be a supplemental requirement that the reinsurer's potential loss be greater than or equal to some minimum amount? (We considered a minimum underwriting loss of 20% in some of our examples.);

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

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

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

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

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

Appendix A

Definition of Downside Risk Measures

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

$$B = P - C \tag{A.1}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$x(y) = \begin{cases} y & if\ y \le 75\% \\ 75\% & if\ 75\% < y < 80\% \\ y - 5\% & if\ y \ge 80\% \end{cases}$$

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

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

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

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

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

Appendix B

Discussion of Analogy to Stock Market Risk

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

Basis of Lognormal Assumption

It is possible, perhaps even likely, that stock prices are not lognormally distributed. However, stock price movements are commonly assumed by financial economists to follow Brownian motion through continuous time, which implies that stock returns over infinitesimal time intervals are normally distributed and stock prices are lognormally distributed after any finite time interval. For example, see Hull [10] Chapter 11 (p. 228) and Baxter-Rennie [11] Chapter 3 (p. 51). The latter says, "It is not the only model for stocks…but it is simple and not that bad." The Black-Scholes call option pricing formula was originally derived using a Brownian motion assumption. It has subsequently been shown that it can also be derived from the assumption that "asset prices are lognormally distributed under the martingale measure Q."[Ibid, p. 181].

At the same time there is some disagreement with the Brownian motion/lognormal assumption. See for example Peters [12], Chapter 3 (p. 27), who presented evidence that the distribution of actual stock market *returns* has a higher peak and fatter tails than predicted by a normal distribution and found, "The stock market's probability of a three-sigma event is roughly twice that of the Gaussian random numbers." [Ibid, p. 29]. He argues that because "capital market theory is, in general, dependent on normally distributed

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

returns"[Ibid, p. 25], the Efficient Market Hypothesis, Capital Asset Pricing Model and Modern Portfolio Theory all rest on a shaky foundation. We don't take a position in that debate. However, we do wish to point out that our use of a lognormal distribution is consistent with the mainstream view.

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

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

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

Suppose the quota share in Example 3.3 involves ceded premiums of $10 million. Given a ceding commission of 25%, the net proceeds to the reinsurer total $7.5 million. Similarly, if S&P 500 "spiders" (symbol SPY) are trading at $117 a share (as they were in early May 2005), a short sale of 64,103 shares also yields net proceeds to the seller of $7.5 million. The expected loss ratio on the quota share is 70%, implying expected losses of $7 million. Claim payments are expected to lag premiums by one year. This is equivalent to the short seller estimating the expected value of SPY in one year's time as $109.20, or $7 million in total for the short position. (A short seller would generally not short the stock if he did not expect it to decline.) In order for the reinsurer to suffer a $1 million present value loss (10% of the ceded premiums), given a risk free interest rate of 5%, the loss ratio would need to reach 85% times 1.05, or 89.25%. In order for the short seller to incur a $1 million present value

loss, the stock price would have to reach $139.23[40]. These are the threshold levels for "passing" the "10-10" test.

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

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

Data Underlying Chart 4

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

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

TABLE B-1 "10-10" Risk Transfer Analysis for Quota Share in Example 2.3 Given Portfolio with Volatility of S&P 500 VIX Data Underlying Chart 4			
VIX Date	VIX	(a) 90th Percentile P.V. Underwriting Loss	(b) Probability of ≥10% P.V. Underwriting Loss
Dec 1990	26.4%	15.3%	14.6%
Dec 1991	19.3%	8.8%	8.8%
Dec 1992	12.6%	2.7%	2.3%
Dec 1993	11.7%	1.9%	1.6%
Dec 1994	13.2%	3.3%	2.8%
Dec 1995	12.5%	2.7%	2.3%
Dec 1996	20.9%	10.3%	10.3%
Dec 1997	24.0%	13.1%	12.9%
Dec 1998	24.4%	13.5%	13.2%
Dec 1999	23.4%	12.6%	12.4%
Dec 2000	26.9%	15.7%	14.9%
Dec 2001	23.8%	12.9%	12.7%
Dec 2002	28.6%	17.3%	16.1%
Dec 2003	18.3%	7.9%	7.8%
Dec 2004	13.3%	3.4%	2.9%
May 2005	13.9%	3.9%	3.4%

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

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

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

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

10. References

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Abbreviations and notations

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

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

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

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

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

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

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

EXHIBIT 5

MADISON CONSULTING GROUP

PROGRAM NAME: ALLSTATE INSURANCE GROUP

SOURCE: MARYLAND RATE FILING SERFF TRACKING # ALSE-129256148 - EXCERPT

FILING EXHIBITS: ATTACHMENT I PAGE 2 (LIMIT)
ATTACHMENT II EXHIBIT 4.1 (PREMIUM)

ALLSTATE INSURANCE GROUP
PROPERTY LINES
MARYLAND

2013 REINSURANCE CONTRACT SUMMARY

The terms of the applicable 2013 Reinsurance contracts are summarized below. Additional information regarding Allstate's Reinsurance Program[1] is available on Allstate.com by clicking the Investor Relations tab and accessing the 2013 Quarterly Investor Information.

Allstate has a Reinsurance Intermediary Broker Contract with Aon Benfield, which encompasses the marketing and placement of our catastrophe reinsurance programs.

Since the 2006 inception of Allstate's catastrophe reinsurance program, our exposure to wind loss has been materially reduced and we have substantially eliminated our exposure to homeowners earthquake loss. Similar to our 2012 program, we have designed our 2013 program to respond to these exposure changes by including coverage in all agreements for multiple perils, in addition to hurricanes and earthquakes, except for the following agreements which reinsure specific perils: a Kentucky agreement, which provides coverage for earthquakes and fires following earthquakes, and an agreement comprising two contracts which provides coverage in specific states for hurricanes and earthquakes, including fires following earthquakes, based on insured industry losses as reported by the Property Claim Service ("PCS") (the "PCS Excess Catastrophe Reinsurance agreement").

Our program includes a Nationwide Per Occurrence Excess Catastrophe Reinsurance program reinsuring our personal lines property and auto excess catastrophe losses resulting from multiple perils in all states other than New Jersey and Florida. For June 1, 2013 to May 31, 2014, the program consists of three agreements: a Per Occurrence Excess Catastrophe Reinsurance agreement that provides $3.25 billion of reinsurance coverage above the retention with reinstatement of limits[2] in the first five of the six layers, a Top and Drop Excess Catastrophe Reinsurance agreement which includes Coverage A and Coverage B and does not include a reinstatement of limits, and a PCS Excess Catastrophe Reinsurance agreement which supplements the reinsurance limits provided by the Fifth and Sixth Layers of the Per Occurrence Excess Catastrophe Reinsurance agreement and does not include a reinstatement of limits.

Our 2013 reinsurance program also includes separate Florida, California, and New Jersey agreements which are designed separately from the other components of the program to address the distinct needs of our separately capitalized legal entities in those states. In addition, Allstate Protection has separate reinsurance contracts in Pennsylvania for multiple perils and in Kentucky for the peril of earthquake and fire following earthquake.

A description of the catastrophe reinsurance agreements that reinsure Allstate Protection as of June 1, 2013 follows:

Nationwide Per Occurrence Excess Catastrophe Reinsurance program, excluding Florida and New Jersey

- The Per Occurrence Excess Catastrophe Reinsurance agreement reinsures personal lines property and auto excess catastrophe losses caused by multiple perils under Six Layers of coverage as follows:

First Layer:	$250 million limit in excess of a $500 million retention and after an initial $250 million in losses "otherwise recoverable" has been satisfied, 1 reinstatement
Second Layer:	$250 million limit in excess of a $750 million retention, 1 reinstatement
Third Layer:	$500 million limit in excess of a $1 billion retention, 1 reinstatement
Fourth Layer:	$750 million limit in excess of a $1.5 billion retention, 1 reinstatement
Fifth Layer:	$1 billion limit in excess of a $2.25 billion retention, 1 reinstatement
Sixth Layer:	$500 million limit in excess of a $3.25 billion retention, no reinstatement

[1] A reinsurance program is comprised of one or more reinsurance agreements and a reinsurance agreement is comprised of one or more reinsurance contracts.

[2] A reinstatement of limits provision allows a cedent to reinstate the full amount of a per occurrence limit, after payment of a loss, capped at the reinsurance contract's limit

Attachment II
Exhibit 4.1

Maryland
Allstate Group
M&A Alternative Reinsurance Charge Indications Using AIY as Allocation Base
Owners

		Allocation Base	
		M&A Alternative	Filed
(1)	Benfield NW Reinsurance Premium	362,654,945	
(2)	% of NW Contract Based on AIY	2.8180%	
(3)	NW Reinsurance Premium	10,219,616	
(4)	NW Loss Recoveries Due to Reinsurance	1,340,656	
(5)	Net Cost of Reinsurance (4)-(5)	8,878,960	5,013,967
(6)	Variable Expense Ratio	13.3%	23.2%
(7)	Net Cost of Reinsurance Including Variable Expenses: (6)/[1.0-(7)]	10,241,015	6,528,603
(8)	Expected AIYs in Reinsurance Period	48,021,293	48,021,293
(9)	Indicated Reinsurance Charge Per AIY (8)/(9)	0.213	0.136
(10)	Adjusted AIYs x Proposed Reinsurance Base Rates	6,598,082	6,598,082
(11)	Indicated Reinsurance Rate Adjustment Factor (8)/(11)	1.552	0.989
(12)	Proposed per Filing	0.989	

EXHIBIT 6

MADISON CONSULTING GROUP

PROGRAM NAME: FLORIDA HURRICANE CAT FUND

SOURCE: http://fhcf.paragonbenfield.com/pdf/13multiple.pdf

Payout Multiples (Posted 1/2/14)

The Payout Multiples are used to calculate an insurer's projected payout for FHCF coverage pursuant to Section 215.555(4)(d)2.b., Florida Statutes.

Each Payout Multiple is derived by dividing either estimated single season Claims-Paying Capacity of the FHCF or the TICL Limit by the total industry Mandatory Reimbursement Premium for the FHCF for the Contract Year billed as of 12/31 of the Contract Year. The Company's Mandatory Reimbursement Premium, as paid to the SBA for the Contract Year, is multiplied by the corresponding Payout Multiple to estimate the Company's coverage from the FHCF for the Contract Year. The SBA is not obligated to reimburse for any losses under the Reimbursement Contract unless the Company incurs losses from Covered Events for Covered Policies in excess of its retention.

The Payout Multiple for the mandatory FHCF coverage is calculated as follows:

Mandatory Maximum Claims Paying Capacity		Aggregate 2013 Mandatory FHCF Premium		Mandatory Payout Multiple
$17,000,000,000	/	$1,271,873,000	=	13.3661

The Payout Multiples for the TICL FHCF coverage is calculated as follows:

TICL Limit		Aggregate 2013 Mandatory FHCF Premium		TICL Payout Multiple
$1,000,000,000	/	$1,271,873,000	=	0.7862
$2,000,000,000	/	$1,271,873,000	=	1.5725

EXHIBIT 7

MADISON CONSULTING GROUP

PROGRAM NAME: TEXAS WINDSTORM ASSOCIATION

SOURCE: http://test.twia.org/Portals/0/Documents/TWIA_Purchases_Reinsurance_6-11_FINAL.pdf

FOR IMMEDIATE RELEASE
June 10, 2011
Contact: Meg Meo, 512-494-2867,
mmeo@echristianpr.com

Texas Windstorm Insurance Association Purchases Reinsurance

Policy Is in Effect Through May 2012 and Helps to Ensure Funding Is in Place in Case of a Major Hurricane

AUSTIN, Texas—The Texas Windstorm Insurance Association (TWIA) has purchased $636 million in reinsurance protection. The policy will cover losses that exceed the $1.6 billion in funds estimated to be available from the Association's Catastrophe Reserve Trust Fund and bonds.

The purchase of reinsurance was made at the direction of the TWIA board of directors at their meeting on May 20, 2011. The net cost of the purchase was slightly less than $100 million and will be paid from premiums received by TWIA in 2011 and 2012. The policy is in effect from June 1, 2011 through May 31, 2012, but effectively covers the 2011 hurricane season.

TWIA purchased the reinsurance from 47 different reinsurance companies worldwide. The purchase was brokered by Guy Carpenter & Company, LLC.

About the Texas Windstorm Insurance Association

The Texas Windstorm Insurance Association (TWIA) is the state's insurer of last resort for wind and hail coverage in the 14 coastal counties and parts of Harris County (east of Highway 146). TWIA provides wind and hail coverage when insurance companies exclude it from their homeowners and other property policies sold to coastal residents. TWIA employees are committed to promote hurricane safety and education, together with the development and enforcement of coastal building codes, in an effort to save lives and property.
www.twia.org

EXHIBIT 8

9/7/02 N.Y. Times C1
2002 WLNR 4441409

New York Times (NY)
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September 7, 2002

Section: C

Insurers Scale Back Corporate Liability Policies

JONATHAN D. GLATER and JOSEPH B. TREASTER

Shellshocked by corporate scandals and fearful of the hefty payments they will have to make to settle shareholder lawsuits, the big commercial insurance companies are cutting back sharply on liability coverage for American corporations, their directors and senior executives.

The cutbacks are taking the form of higher deductibles and lower limits on overall coverage. But the insurance companies are also demanding that corporations pay part of any court settlements or jury awards out of their own pockets. As a result, corporations in telecommunications, energy, financial services and pharmaceuticals -- where the risk of being sued is thought to be highest -- could face payments of up to half of the cost of any settlement.

The three leaders in this line of coverage -- the American International Group, the Chubb Group and Hartford Financial Services -- have already begun requiring some customers to share the expense of settlements.

The cutbacks effectively limit the size of policies insurance companies will sell to any one company, said Andrew Marcell, who is in charge of insurance for directors and corporate officers at Guy Carpenter, a New York reinsurance broker and a unit of the Marsh & McLennan Companies.

"Companies that until recently were willing to provide $50 million in coverage are now offering $25 million, and companies that offered $25 million are now providing $10 million to $15 million," Mr. Marcell said.

Enron had $350 million in this kind of coverage and some corporations had been buying up to $1 billion worth. But now, Mr. Marcell said, "$250 million in coverage is pretty hard to come by."

The sharing of the burden of settlements may also leave directors' and officers' personal assets exposed, lawyers said.

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"This is very bad news for directors and officers," said Michael Young, a partner at the law firm of Willkie Farr & Gallagher in New York who often represents directors and officers. "The insurance industry is sending out the word that for outside directors, insurance that provides 100 percent protection is going to be increasingly difficult to get and companies are going to have to pay through the nose for it."

John Keogh, a unit president of the American International Group, said that some corporations could avoid sharing the costs of lawsuits with insurance companies and get full coverage up to limits of their policies by paying higher premiums. But David H. McElroy, who is in charge of this kind of insurance at Hartford Financial Services, said the riskiest clients could not get full coverage at any price.

The insurers say they are merely acting in self-defense as they watch corporate giant after corporate giant collapse as they come under fire for deceptive accounting and management abuses that have drained companies like WorldCom, Global Crossing and Tyco of hundreds of millions in corporate money.

As share prices of these companies have plunged, shareholders have turned to lawsuits in an attempt to recover at least some of their losses.

Combining the expected costs from some of the latest lawsuits, which are still in their early stages, and scores of others that have been working their way through the courts over the last few years, insurers estimate that they will have to pay out $7.5 billion this year on liability policies for directors and officers -- but they collected only $4.5 billion in premiums.

"The expected claims paid out are going to be multiples of the premiums that have been collected," said Mr. Keogh of A.I.G. He would not comment on specific numbers. Some insurers said that they expected the actual losses to be lower, but that the industry would still lose money this year. Quietly, several insurers have also begun trying to cancel certain policies, arguing that corporate fraud makes them void -- a nightmare for executives.

The cutback in liability coverage and increases in premiums are hitting corporations hard. Bruce S. Zaccanti, an insurance consultant at Ernst & Young, said a nationwide real estate management company he had been advising paid $3 million for $100 million in coverage last year. This year, the company's premium jumped to $4.5 million for $70 million in coverage. On top of that, he said, the deductible has jumped to $15 million from $5 million.

By forcing the companies to share the cost of settlements, the insurers also hope to prod them to fight harder to keep those costs down. When all the costs have been covered, the insurers said, the corporations are often eager to settle quickly -- rather than work for a smaller settlement.

"There is no doubt in our minds that insureds' settlement behavior has been less reluctant than maybe it once was when there was an economic alignment," said Tony Galban, vice president and manager of directors and officers liability insurance underwriting at Chubb Specialty, a subsidiary of Chubb & Son.

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In recent years, the average size of settlements in securities lawsuits has increased drastically, rising to $16 million in 2001, according to the Securities Class Action Clearinghouse, an organization at Stanford University that tracks securities litigation. Before 1995, when a law was passed making it tougher to bring securities fraud claims, the average settlement was less than half that amount.

The possibility that individual directors and officers could be forced to dip into their own wealth may make it harder to recruit executives to serve on corporate boards, said Brooks Chamberlin, head of the global insurance practice at Korn/Ferry International, an executive search firm. Fearful of personal liability, more and more recruits are conducting their own due diligence on prospective employers, he said.

Smaller companies, companies with financial problems, companies in certain industries perceived to have a higher incidence of fraud, and companies with fewer hard assets but sizable market capitalizations will have more trouble, Mr. Chamberlin said.

According to Mr. Young of Willkie Farr & Gallagher, directors want some assurance that somebody else will be able to pay any settlement or damage award.

"What if the company goes into bankruptcy? Then who covers?" he asked rhetorically. "Or what if the company's just not wealthy enough?"

The changes have already had the odd effect of leading to the creation of a new type of policy that will protect only independent directors. A.I.G. will sell the policies that cannot be canceled even in the case of management fraud, Mr. Keogh said.

But Gregory M. Schmidt, general counsel at the LIN TV Corporation, an owner of television stations in several states, wondered whether companies might choose not to take on the additional cost of these policies and instead promise to cover any settlement costs owed by the directors. "The question is whether that's going to be satisfactory" to the directors and officers, he said.

LIN's policies are not up for renewal until March, he said, but executives at the company are monitoring changes the insurers are announcing.

"We're worried," he added.

---- INDEX REFERENCES ---

COMPANY: WHINNEY MURRAY AND CO; ERNST ET YOUNG (IVORY COAST); MCI INC; WORLDCOM; ERNST AND YOUNG (BARBADOS); CHUBB CORP (THE); ERNST YOUNG (COLOMBIA); ERNST AND YOUNG (CHINA); AMERICAN INTERNATIONAL GROUP INC; ERNST AND YOUNG SL; ERNST AND YOUNG (KENYA); ERNST AND YOUNG (BERMUDA); ERNST AND YOUNG (MALTA); ERNST AND YOUNG (ZIMBABWE); HARTFORD FINANCIAL SERVICES GROUP INC (THE); ERNST AND YOUNG

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(LEBANON); ERNST YOUNG (ARGENTINA); ERNST AND YOUNG (BAHRAIN); ERNST AND YOUNG (SYRIA); ERNST AND YOUNG (JORDAN); ERNST AND YOUNG LLP; ERNST AND YOUNG; MCI LLC; ERNST ET YOUNG (BELGIUM)

NEWS SUBJECT: (Corporate Financial Data (1XO59); Business Lawsuits & Settlements (1BU19); Business Litigation (1BU04); Financially Distressed Companies (1FI85); Major Corporations (1MA93))

INDUSTRY: (Commercial Property & Casualty Insurance (1CO35); Financial Services Products (1FI16); Insurance Liability (1IN26); Property & Casualty Insurance (1PR21); Insurance Industry Legal Issues (1IN64); Financial Services Convergence (1FI45); Corporate Insurance (1XO50); Financial Services (1FI37); Insurance (1IN97))

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Language: EN

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COMPANY TERMS: AMERICAN INTERNATIONAL GROUP; CHUBB GROUP INSURANCE; HARTFORD FINANCIAL SERVICES GROUP

EDITION: Late Edition - Final

Word Count: 1401
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EXHIBIT 9

Supplemental Short Term Disability Insurance

Supplemental short term disability insurance is an important benefit for growing families. At the same time it may be the most difficult to understand, and purchase.

The limiting factor is purchasing policies that work for maternity leave – those covering normal childbirth. Understand how supplemental short term disability works to fill these holes, and discover the simple solution to a big problem.

- *Maternity leave income*

- *Covering pregnancy complications*
- *Accidents and illnesses*
- *State mandated programs*

Take the Next Step

Supplemental Disability Fills Maternity Holes

Supplemental short term disability benefits are designed to fill holes. The policies make up one very important component of supplemental health insurance for growing families – replacing mom's income during her maternity leave, and in case of pregnancy complications, or postpartum disorders.

This is an important but often misunderstood income security program. Understand precisely how the policies work based upon the objective of the coverage. There are many income security programs, and they all have holes that supplemental short term disability insurance helps to fill.

Cash in on Your Smart Purchase

Maternity Leave

Supplemental short term disability for maternity leave covers mom's recovery from normal childbirth. Normal childbirth is often a planned medical event. The benefits paid to the policyholder for this planned medical event can be several multiples of the premiums paid by the policyholder. Coverage must begin before conception.

As a result these policies are sold through only one channel –at the work site. If you want a policy covering recovery from normal childbirth it must be offered by an employer. There are two basic types of options for employees: group employee plans, and individual employee programs.

Group Employee Plans

Group short term disability is great to have as an employee benefit, but is scarce. The employer owns the policy, and often pays the premium on behalf of employees. The option is scarce because there is a direct cost to employers. There are group plans that are 100% employee paid, but frequently have significant participation requirements.

Individual Employee Plans

Supplemental short term disability employee benefits programs can be 100% employee paid. There is no direct cost to employers to allow employees to enjoy maternity leave income. The policies are employee-owned so they can keep the coverage wherever they work. Participation requirements are much lower (only three participating employees), so the option is widely accessible.

That is why we state that paid maternity leave exists in the U.S.A. Many women enjoy maternity leave income while recovering from normal childbirth. They bought a policy at work and paid for it themselves. More employers should be making this coverage available, and more employees should be asking for the option.

You can get a short term disability quote to estimate premium costs and compare them with projected benefits for maternity leave. Determine whether asking your employer to make an option available is worth the security of maternity leave income.

Pregnancy Complications

Complications of pregnancy are very common. Mom may need to leave work prior to delivery when her doctor orders bed rest. Postpartum disorders may delay her recovery from childbirth.

Supplemental short term disability can be purchased as individual policies. Individual short term disability policies can be purchased through employers or directly. Policies purchased directly will not cover recovery from normal childbirth, but may cover complications of pregnancy and other medical conditions.

Applying for benefits after delivery is straightforward. There is often an express pregnancy claim form for normal childbirth. Women experiencing complications during pregnancy may need to provide additional medical details.

Supplemental Disability Fills Other Holes

Supplemental short term disability insurance also fills two very large holes in other income security programs: long elimination periods, and strict eligibility criteria. Temporary disabilities are far more common than permanent disabilities, yet many people find it far easier to find coverage for permanent conditions. Common accidents and illnesses trigger the need for this type of coverage.

Long Elimination Periods

Long term disability insurance makes benefit payments for disabling conditions – often up to age

65. But many of these policies come with very long elimination periods. The elimination period is the length of time you are disabled before payments begin.

The longer elimination periods are needed to keep the premium costs affordable. But if a family is living check to check they may lose everything before payments begin.

Strict Eligibility Criteria

Social Security Disability is available across the U.S. The program is designed to provide income security for permanent disabilities; those expected to last one year or more, or to result in death. There is an “any occupation” disability definition that is very strict, making it difficult to qualify.

Many disability attorneys make a comfortable living helping people dispute denied Social Security Disability claims. Supplemental short term disability insurance uses an “own occupation” disability definition that makes it far easier to qualify.

Off the Job Accidents

Workers compensation is geared to provide income security for workers who get injured at the worksite. This program is mandatory in all fifty states. But off the job accidents are more frequent, and leave families exposed. Supplemental short term disability insurance helps close this gap.

State Mandated Disability Programs

Supplemental short term disability insurance plugs the holes in state mandated temporary disability programs. There are two holes to fill: availability, benefit amounts and duration.

State disability programs have very limited availability. Only five states require employers and employees to participate. That means forty five states have nothing.

The states that do require a program have limited benefits. Some limit the monthly replacement amount to only 55%, while one limits the weekly benefit amount to a paltry $170 per week. Four states limit the length of time payments are made to only six months. Benefit amounts are sometimes taxable.

Supplemental short term disability insurance helps fill all these holes.

Posted on February 27, 2013 by Kevin Haney

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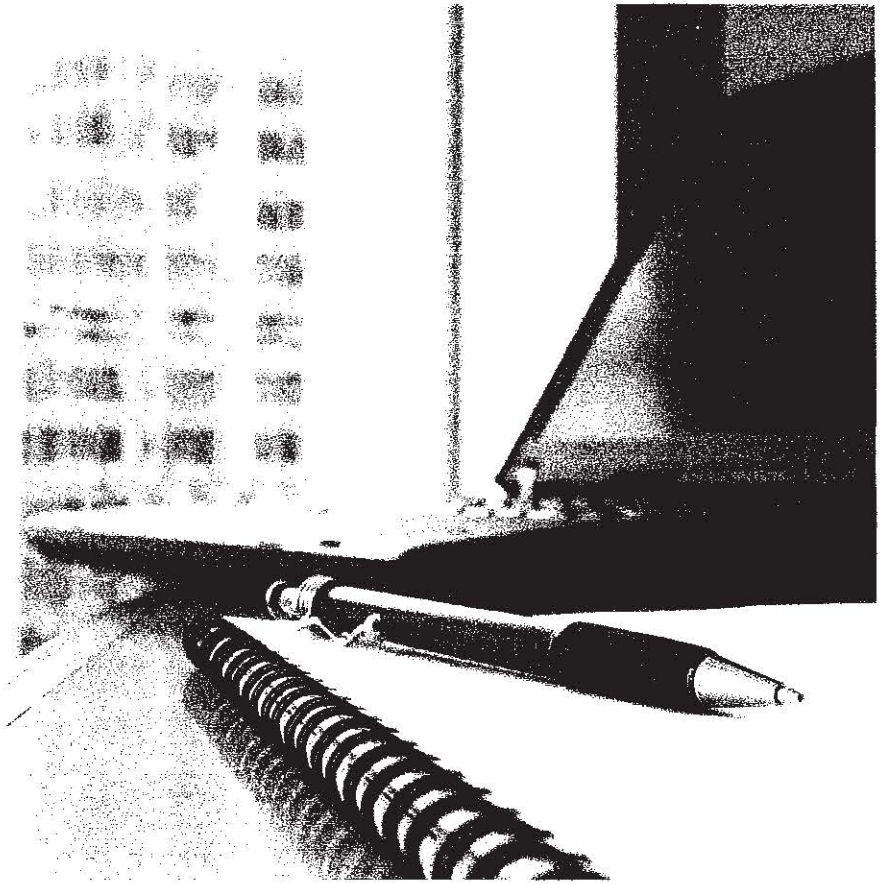
EXHIBIT 10

Milliman

Milliman Mortgage Risk Analysis



Reinsurance Performance Metrics for Atrium Reinsurance Corporation

1st Quarter 2013

Michael C. Schmitz, FCAS, MAAA -- Principal and Consulting Actuary
Ken Bjurstrom -- Principal and Financial Consultant
Jean Cox -- Financial Consultant
July 11, 2013

Reinsurance Performance Metrics

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Reinsurance Performance Metrics for Atrium Reinsurance Corporation

Executive Summary

March 31, 2013 Evaluation

Milliman, Inc.

Mike Schmitz, FCAS, MAAA – Principal and Consulting Actuary
Ken Bjurstrom – Principal and Financial Consultant
Jean Cox – Financial Consultant

July 11, 2013

Milliman

Executive Summary Overview

The Executive Summary provides highlights of the results of our Reinsurance Performance Metrics analysis as of March 31, 2013 for Atrium Reinsurance Corporation ("Atrium"). Consistent with our approach for the past several quarters, we lead this Executive Summary with an overview of our forecasting results, together with a summary of home price forecasts, as incorporated into our analysis. While the full set of Metrics exhibits also includes a variety of risk analytics sections, this Executive Summary addresses the following primary topics:

Milliman

Forecasting Results: Selected Loss Rate Comparison

Atrium Reinsurance Corporation

Summary Comparison of Selected Loss Rate in the Layers
12/31/12 vs. 03/31/13

UGC

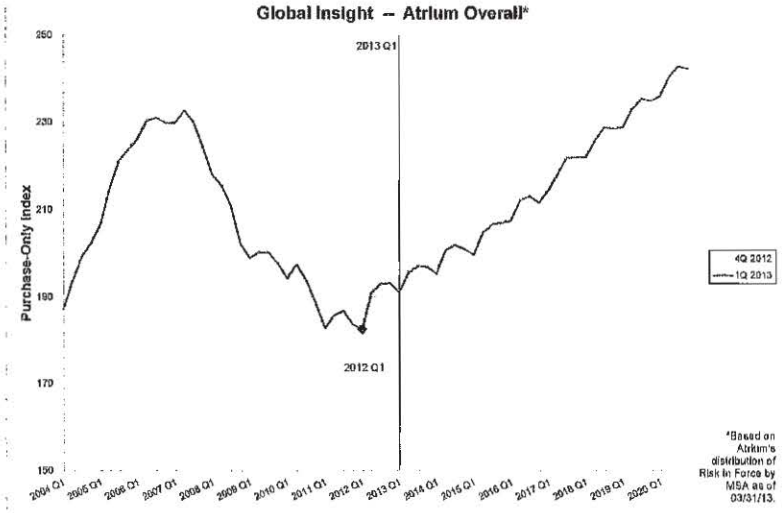
Book Year	Selected Loss Rate in the Layer as of the 12/31/12 Evaluation	Selected Loss Rate in the Layer as of the 03/31/13 Evaluation
2001	0.00%	0.00%
2002	0.00%	0.00%
2003	0.05%	0.05%
2004	4.50%	4.39%
2005	10.00%	10.00%
2006	10.00%	10.00%
2007	10.00%	10.00%
2008	10.00%	10.00%
2009	1.50%	1.45%

- **Overall, our March 31, 2013 loss rate selections (as a percentage of original risk) decreased for two of Atrium's contracts with United Guaranty, while the remainder of the selections are unchanged from those in our December 2012 analysis**
- **Our March 2013 ultimate loss rate selections continue to consume Atrium's entire 10% reinsured risk band in the four United Guaranty contracts in book years 2005 - 2008**
- **At 4.39%, our March 2013 selection for the 2004 United Guaranty contract is 11 basis points lower than our December selection**
  - **This is less than half the total potential risk exposure of 10% for this particular contract**
- **Our March selection for the 2009 United Guaranty contract is 5 basis points lower than the previous selection, reflecting a decline from 1.50% to 1.45%**
  - **The selection for the 2003 book is unchanged at 0.05%**

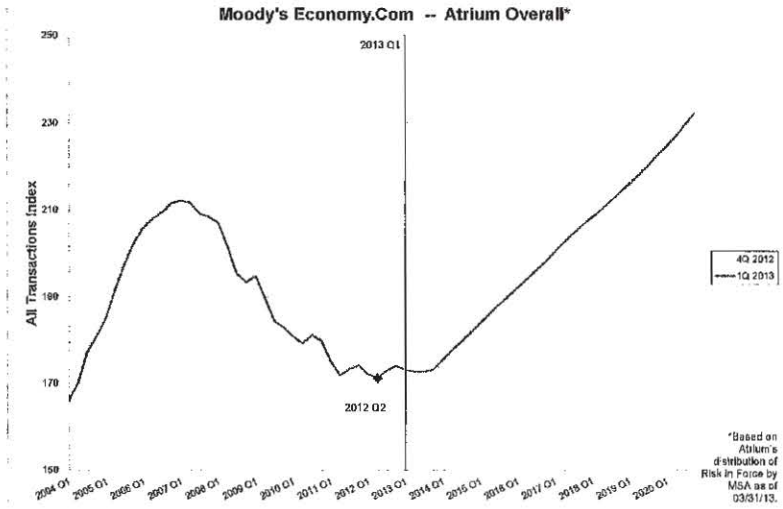
Milliman

Home Price Forecast Comparisons

- As illustrated by the blue line in the chart to the right, Global Insight's most recent forecast (which reflects actual FHFA data through December 31, 2012) generally coincides with the previous forecast (see green line)
  - Global Insight's 1st quarter 2013 forecast continues to indicate a belief that the home price trough is behind us, with roughly a 22% decline in home prices from the peak in the 2nd quarter of 2007 to the trough in the 1st quarter of 2012 (based on Atrium's specific risk distribution by MSA)
    - The previous analysis showed a similar peak-to-trough decline and projected a trough at 1st quarter 2012 as well



- The most recent forecast from Moody's Economy.Com (which is also represented by a blue line) continues to predict that home prices will be relatively flat through 2013 before beginning to increase
  - The updated forecast from Moody's is based on the assumption that home prices reached a bottom in the 2nd quarter of 2012
  - Moody's 1st quarter 2013 forecast predicts a decline of approximately 19% from the peak in the 1st quarter of 2007 to the 2nd quarter 2012 trough (again, based on Atrium's specific risk distribution)
  - The previous forecast (as shown in green) also projected that the trough was reached in 2nd quarter 2012



Note: The 1Q 2013 forecasts incorporate actual FHFA indices as of December 31, 2012

Milliman

Projected Ultimate Losses and Premium

- In our evaluation of Atrium's books as of March 31, 2013, we project total ultimate paid losses of approximately $168 million in the captive's reinsured layers
  - Of this amount, nearly $126 million has been paid as of March 2013, and $43 million is projected to be paid over the remaining term of the United Guaranty contracts
- We also project total ultimate written premium of approximately $327 million for the captive
  - As of March 2013, approximately $308 million has already been written
  - Over the remainder of the contract term, an additional $19 million in premium is projected to be written, but the projected future losses are more than 2.2 times the magnitude of the projected future premium
- Overall, for all United Guaranty book years combined, the projected ultimate loss ratio as of March 31, 2013 is 51.5%, which is generally comparable to the 51.9% projected ultimate loss ratio from our December 2012 evaluation

Atrium Reinsurance Corporation
UGC

Loss Ratios by Book Year
Evaluated as of 03/31/13

($000's)

Book Year	Projected Ultimate Paid Losses	Projected Ultimate Written Premium	Projected Ultimate Loss Ratio
2001 [1]	0	157,931	0.0%
2002	0	24,601	0.0%
2003	253	20,728	1.2%
2004	37,060	41,108	90.2%
2005	46,303	27,446	168.7%
2006	21,905	13,401	163.5%
2007	37,367	24,335	153.5%
2008	23,812	14,195	167.7%
2009	1,693	3,227	52.5%
UGC Total	168,393	326,974	51.5%

[1] Also includes reinsurer written premium for book years 1994 - 2000.

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Forecasting Results: Loss Ratios

- **At $168.4 million, the projected ultimate losses from our March 2013 analysis are roughly $1.0 million lower than those projected in our December 2012 analysis, and projected written premium is approximately $712,000 higher than our previous estimate**
  - **The reduction in the projected ultimate loss rate for the 2004 book had the largest favorable impact on projected losses, accounting for $952,000 of the $1.0 million decrease in projected ultimate losses for the captive**

Atrium Reinsurance Corporation
UGC

Loss Ratio Comparison
($000's)

	A	B	C	D	E	F	G = D - A	H = E - B	I = F - C
							Difference between 12/31/12 and 03/31/13		
	Projections as of 12/31/12			Projections as of 03/31/13			Difference		
Book Year	Projected Ultimate Paid Losses	Projected Ultimate Written Premium	Projected Ultimate Loss Ratio	Projected Ultimate Paid Losses	Projected Ultimate Written Premium	Projected Ultimate Loss Ratio	Projected Ultimate Paid Losses	Projected Ultimate Written Premium	Projected Ultimate Loss Ratio
2001 [1]	0	157,931	0.0%	0	157,931	0.0%	0	0	0.0%
2002	0	24,600	0.0%	0	24,601	0.0%	0	1	0.0%
2003	253	20,688	1.2%	253	20,728	1.2%	0	40	0.0%
2004	38,012	41,073	92.5%	37,060	41,108	90.2%	(952)	36	-2.4%
2005	46,308	27,435	168.8%	46,303	27,446	168.7%	(5)	12	-0.1%
2006	21,894	13,334	164.2%	21,905	13,401	163.5%	11	68	-0.7%
2007	37,375	23,873	156.6%	37,367	24,335	153.5%	(9)	462	-3.0%
2008	23,798	14,103	168.7%	23,812	14,195	167.7%	14	93	-1.0%
2009	1,756	3,225	54.4%	1,693	3,227	52.5%	(62)	2	-2.0%
Total	169,394	326,262	51.9%	168,393	326,974	51.5%	(1,001)	712	-0.4%

[1] Also includes reinsurer written premium for book years 1994 - 2000.

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Indicated Unpaid Claim Estimate per MI Cession Statement

Atrium Reinsurance Corporation
Indicated Unpaid Claim Estimate at 03/31/13
UGC

($000's)

		(A)	(B)	(C) = (A) - (B)
	Book Year	Primary Insurer: Incurred Losses in Layer [1] As of 03/31/13	Primary Insurer: Paid Losses in Layer [2] As of 03/31/13	Primary Insurer: Indicated Unpaid Claim Estimate As of 03/31/13
	2001	0	0	0
	2002	0	0	0
	2003	0	0	0
	2004	30,732	18,405	12,327
	2005	46,303	36,541	9,762
	2006	21,905	21,905	0
	2007	37,367	37,367	0
	2008	17,697	11,465	6,232
	2009	0	0	0
(D)	Total	154,004	125,683	28,322
(E)	Reserve posted on Atrium 03/31/13 Financial Statement ($000's)			30,091
(F)	Less: Outstanding Payments Attributable to March 2013 Cession Activity [3]			1,272
(G)	Adjusted Reserve: (E) - (F)			28,819
(H)	Difference = (D) - (G): ($000's)			(498)
(I)	Difference = (H) / (G): (%)			-1.7%

[1] As reported by primary MI company on cession statements (includes an IBNR provision)
[2] As reported in the cession statement (includes reinsured losses payable but not disbursed)
[3] This adjustment accounts for the lag in payments attributable to the most recent cession activity. These losses payable are included in the booked loss reserve on Atrium's March 2013 financial statements.

- **Prior to 2010, Atrium had historically booked its loss reserve using the method of multiplying the projected ultimate loss ratio by the earned premium to date**
- **It is our understanding that in 2010 and subsequent, Atrium has been booking a reserve that is based on the delinquent loan methodology of its primary insurers**
- **In the accompanying exhibit, we provide a summary of the incurred losses in Atrium's reinsured layers (column A), together with the paid losses as of March 31 (column B), as provided in the cession statement from United Guaranty (Atrium's sole remaining MI partner)**
- **Based on United Guaranty's cession statement information, the indicated unpaid claim estimate as of March 31, 2013 is approximately $28.3 million, as shown in column (C)**
- **Atrium's booked reserve (after adjusting for outstanding losses payable pertaining to March 2013 cession activity) is $28.8 million (row G)**

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Statutory Premium Deficiency Calculations – Actuarial Central Estimate

Atrium Reinsurance Corporation
Statutory Premium Deficiency Calculation -- Actuarial Central Estimate [1]
As of 03/31/13
($000's)

		UGC Total
A	Present Value of Future Paid Losses	41,733
B	Present Value of Future Expenses [2]	1,388
C = A + B	Present Value of Total Future Costs	43,121
D	Present Value of Future Written Premium	18,555
E	Unearned Premium Reserve (UPR) as of 03/31/13	66
F	Loss Reserve as of 03/31/13 (Adjusted To Reflect Pending Payments)	28,819
G = D + E + F	Total Sources of Funds (Excluding Contingency Reserve)	47,441
H = max (C - G, 0)	Indicated Premium Deficiency (Gross of Trust Balance and Excl. Contingency Reserve)	0
I	March 31, 2013 Trust Balance, Net of UPR [3]	118,628
J = max (I - F, 0)	Trust Balance, Net of Carried Loss Reserve	89,810
K = min (H, J)	Indicated Premium Deficiency (Limited to Trust Balance and Excl. Contingency Reserve)	0
L	Contingency Reserve as of 03/31/13	54,403
M = max ((H or K) - L, 0)	Indicated Statutory Premium Deficiency (Including Contingency Reserve, with Trust Balance Limitation)	0

[1] Refers to a range of reasonable ultimate loss estimates, as developed in Milliman's analysis for Atrium.
Note that these scenarios only present a range of projected ultimate losses. Projected written premium does not vary in these exhibits.
[2] This analysis incorporates expense assumptions provided by Atrium management.
[3] The trust account balance was taken from the cedant's cession statement. This represents the market value of the trust, plus the net settlement attributable to the March 2013 cession activity, less the unearned premium reserve as of March 31, 2013.

Notes: (1) The Discount Rate in this scenario is 2.0%, for illustrative purposes only.
Alternative discount rate scenarios have also been provided for evaluation by Atrium management.
(2) These loss and premium forecasts reflect the full run-off of the business on the books as of March 31, 2013.

- **Based on Milliman's actuarial central estimate at an illustrative 2% discount rate, the present value of Atrium's total projected future paid losses and expenses is approximately $43.1 million, while the present value of the total sources of funds (including future written premium, the unearned premium reserve and loss reserve) is roughly $47.4 million**

- **Historically, we have provided the statutory premium deficiency calculations under two methods: (1) On an aggregate, pooled basis (in which a deficiency in one trust could be offset by a surplus in another trust) and (2) On an individual trust basis (in which individual trust deficiencies are combined without the offsetting benefit of trusts in a surplus position), but only one trust currently remains active for Atrium, so there is no offsetting benefit**

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Statutory Premium Deficiency Calculations

- In this quarter's evaluation, Atrium's contingency reserve of approximately $54.4 million – as an additional source of funds – is not necessary to shield the company from an indicated statutory premium deficiency, since the company's sources of funds exceed the corresponding uses
  - Atrium's sources of funds (row G) exceed the uses of funds (row C) by approximately $4.3 million, so there is no deficiency indicated in row H
  - Similarly, the trust account balance limitations shown in rows I through K are not necessary to protect Atrium from an indicated deficiency for its United Guaranty contracts
    - In our December 2012 evaluation, the indicated premium deficiency attributable to the United Guaranty contracts was also zero
  - Generally, GAAP financial statements do not have a contingency reserve, but the scope of our engagement did not include analyzing the need for a premium deficiency reserve on a GAAP basis
- These calculations reflect the full run-off of the business on the books as of March 31, 2013 and also consider the impact of trust account balance limitations
- Note that Milliman is not opining on the appropriateness of the premium deficiency calculations
- For reference, Milliman has also prepared statutory premium deficiency calculation exhibits under more favorable and adverse loss scenarios within a range of reasonable unpaid claim estimates (see pages 18 and 19 of this Executive Summary)
  - Note that these scenarios only present a range of projected ultimate losses; projected written premium does not vary in these exhibits

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Premium Deficiency Calculation – Sensitivity to Alternative Discount Rate Assumptions

- **We recognize that our clients may wish to consider different investment yield assumptions for discounting future cash flows**
  - **The following exhibit illustrates the sensitivity of the premium deficiency calculation to alternative discount rate assumptions (based on the actuarial central estimate of losses)**
  - **A statutory premium deficiency (limited to trust balance and including contingency reserve) is not indicated in any of the discount rate scenarios ranging from 0% to 6%, as presented below**

Atrium Reinsurance Corporation

Statutory Premium Deficiency Calculation -- Actuarial Central Estimate [1]
Alternative Discount Rate Scenarios (UGC Total)

As of 03/31/13
($000's)

Discount Rate	0.0%	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%	4.0%	5.0%	6.0%
Present Value of Future Paid Losses	42,710	42,461	42,215	41,972	41,733	41,497	41,265	40,809	40,365	39,933
Present Value of Future Expenses	1,500	1,471	1,442	1,415	1,388	1,362	1,337	1,288	1,243	1,200
Present Value of Total Future Costs	44,210	43,932	43,657	43,387	43,121	42,859	42,601	42,097	41,608	41,133
Present Value of Future Written Premium	19,185	19,024	18,865	18,709	18,555	18,405	18,257	17,969	17,690	17,421
Unearned Premium Reserve (UPR) as of 03/31/13	66	66	66	66	66	66	66	66	66	66
Loss Reserve as of 03/31/13 (Adjusted To Reflect Pending Payments)	28,819	28,819	28,819	28,819	28,819	28,819	28,819	28,819	28,819	28,819
Total Sources of Funds (Excluding Contingency Reserve)	48,071	47,909	47,750	47,594	47,441	47,290	47,142	46,854	46,575	46,306
Indicated Premium Deficiency (Gross of Trust Balance and Excl. Contingency Reserve)	0	0	0	0	0	0	0	0	0	0
Indicated Premium Deficiency (Limited to Trust Balance and Excl. Contingency Reserve)	0	0	0	0	0	0	0	0	0	0
Contingency Reserve as of 03/31/13	54,403	54,403	54,403	54,403	54,403	54,403	54,403	54,403	54,403	54,403
Indicated Statutory Premium Deficiency (Including Contingency Reserve, with Trust Balance Limitation)	0	0	0	0	0	0	0	0	0	0

[1] Refers to a range of reasonable ultimate loss estimates, as developed in Milliman's analysis for Atrium.
Note that these scenarios only present a range of projected ultimate losses. Projected written premium does not vary in these exhibits.

Note: These loss and premium forecasts reflect the full run-off of the business on the books as of March 31, 2013.

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Forecasting Results: Emergence of Projected Loss Payments

Atrium Reinsurance Corporation
UGC

($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D														
		Atrium Reinsured Layer																	
						Projected Incremental Paid Losses in the Reinsured Layer													
Book Year	Gross Losses Paid by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Paid Losses in Layer as of 03/31/13	Projected Future Losses in Layer	2013[1]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001	9,463	43,677	0	0	0														
2002	12,476	36,335	0	0	0	0													
2003	14,571	20,208	253	0	253	0	253												
2004	52,200	33,795	37,060	18,405	18,655	5,865	9,134	3,636											
2005	55,062	18,521	46,303	36,541	9,762	6,536	3,226	0	0										
2006	40,118	8,762	21,905	21,905	0	0	0	0	0	0									
2007	63,129	14,947	37,367	37,367	0	0	0	0	0	0	0								
2008	20,890	9,525	23,812	11,465	12,347	3,292	7,245	1,810	0	0	0	0							
2009	885	4,672	1,693	0	1,693	0	0	0	475	764	353	92	9						
Total	268,697		168,393	125,683	42,710	15,713	19,858	5,446	475	764	353	92	9	0	0	0	0	0

[1] For remaining nine months of 2013

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.

- **During the 1st quarter of 2013, Atrium issued roughly $4.2 million in loss payments, resulting in ever-to-date payments of nearly $126 million for the United Guaranty contracts**
  - **Actual 1st quarter payments were $779,000 more than the projected 1st quarter payments of $3.4 million from our December analysis**
  - **The actual 1st quarter payments of $1.4 million for the 2008 book were $771,000 higher than the projected payments of $656,000, accounting for nearly the entire difference between actual and projected payments**
- **As indicated above, our analysis projects that nearly 40% of Atrium's remaining loss payments will materialize in 2013, with estimated total payments of approximately $15.7 million for the remaining nine months of this calendar year**

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Projected Loss Payments by Quarter through 2015

- **Our analysis further projects that more than 50% of Atrium's remaining payments will be distributed by the 1st quarter of 2014, with the largest dollar distributions estimated to occur between 3rd quarter 2013 and 1st quarter 2014**
  - **This evaluation also projects that loss payments for the 2005 contract with United Guaranty will exhaust the captive's reinsured layer in early 2014**

Atrium Reinsurance Corporation
UGC

($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D																
		Atrium Reinsured Layer				Projected Incremental Paid Losses in the Reinsured Layer															
Book Year	Gross Losses Paid by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Paid Losses in Layer as of 03/31/13	Projected Future Losses in Layer	2013 2Q	2013 3Q	2013 4Q	2014 1Q	2014 2Q	2014 3Q	2014 4Q	2015 1Q	2015 2Q	2015 3Q	2015 4Q	2016	2017	2018	2019	2020 - 2025
2001	9,453	43,677	0	0	0																0
2002	12,478	36,336	0	0	0	0	0	0													0
2003	14,571	20,208	253	0	253	0	0	0	0	0	0	253									0
2004	52,200	33,795	37,060	18,405	18,655	1,276	2,124	2,485	2,533	2,434	2,201	1,967	1,661	1,445	530	0					0
2005	55,062	18,521	46,303	36,541	9,762	1,394	2,342	2,800	2,953	273	0	0	0	0	0	0	0				0
2006	40,118	8,762	21,905	21,905	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2007	63,129	14,947	37,367	37,367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
2008	20,990	9,525	23,812	11,465	12,347	669	1,156	1,467	1,669	1,812	1,869	1,894	1,810	0	0	0	0	0	0	0	0
2009	685	4,672	1,693	0	1,693	0	0	0	0	0	0	0	0	0	0	0	475	764	353	92	9
Total	268,697		168,393	125,683	42,710	3,338	5,622	6,753	7,155	4,519	4,070	4,114	3,471	1,445	530	0	475	764	353	92	9

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.

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Forecasting Results: Emergence of Projected Incurred Losses

Atrium Reinsurance Corporation
UGC

($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D													
		Atrium Reinsured Layer				Projected Incremental Incurred Losses in the Reinsured Layer (Based on Primary Insurer's case reserves for known delinquencies, as well as an IBNR loss provision)												
Book Year	Gross Losses Incurred by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Incurred Losses in Layer as of 03/31/13	Projected Future Losses in Layer	2013[1]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001	10,070	43,677	0	0	0													
2002	14,249	36,335	0	0	0	0												
2003	18,931	20,208	253	0	253	253	0											
2004	64,527	33,795	37,060	30,732	6,328	6,328	0	0										
2005	68,410	18,521	46,303	46,303	0	0	0	0	0									
2006	47,686	8,762	21,905	21,905	0	0	0	0	0	0								
2007	78,392	14,947	37,367	37,367	0	0	0	0	0	0	0							
2008	27,222	9,525	23,812	17,697	6,115	6,115	0	0	0	0	0	0						
2009	1,119	4,672	1,693	0	1,693	0	0	805	666	222	0	0	0					
Total	330,605		168,393	154,004	14,389	12,696	0	805	666	222	0	0	0	0	0	0	0	0

[1] For remaining nine months of 2013

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.
(3) The incurred loss development in this exhibit is based on the Primary Insurer's underlying case reserves for known delinquencies, as well as an IBNR loss provision provided by the Primary Insurer.

- **According to United Guaranty's cession statement, Atrium has *incurred* losses in the layer of approximately $154 million (of which approximately $126 million has been paid) as of March 31, 2013**
  - **As of the March evaluation date, five contracts in book years 2004 – 2008 had penetrated Atrium's reinsured layers, while three contracts fully exhausted the layers on an incurred basis**
- **Our March 2013 analysis forecasts additional incurred losses of approximately $12.7 million for the remaining nine months of calendar year 2013**
  - **The forecasted emergence of projected incurred losses in this exhibit is based on the primary insurer's case reserves for known delinquencies (as reported in the MI cession statement, not Atrium's financial statements), together with an IBNR provision**

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Projected Incurred Losses by Quarter through 2015

Atrium Reinsurance Corporation
UGC

($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D
			Atrium Reinsured Layer		
Book Year	Gross Losses Incurred by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Incurred Losses in Layer as of 03/31/13	Projected Future Losses in Layer
2001	10,070	43,677	0	0	0
2002	14,249	36,335	0	0	0
2003	18,931	20,208	253	0	253
2004	64,527	33,795	37,060	30,732	6,328
2005	68,410	18,521	46,303	46,303	0
2006	47,686	8,762	21,905	21,905	0
2007	78,392	14,947	37,367	37,367	0
2008	27,222	9,525	23,812	17,697	6,115
2009	1,119	4,672	1,693	0	1,693
Total	330,605		168,393	154,004	14,389

Projected Incremental Incurred Losses in the Reinsured Layer
(Based on Primary Insurer's case reserves for known delinquencies, as well as an IBNR loss provision)

Book Year	2013 2Q	2013 3Q	2013 4Q	2014 1Q	2014 2Q	2014 3Q	2014 4Q	2015 1Q	2015 2Q	2015 3Q	2015 4Q	2016	2017	2018	2019	2020 - 2025
2001																0
2002	0	0	0													0
2003	0	0	253	0	0	0	0									0
2004	2,251	2,163	1,913	0	0	0	0	0	0	0	0					0
2005	0	0	0	0	0	0	0	0	0	0	0	0				0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
2008	2,359	2,266	1,490	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	272	272	261	666	222	0	0	0
Total	4,610	4,429	3,656	0	0	0	0	0	272	272	261	666	222	0	0	0

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.
(3) The incurred loss development in this exhibit is based on the Primary Insurer's underlying case reserves for known delinquencies, as well as an IBNR loss provision provided by the Primary Insurer.

- **As of March 31, 2013, the incurred losses continue to fully exhaust the layers for the 2005 – 2007 books for United Guaranty**

- **Our analysis further projects that incurred losses for the 2008 book will fully exhaust its layer by year-end 2013**
  - **We also project that incurred losses for the 2003 and 2004 books will reach their respective projected ultimate loss levels by year-end 2013**

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Projected Future Written Premium

Atrium Reinsurance Corporation

UGC

($000's)

	Reinsurer Written Premium[3]																
Book Year	Projected Ultimate Premium	Written as of 03/31/13	Projected Total Future	PV Future[1] @ 03/31/13	2013[2]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001	157,931	157,931	0	0 [4]													
2002	24,601	24,601	0	0													
2003	20,728	20,560	168	167	168												
2004	41,108	39,323	1,785	1,762	1,175	610											
2005	27,446	24,436	3,010	2,946	1,161	1,304	545										
2006	13,401	11,230	2,172	2,109	629	707	590	246									
2007	24,335	17,781	6,554	6,310	1,483	1,727	1,494	1,292	559								
2008	14,195	9,677	4,518	4,325	947	1,064	888	742	619	259							
2009	3,227	2,250	977	937	248	240	175	128	93	68	25						
Total	326,974	307,768	19,185	18,555	5,811	5,651	3,692	2,408	1,271	327	25	0	0	0	0	0	0

[1] The Discount Rate in this scenario is 2%, for illustrative purposes only. Alternative discount rate scenarios have also been provided for evaluation by Atrium management.

[2] For remaining nine months of 2013

[3] Net of Ceding Commission and Terminal Unearned Premium Reserve

[4] Also includes reinsurer written premium for book years 1994 - 2000.

Note: The written premium projections incorporate the following PSA assumptions by book year: 450% for 2003; 375% for 2004; 275% for 2005 - 2006; 225% for 2007; 275% for 2008; and 450% for 2009.

- **In our March 31, 2013 analysis, we project that Atrium's total ultimate written premium for its United Guaranty contracts will be approximately $327.0 million, which is $712,000 higher than our projected ultimate premium projection from our December 2012 evaluation**
  - **The actual 1st quarter premium of $2.3 million was $172,000 more than the projected written premium of $2.1 million for the quarter**
  - **The updated premium estimate reflects the effects of adjustments to PSA assumptions based on changes in the rate of run-off in recent quarters, together with judgmental adjustments based on current interest rate activity**

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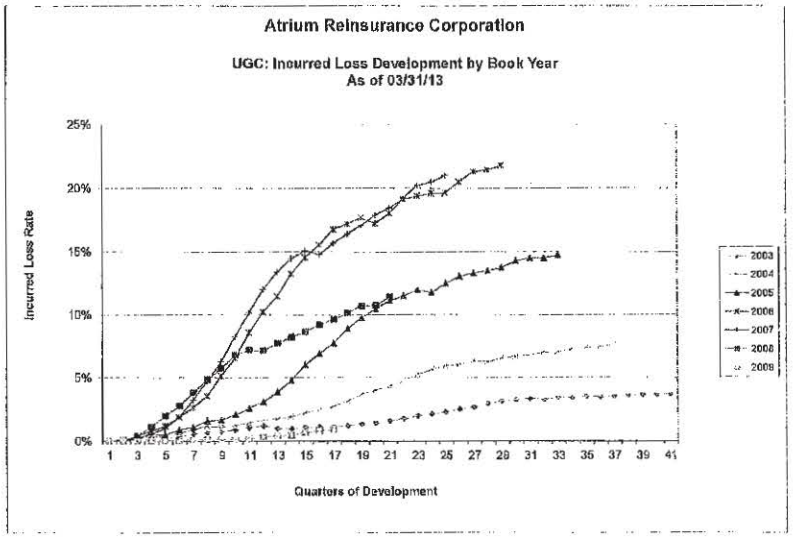
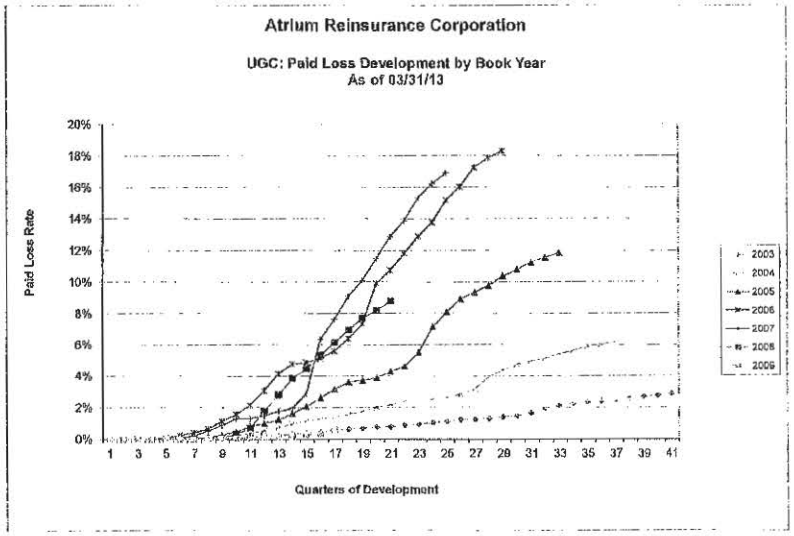
Historical Incurred and Paid Loss Development

- As illustrated in the accompanying charts, recent book years have experienced an acceleration in incurred and paid loss development (versus that for older book years)
  - For example, United Guaranty's 2007 book surpassed a 10% incurred loss rate after 11 quarters of development, while the 2005 vintage required 20 quarters to pass the same threshold
  - As of the March 2013 evaluation point, the highest incurred loss rates for Atrium correspond to the 2006 and 2007 United Guaranty books, at 21.8% and 21.0% respectively
  - As shown in the bottom chart, loss payments for United Guaranty's 2006 and 2007 books are now more than 14% of the original risk threshold (which is the layer detachment point for the books)
    - For the 2005 book, the paid loss rate is nearly 11.9% as of March 31, 2013





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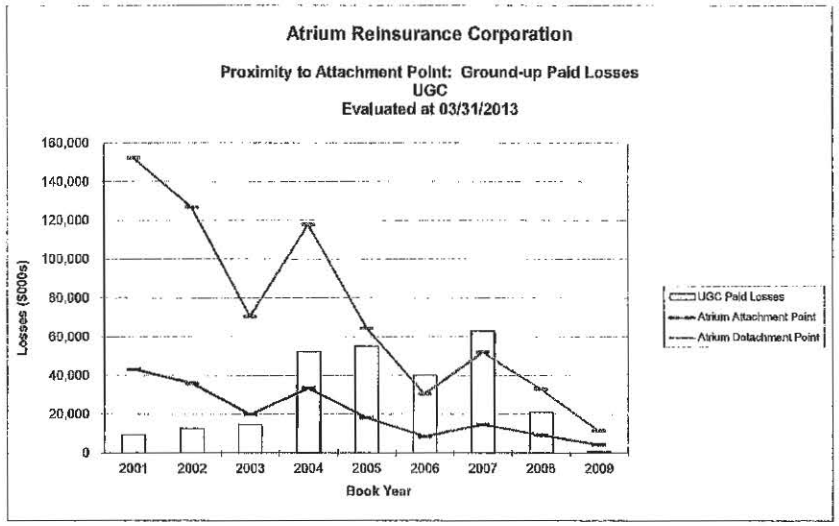
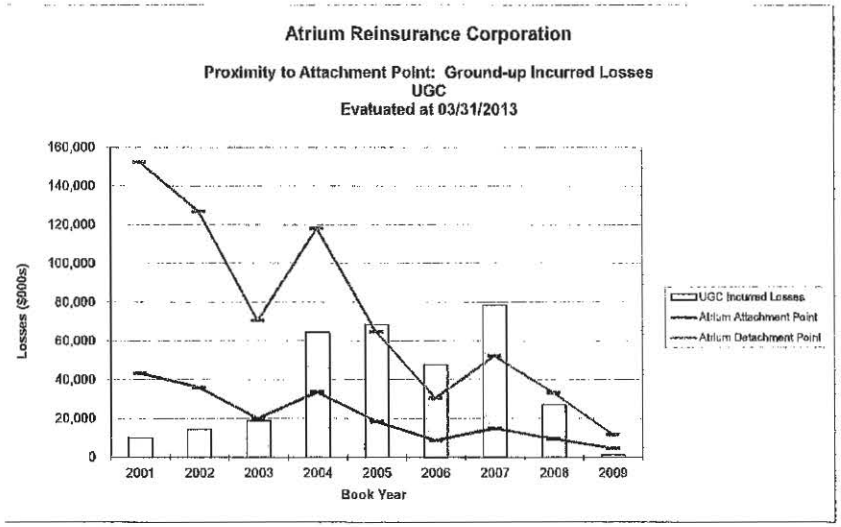
Proximity to Risk Layers





- **As shown above, paid losses for United Guaranty's 2004 - 2008 books are in Atrium's reinsured risk layers**
  - **In addition (as mentioned previously), paid losses for book years 2006 and 2007 are above the <u>detachment</u> point for their respective layers**
  - **Paid losses for book year 2005 are approximately $9.8 million away from reaching the detachment point for its layer and are projected to pass this point by mid-2014**
- **Also note that as of March 31, 2013, incurred losses for United Guaranty's 2005 - 2007 books are above the corresponding Atrium layer <u>detachment</u> points**

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Forecasting – Additional Exhibits for Reference

For ease of reference, we have attached the following exhibits to the Executive Summary. Please refer to Sections M and N of the Metrics deliverable for the full set of exhibits:

- Statutory Premium Deficiency Calculations – Low Scenario
- Statutory Premium Deficiency Calculations – High Scenario
- Summary of Reinsurance Programs
- Summary of Selected A Priori Loss Rates
- A Priori Loss Rate Indications
- Selected Loss Rate Summary
- Projected Ultimate Losses
- Projected Ultimate Loss Ratio Comparison
- Present Value of Future Paid Losses and Written Premium
- Projected Paid and Incurred Loss Emergence
- Quarterly Breakdown through 2015 – Losses
- Quarterly Breakdown through 2015 – Premium

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Statutory Premium Deficiency Calculations – Low Scenario

Atrium Reinsurance Corporation
Statutory Premium Deficiency Calculation -- Low Scenario [1]
As of 03/31/13
($000's)

		UGC Total
A	Present Value of Future Paid Losses	38,264
B	Present Value of Future Expenses [2]	1,388
C = A + B	Present Value of Total Future Costs	39,652
D	Present Value of Future Written Premium	18,555
E	Unearned Premium Reserve (UPR) as of 03/31/13	66
F	Loss Reserve as of 03/31/13 (Adjusted To Reflect Pending Payments)	28,819
G = D + E + F	Total Sources of Funds (Excluding Contingency Reserve)	47,441
H = max (C - G, 0)	Indicated Premium Deficiency (Gross of Trust Balance and Excl. Contingency Reserve)	0
I	March 31, 2013 Trust Balance, Net of UPR [3]	118,629
J = max (I - F, 0)	Trust Balance, Net of Carried Loss Reserve	89,810
K = min (H, J)	Indicated Premium Deficiency (Limited to Trust Balance and Excl. Contingency Reserve)	0
L	Contingency Reserve as of 03/31/13	54,403
M = max ((H or K) - L, 0)	Indicated Statutory Premium Deficiency (Including Contingency Reserve, with Trust Balance Limitation)	0

[1] Refers to a range of reasonable ultimate loss estimates, as developed in Milliman's analysis for Atrium. Note that these scenarios only present a range of projected ultimate losses. Projected written premium does not vary in these exhibits.

[2] This analysis incorporates expense assumptions provided by Atrium management.

[3] The trust account balance was taken from the cedant's cession statement. This represents the market value of the trust, plus the net settlement attributable to the March 2013 cession activity, less the unearned premium reserve as of March 31, 2013.

Notes: (1) The Discount Rate in this scenario is 2.0%, for illustrative purposes only.
Alternative discount rate scenarios have also been provided for evaluation by Atrium management.
(2) These loss and premium forecasts reflect the full run-off of the business on the books as of March 31, 2013.

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Statutory Premium Deficiency Calculations – High Scenario

Atrium Reinsurance Corporation
Statutory Premium Deficiency Calculation -- High Scenario [1]
As of 03/31/13
($000's)

		UGC Total
A	Present Value of Future Paid Losses	48,624
B	Present Value of Future Expenses [2]	1,388
C = A + B	Present Value of Total Future Costs	50,012
D	Present Value of Future Written Premium	18,555
E	Unearned Premium Reserve (UPR) as of 03/31/13	66
F	Loss Reserve as of 03/31/13 (Adjusted To Reflect Pending Payments)	28,819
G = D + E + F	Total Sources of Funds (Excluding Contingency Reserve)	47,441
H = max (C - G, 0)	Indicated Premium Deficiency (Gross of Trust Balance and Excl. Contingency Reserve)	2,572
I	March 31, 2013 Trust Balance, Net of UPR [3]	118,629
J = max (I - F, 0)	Trust Balance, Net of Carried Loss Reserve	89,810
K = min (H, J)	Indicated Premium Deficiency (Limited to Trust Balance and Excl. Contingency Reserve)	2,572
L	Contingency Reserve as of 03/31/13	54,403
M = max ((H or K) - L, 0)	Indicated Statutory Premium Deficiency (Including Contingency Reserve, with Trust Balance Limitation)	0

[1] Refers to a range of reasonable ultimate loss estimates, as developed in Milliman's analysis for Atrium.
Note that these scenarios only present a range of projected ultimate losses. Projected written premium does not vary in these exhibits.
[2] This analysis incorporates expense assumptions provided by Atrium management.
[3] The trust account balance was taken from the cedant's cession statement. This represents the market value of the trust, plus the net settlement attributable to the March 2013 cession activity, less the unearned premium reserve as of March 31, 2013.

Notes: (1) The Discount Rate in this scenario is 2.0%, for illustrative purposes only.
Alternative discount rate scenarios have also been provided for evaluation by Atrium management.
(2) These loss and premium forecasts reflect the full run-off of the business on the books as of March 31, 2013.

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Summary of Reinsurance Programs

Atrium Reinsurance Corporation

Summary of Reinsurance Programs

UGC

Book Year	Net Premium Cede[1] (As a % of Gross Premium)	Attachment Point (As a % of Original Risk)	Limit (Detachment Point as a % of Original Risk)
2001		4.0%	14.0%
2002	40.0%	4.0%	14.0%
2003	40.0%	4.0%	14.0%
2004	40.0%	4.0%	14.0%
2005	40.0%	4.0%	14.0%
2006	40.0%	4.0%	14.0%
2007	40.0%	4.0%	14.0%
2008	40.0%	4.0%	14.0%
2009	25.0%	4.0%	10.0%

[1] Shows Calendar Year 2013 Net Premium Cede Only

Note: For loss forecasting purposes, we have assumed a May 31, 2008 contract end date for UGC's 2008 book, since no new loans were written after that date for this MI carrier.

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Summary of Selected A Priori Loss Rates

Atrium Reinsurance Corporation

Comparison of
Selected A Priori Loss Rates

As of 03/31/13

Book Year	UGC
2001	5.20%
2002	5.30%
2003	9.25%
2004	14.75%
2005	21.00%
2006	23.75%
2007	21.00%
2008	14.50%
2009	5.00%

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A Priori Loss Rate Indications

Atrium Reinsurance Corporation

Summary of Selected A Priori Ultimate Loss Rates
By Mortgage Insurer and Book Year

Evaluated as of 03/31/13

Mortgage Insurer	Book Year	A Baseline Indicated A Priori Loss Rate	B A Priori Loss Rate, with Global Insight HPA	C A Priori Loss Rate, with Moody's HPA	D A Priori Loss Rate, with Global Insight HPA and Adjusted Underwriting Risk Factor	E A Priori Loss Rate, with Global Insight HPA and Unadjusted Underwriting Risk Factor	F A Priori Loss Rate, with Moody's HPA and Adjusted Underwriting Risk Factor	G A Priori Loss Rate, with Moody's HPA and Unadjusted Underwriting Risk Factor	H Selected A Priori Ultimate Loss Rate
United Guaranty	2004	7.06%	10.20%	9.56%	11.99%	14.10%	11.24%	13.22%	14.75%
United Guaranty	2005	6.82%	12.87%	12.52%	16.22%	20.46%	15.79%	19.91%	21.00%
United Guaranty	2006	7.02%	16.30%	15.06%	18.97%	23.63%	18.68%	23.16%	23.75%
United Guaranty	2007	6.27%	14.54%	14.87%	17.12%	20.15%	17.51%	20.61%	21.00%
United Guaranty	2008	4.03%	9.19%	10.20%	11.10%	13.40%	12.31%	14.87%	14.50%
United Guaranty	2009	1.76%	2.67%	3.34%	2.66%	2.64%	3.32%	3.30%	5.00%

Notes:

(1) The "Baseline Indicated A Priori Loss Rate" in Column A is derived based on FICO and LTV using Fitch RMBS assumptions.

(2) The HPA adjustments in Columns B and C are based on the captive's geographic distribution of risk in force and forecasts of home price appreciation over a 20-quarter period from the evaluation date through March 2018, as provided by Global Insight and Moody's Economy.Com. The weights applied to each future quarter reflect the probability distribution of time from origination date to first foreclosure date, based on industry data.

(3) In addition to reflecting the impact of HPA, Columns D through G include the impact of Underwriting Risk Factors based on documentation type, amortization/product type, interest-only indicators, occupancy type, loan purpose, property type and loan size.

(4) The "Unadjusted" Underwriting Factor is the product of the individual risk factors, while the "Adjusted" Underwriting Factor is the square root of the product of the individual factors.

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Selected Loss Rate Summary

Atrium Reinsurance Corporation

Selected Loss Rate and Attachment Point Summary

Evaluated as of 03/31/13

UGC

Book Year	Selected Ground-Up Loss Rate	Attachment Point	Selected Loss Rate in the Layer
2001	0.92%	4.00%	0.00%
2002	1.57%	4.00%	0.00%
2003	3.90%	4.00%	0.05%
2004	8.72%	4.00%	4.39%
2005	18.71%	4.00%	10.00%
2006	28.17%	4.00%	10.00%
2007	30.43%	4.00%	10.00%
2008	19.13%	4.00%	10.00%
2009	3.48%	4.00%	1.45%

Note: The sum of the Attachment Point and Selected Loss Rate in the Layer do not necessarily equal the Selected Ground-Up Loss Rate

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Projected Ultimate Losses

Atrium Reinsurance Corporation
UGC

Projected Ultimate Losses
($000's)

	A	B	C	D = A * B * C	E	F = D - E
Book Year	Original Risk	% of Risk Assumed	Selected Loss Rate in the Layer	Projected Ultimate Paid Losses in the Layer	Atrium Losses Paid as of 03/31/13	Projected Future Paid Losses
2001	1,091,927	100%	0.00%	0	0	0
2002	908,386	100%	0.00%	0	0	0
2003	505,203	100%	0.05%	253	0	253
2004	844,877	100%	4.39%	37,060	18,405	18,655
2005	463,030	100%	10.00%	46,303	36,541	9,762
2006	219,053	100%	10.00%	21,905	21,905	0
2007	373,665	100%	10.00%	37,367	37,367	0
2008	238,123	100%	10.00%	23,812	11,465	12,347
2009	116,791	100%	1.45%	1,693	0	1,693
Total	4,761,054			168,393	125,683	42,710

Note: No additional delinquencies will be reported for UGC's 1994 - 2002 books.
However, Atrium will continue to have potential liability for any delinquencies that were reported as of each book's respective 10-year anniversary.

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Projected Ultimate Loss Ratio Comparison

Atrium Reinsurance Corporation

Summary Comparison of Projected Ultimate Loss Ratios
12/31/12 vs. 03/31/13

UGC

Book Year	Projected Ultimate Loss Ratios as of the 12/31/12 Evaluation	Projected Ultimate Loss Ratios as of the 03/31/13 Evaluation
2001	0.0%	0.0%
2002	0.0%	0.0%
2003	1.2%	1.2%
2004	92.5%	90.2%
2005	168.8%	168.7%
2006	164.2%	163.5%
2007	156.6%	153.5%
2008	168.7%	167.7%
2009	54.4%	52.5%
Total	51.9%	51.5%

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Present Value of Future Paid Losses and Written Premium

Atrium Reinsurance Corporation

UGC

($000's)

	Reinsurer Paid Losses in Layer																
Book Year	Projected Ultimate Losses	Paid as of 03/31/13	Projected Total Future	PV Future[1] @ 03/31/13	2013[2]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001	0	0	0	0													
2002	0	0	0	0	0												
2003	253	0	253	246	0	253											
2004	37,060	18,405	18,655	18,230	5,885	9,134	3,636										
2005	46,303	36,541	9,762	9,635	6,536	3,226	0	0									
2006	21,905	21,905	0	0	0	0	0	0	0								
2007	37,367	37,367	0	0	0	0	0	0	0	0							
2008	23,812	11,465	12,347	12,067	3,292	7,245	1,810	0	0	0	0						
2009	1,693	0	1,693	1,555	0	0	0	475	764	353	92	9					
Total	168,393	125,683	42,710	41,733	15,713	19,858	5,446	475	764	353	92	9	0	0	0	0	0

	Reinsurer Written Premium[3]																
Book Year	Projected Ultimate Premium	Written as of 03/31/13	Projected Total Future	PV Future[1] @ 03/31/13	2013[2]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001	157,931	157,931	0	0 [4]													
2002	24,601	24,601	0	0													
2003	20,728	20,560	168	167	168												
2004	41,108	39,323	1,785	1,762	1,175	610											
2005	27,446	24,436	3,010	2,946	1,161	1,304	545										
2006	13,401	11,230	2,172	2,109	629	707	590	246									
2007	24,335	17,781	6,554	6,310	1,483	1,727	1,494	1,292	559								
2008	14,195	9,677	4,518	4,325	947	1,064	888	742	619	259							
2009	3,227	2,250	977	937	248	240	175	128	93	68	25						
Total	326,974	307,788	19,185	18,555	5,811	5,651	3,692	2,408	1,271	327	25	0	0	0	0	0	0

[1] The Discount Rate in this scenario is 2%, for illustrative purposes only. Alternative discount rate scenarios have also been provided for evaluation by Atrium management.

[2] For remaining nine months of 2013

[3] Net of Ceding Commission and Terminal Unearned Premium Reserve

[4] Also includes reinsurer written premium for book years 1994 - 2000.

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.

(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.

(3) The written premium projections incorporate the following PSA assumptions by book year: 450% for 2003; 375% for 2004; 275% for 2005 - 2006; 225% for 2007; 275% for 2008; and 450% for 2009.

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Projected Paid and Incurred Loss Emergence

Atrium Reinsurance Corporation
UGC

Comparison of Projected Incremental Paid and Incurred Losses
($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D
		Atrium Reinsured Layer			
Book Year	Gross Losses Paid by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Paid Losses in Layer as of 03/31/13	Projected Future Losses in Layer
2001	9,463	43,677	0	0	0
2002	12,478	36,335	0	0	0
2003	14,571	20,208	253	0	253
2004	52,200	33,795	37,060	18,405	18,655
2005	55,062	18,521	46,303	36,541	9,762
2006	40,118	8,762	21,905	21,905	0
2007	63,129	14,947	37,367	37,367	0
2008	20,990	9,525	23,812	11,465	12,347
2009	685	4,672	1,693	0	1,693
Total	268,697		168,393	125,683	42,710

Projected Incremental Paid Losses in the Reinsured Layer

Book Year	2013[1]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001													
2002	0												
2003	0	253											
2004	5,885	9,134	3,636										
2005	6,536	3,226	0	0									
2006	0	0	0	0	0								
2007	0	0	0	0	0	0							
2008	3,282	7,245	1,810	0	0	0	0						
2009	0	0	0	475	784	353	92	9					
Total	15,713	19,858	5,446	475	784	353	92	9	0	0	0	0	0

		Atrium Reinsured Layer			
Book Year	Gross Losses Incurred by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Incurred Losses in Layer as of 03/31/13	Projected Future Losses in Layer
2001	10,070	43,677	0	0	0
2002	14,249	36,335	0	0	0
2003	18,931	20,208	253	0	253
2004	64,527	33,795	37,060	30,732	6,328
2005	68,410	18,521	46,303	46,303	0
2006	47,686	8,762	21,905	21,905	0
2007	78,392	14,947	37,367	37,367	0
2008	27,222	9,525	23,812	17,697	6,115
2009	1,119	4,672	1,693	0	1,693
Total	330,605		168,393	154,004	14,389

Projected Incremental Incurred Losses in the Reinsured Layer
(Based on Primary Insurer's case reserves for known delinquencies, as well as an IBNR loss provision)

Book Year	2013[1]	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2001													
2002	0												
2003	253	0											
2004	6,328	0	0										
2005	0	0	0	0									
2006	0	0	0	0	0								
2007	0	0	0	0	0	0							
2008	6,115	0	0	0	0	0	0						
2009	0	0	805	666	222	0	0	0					
Total	12,696	0	805	666	222	0	0	0	0	0	0	0	0

[1] For remaining nine months of 2013

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.
(3) The incurred loss development in this exhibit is based on the Primary Insurer's underlying case reserves for known delinquencies, as well as an IBNR loss provision provided by the Primary Insurer.

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Quarterly Breakdown through 2015 – Losses

Atrium Reinsurance Corporation
UGC

Projected Incremental Paid and Incurred Losses – Quarterly Breakdown through 2015
($000's)

Evaluated as of 03/31/13

	A	B	C	D	E = C - D	Projected Incremental Paid Losses in the Reinsured Layer															
		Atrium Reinsured Layer																			
Book Year	Gross Losses Paid by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Paid Losses in Layer as of 03/31/13	Projected Future Losses in Layer	2013 2Q	2013 3Q	2013 4Q	2014 1Q	2014 2Q	2014 3Q	2014 4Q	2015 1Q	2015 2Q	2015 3Q	2015 4Q	2016	2017	2018	2019	2020 - 2025
2001	9,463	43,677	0	0	0																0
2002	12,478	36,335	0	0	0	0	0	0													0
2003	14,571	20,208	253	0	253	0	0	0	0	0	0	253									0
2004	52,200	33,795	37,060	18,405	18,655	1,276	2,124	2,485	2,533	2,434	2,201	1,967	1,661	1,445	530	0					0
2005	55,062	18,521	46,303	36,541	9,762	1,394	2,342	2,800	2,953	273	0	0	0	0	0	0	0				0
2006	40,118	8,762	21,905	21,905	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2007	63,129	14,947	37,367	37,367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
2008	20,990	9,525	23,812	11,465	12,347	669	1,156	1,467	1,669	1,812	1,869	1,884	1,810	0	0	0	0	0	0	0	0
2009	685	4,672	1,693	0	1,693	0	0	0	0	0	0	0	0	0	0	0	475	764	353	92	9
Total	268,697		168,393	125,683	42,710	3,338	5,622	6,753	7,155	4,519	4,070	4,114	3,471	1,445	530	0	475	764	353	92	9

						Projected Incremental Incurred Losses in the Reinsured Layer (Based on Primary Insurer's case reserves for known delinquencies, as well as an IBNR loss provision)															
		Atrium Reinsured Layer																			
Book Year	Gross Losses Incurred by UGC as of 03/31/13	Layer Attachment Point	Projected Ultimate Losses in Layer	Incurred Losses in Layer as of 03/31/13	Projected Future Losses in Layer	2013 2Q	2013 3Q	2013 4Q	2014 1Q	2014 2Q	2014 3Q	2014 4Q	2015 1Q	2015 2Q	2015 3Q	2015 4Q	2016	2017	2018	2019	2020 - 2025
2001	10,070	43,677	0	0	0																0
2002	14,249	36,335	0	0	0	0	0	0													0
2003	18,931	20,208	253	0	253	0	0	253	0	0	0	0									0
2004	64,527	33,795	37,060	30,732	6,328	2,251	2,169	1,913	0	0	0	0	0	0	0	0					0
2005	68,410	18,521	46,303	46,303	0	0	0	0	0	0	0	0	0	0	0	0	0				0
2006	47,686	8,762	21,905	21,905	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0
2007	78,392	14,947	37,367	37,367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
2008	27,222	9,525	23,812	17,697	6,115	2,359	2,266	1,490	0	0	0	0	0	0	0	0	0	0	0	0	0
2009	1,119	4,672	1,693	0	1,693	0	0	0	0	0	0	0	0	272	272	261	666	222	0	0	0
Total	330,605		168,393	154,004	14,389	4,610	4,429	3,656	0	0	0	0	0	272	272	261	666	222	0	0	0

61,908 UGC Reserves (including IBNR) at 03/31/13

Notes: (1) For book years 2005 and prior, projected paid and incurred losses are based on Milliman's expected emergence patterns, with both a 1/2 year acceleration and supplemental adjustments across all book years to reflect current market conditions.
(2) For the 2006 - 2009 books, Milliman applied an accelerated paid and incurred loss emergence pattern, with supplemental adjustments across all book years to reflect current market conditions.
(3) The incurred loss development in this exhibit is based on the Primary Insurer's underlying case reserves for known delinquencies, as well as an IBNR loss provision provided by the Primary Insurer.

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Quarterly Breakdown through 2015 – Premium

Atrium Reinsurance Corporation
UGC

Reinsurer Written Premium – Quarterly Breakdown through 2015

($000's)

Evaluated as of 03/31/13

	Reinsurer Written Premium																			
Book Year	Projected Ultimate Premium	Written as of 03/31/13	Projected Total Future	2013 2Q	2013 3Q	2013 4Q	2014 1Q	2014 2Q	2014 3Q	2014 4Q	2015 1Q	2015 2Q	2015 3Q	2015 4Q	2016	2017	2018	2019	2020 - 2025
2001	157,931	157,931	0 [1]																0
2002	24,601	24,601	0																0
2003	20,728	20,560	168	58	56	54													0
2004	41,108	39,323	1,785	408	392	376	162	155	149	143									0
2005	27,446	24,436	3,010	403	387	371	346	333	320	307	144	139	133	128					0
2006	13,401	11,230	2,172	218	210	201	187	180	173	166	156	150	145	139	246				0
2007	24,335	17,781	6,554	514	494	474	458	440	423	406	396	381	366	351	1,292	559			0
2008	14,195	9,677	4,518	328	316	303	282	271	261	250	235	227	218	209	742	619	259		0
2009	3,227	2,250	977	86	83	79	64	61	59	56	46	45	43	41	128	93	68	25	0
Total	326,974	307,788	19,185	2,016	1,937	1,858	1,498	1,441	1,385	1,328	978	941	904	868	2,408	1,271	327	25	0

[1] Also includes reinsurer written premium for book years 1994 - 2000.

Note: The written premium projections incorporate the following PSA assumptions by book year: 450% for 2003; 375% for 2004; 275% for 2005 - 2006; 225% for 2007; 275% for 2008; and 450% for 2009.

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Qualifications and Limitations

- **Qualifications**
  - The authors and peer reviewers of this analysis are Members of the American Academy of Actuaries, Fellows of the Casualty Actuarial Society and/or have significant expertise in the evaluation of mortgage reinsurance.

- **Data Reliance**
  - In performing this analysis, we have relied on data evaluated as of March 31, 2013, as well as other information provided to us by or on behalf of Atrium through the date of this document. In this regard, we relied on Mr. Mike Bogansky, Vice President, Controller, as to the accuracy and completeness of the data (i.e., the data was provided under the supervision of Mr. Bogansky). We have not audited or independently verified this data and information. If the underlying data or information is inaccurate or incomplete, our analysis may likewise be inaccurate or incomplete.
  - In performing this evaluation, we have assumed that Atrium (a) used its best efforts to supply accurate and complete data and (b) did not knowingly provide any inaccurate data. We have performed a limited review of the data used directly in our analysis for reasonableness and consistency, and we have not found material defects in the data. If there are material defects in the data, it is possible that they would be uncovered by a detailed, systematic review and comparison of the data to search for data values that are questionable or relationships that are materially inconsistent. Such a review was beyond the scope of our assignment.
  - The analysis and any conclusions provided in Milliman's deliverables are based on data provided to Milliman by third-party sources. Milliman does not warrant the accuracy or completeness of any third-party data, and Milliman disclaims any and all liability in connection with such third-party data. Any errors in the data provided may affect the results of our analysis. Milliman shall not be liable for the results of its analysis to the extent errors are contained in third-party data sources.

- **Uncertainty and Variability**
  - Any study of future operating results involves estimates of future contingencies. While our analysis represents our best professional judgment, arrived at after careful analysis of the available information, it is important to note that a significant degree of variation from our projections is not only possible, but is in fact probable. The sources of this variation are numerous: future national or regional economic conditions, mortgage prepayment speeds, and economic or legislative developments affecting the program are examples. Furthermore, because of Atrium's limited history, we have augmented its experience with mortgage insurance industry claims experience in developing our projections. To the extent that Atrium's claims experience or risk profile differs from industry averages, the results of our analysis may not be appropriate. Atrium's relatively short operating history and immature loss experience may also increase the uncertainty of our estimates.
  - The uncertainty associated with our estimates is also magnified by the nature of mortgage insurance. Mortgage insurance results are sensitive to economic factors such as housing market conditions, unemployment, interest rate levels and so on. Accordingly, past experience may not be indicative of future conditions. A loan underwritten in a given year is generally insured over several calendar years. Therefore, adverse economic conditions in a given calendar year could affect results not only for the current underwriting year but also for prior underwriting years. Future economic developments that give rise to additional delinquencies and losses will impact ultimate losses, and unprecedented changes and stresses in the market add to uncertainty. Additionally, estimates are significantly more uncertain given the current economic deterioration, elevated default rates and adverse house price trends, together with activity relating to policy rescissions, claim denials, and loan modifications by primary mortgage insurers and mortgage servicers. Many of these variables are at unprecedented levels, and historical trends may not be indicative of future outcomes. The overall results are potentially sensitive to any of these variables, and reasonable deviations from the embedded assumptions could materially change the results.

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Qualifications and Limitations

- **Additional Items**
  - Any reader of this document must possess a certain level of expertise in areas relevant to this analysis to appreciate the significance of the assumptions and the impact of these assumptions on the illustrated results. The reader should be advised by – among other experts – actuaries or other professionals competent in the area of actuarial projections of the type in this document, so as to properly interpret the projection results.
  - This document is not complete without the accompanying oral discussion and explanation of the underlying projection methodologies, results and variability.

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Disclosures

Actuarial Standards require us to disclose the following:

- **Purpose**
  - The purpose of this analysis is to assist Atrium in the evaluation of its forecasted future claim payments for in-force business. Data used in our analysis was evaluated as of March 31, 2013.
- **Constraints**
  - There have been no unusual constraints (such as time, availability of data, or access to staff) on our ability to provide this analysis to Atrium.
- **Scope**
  - Our estimate of Atrium's forecasted future claim payments for in-force business is characterized as an actuarial central estimate. Our estimates represent an expected value over a range of reasonably possible outcomes. The estimates are not defined by a precise statistical measure (mean, median, mode, nth percentile, etc.) but are selected from multiple indications produced by a variety of generally accepted actuarial methods that are intended to respond to various drivers of ultimate claim liability.
  - We produced a range of reasonable forecasted future claim payments, defined by a low estimate, a high estimate, and an actuarial central estimate within this range. The range of estimates has been produced by alternative ultimate loss rate selections that we consider reasonable based on information available to us. It should be understood that this range does not represent the lowest or highest possible outcomes. Instead, the range should be interpreted as a range of reasonable outcomes that can be expected given current information. Actual results may fall outside this range.
    - Our estimate is undiscounted with respect to the time value of money (although present value indications are provided for purposes of presenting exhibits showing the premium deficiency calculations).
    - Atrium does not have outwards reinsurance. As such, the estimates net and gross of reinsurance recoverables are equivalent.
    - Our estimates of forecasted future claim payments include what are commonly referred to as allocated loss adjustment expenses (ALAE). Generally, ALAE includes claims settlement costs directly assigned to specific claims, such as legal fees. They do not include unallocated loss adjustment expenses (ULAE). ULAE typically includes other claims administration expenses.
- **Other Disclosures**
  - Our estimate is an update of an analysis performed as of December 31, 2012. There have been no changes in procedures or methodology used in deriving our estimates. Our assumptions are revised each quarter based on performance data, economic conditions and industry developments.

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Limited Distribution of Results

- Milliman's work has been prepared solely for the internal use of Atrium (Company) and its affiliates. No portion of Milliman's work may be provided to any other party without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work. Milliman's work may not be filed with the SEC or other securities regulatory bodies. In addition, references to Milliman or its estimates in communications with third parties are not authorized. Should the Company make reference to the engagement of an independent actuary (without specifically identifying Milliman) in any SEC filing, the SEC may require disclosure of the name of the actuary. Such disclosure is prohibited without Milliman's prior written consent.

- Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Third Party Release Agreement, subject to the following exceptions:

  - Company may provide a copy of Milliman's work to its accounting auditor ("auditor") to be used solely for audit purposes. In the event the auditor's audit reveals any error or inaccuracy in the data underlying Milliman's work, Milliman requests the auditor or the Company notify Milliman as soon as possible.

  - Company may provide a copy of Milliman's work to governmental entities, as required by law.

  - Company may provide a copy of Milliman's work to its captive manager and/or attorney, provided they agree not to distribute it further.

- In the event Milliman consents to release its work product, it must be provided in its entirety. We recommend that any such party have its own actuary or other qualified professional review the work product to ensure that the party understands the assumptions and uncertainties inherent in our estimates. No third party recipient of Milliman's work product should rely upon Milliman's work product.

- Any reader of this report agrees that they shall not use Milliman's name, trademarks or service marks, or refer to Milliman directly or indirectly in any third party communication without Milliman's prior written consent for each such use or release, which consent shall be given in Milliman's sole discretion.

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United Guaranty Residential Insurance Company
In Force Schedule
Atrium Re #3-44
September 30, 2012

Policy Year / Certificate Effective Dates Covered	(1) In Force Loan Count	(2) Gross In Force Insured Amount	(3) Gross In Force Risk	(4) Gross Unearned Premium	(5) Gross Case & IBNR Loss Reserves	(6) Ceded In Force Insured Amount	(7) Ceded In Force Risk	(8) Ceded Unearned Premium	(9) Ceded Case & IBNR Loss Reserves
Policy Year 1994 (10/1/93-12/31/1994)	1	50,400	8,568	-	6,208	$ -	$ -	$ -	-
Policy Year 1995	-	-	-	-	-	-	-	-	-
Policy Year 1996 (1/1/1996-3/31/1997)	-	-	-	-	-	-	-	-	-
Policy Year 1997 (4/1/1997-12/31/1997)	-	-	-	-	-	-	-	-	-
Policy Year 1998	3	392,250	117,675	-	95,916	-	-	-	-
Policy Year 1999	15	1,340,729	349,449	-	211,454	-	-	-	-
Policy Year 2000	20	1,669,680	400,350	-	264,319	-	-	-	-
Policy Year 2001	50	4,424,399	1,271,032	-	826,069	-	-	-	-
Policy Year 2002	532	57,083,320	18,057,161	589	2,686,370	-	-	265.02	-
Policy Year 2003	1,648	191,027,421	61,092,773	10,000	4,935,039	157,968,867	50,520,266	4,499.82	-
Policy Year 2004	4,330	544,948,854	173,509,814	24,708	12,574,987	214,746,078	68,374,402	11,118.69	12,574,987
Policy Year 2005	3,473	508,608,214	158,089,905	35,057	15,030,177	40,667,972	12,640,763	15,775.77	12,640,763
Policy Year 2006	1,837	284,370,163	84,785,568	23,157	8,812,623	-	-	10,420.53	-
Policy Year 2007	4,634	731,971,619	197,521,834	46,048	18,316,946	-	-	20,721.76	-
Policy Year 2008	2,855	511,540,532	138,979,262	8,405	7,079,517	54,720,125	14,866,784	3,782.04	7,079,517
Policy Year 2009	1,490	286,179,804	69,184,023	48,816	485,141	28,986,434	7,007,476	12,203.91	-
Total All Policy Years	20,888	$ 3,123,607,385	$ 903,367,414	196,779	$ 71,324,766	$ 497,089,476	$ 153,409,691	78,787.54	$ 32,295,267

Notes:
Policy Year 1-3 ceded at 25%.
Policy Year 1998 - 2008 ceded at 45%.
Policy Year 2009 forward ceded at 25%.
Insurance In Force Ceded at percentage of Ceded Risk to Gross Risk In Force for each policy year.
Ceded Risk In Force is the remaining reinsurer exposure and is calculated as follows:

A) Gross Risk In Force
B) Paid Loss
C) Uppper Limit
D) Attachment Point
E) Lessor of A+B or C
F) Greater of D or B
G) E - F = Ceded Inforce Risk

Terminated 5/31/08
Reinstated 3/01/09 with new structure

United Guaranty Residential Insurance Company
Original Accumulated Balances
Atrium Re #3-44
September 30, 2012

Policy Year / Certificate Effective Dates Covered	(1) Original Loan Count	(2) Original Principal Balance	(3) Original Risk
Policy Year 1994 (10/1/93-12/31/94)	$ 10,229	$ 1,265,496,586	$ 227,962,492
Policy Year 1995	9,271	1,180,530,026	286,058,676
Policy Year 1996 (1/1/1996-3/31/1997)	13,702	1,838,243,715	467,383,501
Policy Year 1997 (4/1/1997 - 12/31/1997)	13,146	1,859,079,217	479,888,947
Policy Year 1998	34,236	4,689,932,598	1,199,138,913
Policy Year 1999	43,581	5,911,645,037	1,498,053,602
Policy Year 2000	40,850	5,622,492,695	1,294,769,736
Policy Year 2001	32,255	4,443,600,597	1,091,927,028
Policy Year 2002	24,153	3,362,404,407	908,399,576
Policy Year 2003	12,928	1,849,329,910	505,202,659
Policy Year 2004	19,915	2,873,458,888	844,853,686
Policy Year 2005	10,087	1,565,827,821	463,147,324
Policy Year 2006	4,714	756,744,867	219,080,731
Policy Year 2007	8,436	1,390,886,064	373,627,303
Policy Year 2008 (1/1/2008-5/31/2008)	4,872	901,155,678	237,967,784
Policy Year 2009 (3/1/2009-12/31/2009)	2,511	502,533,780	116,791,262
Total All Policy Years	284,886	$ 40,013,361,886	$ 10,214,253,220

United Guaranty Residential Insurance Company
Premium Settlement
Atrium Re #3-44
September 30, 2012

Policy Year / Certificate Effective Dates Covered	(1) Gross Premium Written Inception To Date	(2) Ceded Premium Written Inception To Date	(3) Inception To Date Commission Allowance	(4) Losses Paid To Date By Reinsurer	(5)=(2)-(3)-(4) Inception To Date Net Settlement	(6) Gross Premium Written Month To Date	(7) Ceded Premium Written Month To Date	(8) Month To Date Commission Allowance	(9) Losses Paid Month To Date By Reinsurer	(10)=(7)-(8)-(9) Month To Date Net Settlement
Policy Year 1994 (10/1/93-12/31/1994)	$ 16,671,799.07	$ 3,098,059.41	$ -	$ -	$ 3,098,059.41	$ -	$ -	$ -	$ -	$ -
Policy Year 1995 (1/1/95-12/31/1995)	24,253,341.99	4,626,148.00	-	-	4,626,148.00	-	-	-	-	-
Policy Year 1996 (1/1/1996-3/31/1997)	38,305,947.54	8,213,161.09	-	-	8,213,161.09	-	-	-	-	-
Policy Year 1997 (4/1/1997 - 12/31/1997)	36,243,266.58	15,374,957.73	2,790,305.57	-	12,584,652.16	-	-	-	-	-
Policy Year 1998 (1/1/1998 - 12/31/1998)	100,610,521.21	45,272,300.96	8,601,491.87	-	36,670,809.09	-	-	-	-	-
Policy Year 1999 (1/1/1999 - 12/31/1999)	113,586,166.75	51,113,775.04	9,711,617.25	-	41,402,157.79	-	-	-	-	-
Policy Year 2000 (1/1/2000 - 12/31/2000)	64,000,993.76	28,800,447.19	3,196,849.64	-	25,603,597.55	-	-	-	-	-
Policy Year 2001 (1/1/2001 - 12/31/2001)	64,322,803.44	28,945,261.55	3,212,924.03	-	25,732,337.52	-	-	-	-	-
Policy Year 2002 (1/1/2002 - 12/31/2002)	61,444,639.25	27,650,087.66	3,069,159.73	-	24,580,927.93	38,577.43	17,359.84	1,926.94	-	15,432.90
Policy Year 2003 (1/1/2003 - 12/31/2003)	50,622,854.67	22,780,284.60	2,528,611.59	-	20,251,673.01	146,091.98	65,741.39	7,297.29	-	58,444.10
Policy Year 2004 (1/1/2004 - 12/31/2004)	95,963,075.73	43,183,384.08	4,793,355.63	16,110,967.00	22,279,061.45	412,059.58	185,426.81	20,582.37	586,140.00	(421,295.56)
Policy Year 2005 (1/1/2005 - 12/31/2005)	58,940,755.56	26,523,340.00	2,944,090.74	33,673,969.00	(10,094,719.74)	366,703.05	165,016.37	18,316.82	755,356.00	(608,656.45)
Policy Year 2006 (1/1/2006 - 12/31/2006)	26,919,613.23	12,113,825.95	1,344,634.68	21,908,073.00	(11,138,881.73)	149,126.49	67,106.92	7,448.87	(26,698.00)	86,356.05
Policy Year 2007 (1/1/2007 - 12/31/2007)	41,725,866.08	18,776,639.74	2,084,207.01	37,362,730.00	(20,670,297.27)	421,711.16	189,770.03	21,064.47	(39,453.00)	208,158.56
Policy Year 2008 (1/1/2008 - 5/31/2008)	22,412,018.77	10,085,408.45	1,119,480.34	8,929,995.00	35,933.11	298,577.62	134,359.93	14,913.95	293,404.00	(173,958.02)
Policy Year 2009 (3/1/2009 - 12/31/2009)	8,167,988.09	2,041,997.02	-	-	2,041,997.02	155,874.02	38,968.50	-	-	38,968.50
Total All Policy Years	$ 824,191,651.72	$ 348,599,078.47	$ 45,396,728.08	$ 117,985,734.00	$ 185,216,616.39	$ 1,988,721.33	$ 863,749.79	$ 91,550.71	$ 1,568,749.00	$ (796,549.92)

Notes:
Premiums ceded on the following basis:
Policy Year 1-3: 1996 premium at 10%, 1997 premium at 19.1%, thereafter 25%
Policy Year 4-6: 1997 premium at 19.1%, thereafter 45% with 19% ceding commission allowance
Policy Year 2000- 2008: 2000 premium at 45% with 11.1% ceding commission allowance
Policy Year 2009: premium at 25% with 0% ceding commission allowance

$ 185,216,616.39

United Guaranty Residential Insurance Company
Earned Premium
Atrium Re # 3-44
September 30, 2012

Policy Year / Certificate Effective Dates Covered	(1) Ceded Premium Written Inception To Date	(2) Beginning Unearned Premium 10/1/1993	(3) Ending Unearned Premium 9/30/2012	(4)=(1)+(2)-(3) Inception To Date Earned Premium	(5) Ceded Premium Written Quarter To Date	(6) Beginning Unearned Premium 8/31/2012	(7) Ending Unearned Premium 9/30/2012	(8)=(5)+(6)-(7) Month To Date Earned Premium
Policy Year 1994 (10/1/93-12/31/1994)	$ 3,098,059.41	$ -	$ -	$ 3,098,059.41	$ -	$ -	$ -	$ -
Policy Year 1995 (1/1/95-12/31/1995)	4,626,148.00	-	-	4,626,148.00	-	$ -	-	-
Policy Year 1996 (1/1/1996-3/31/1997)	8,213,161.09	-	-	8,213,161.09	-	$ -	-	-
Policy Year 1997 (4/1/1997 - 12/31/1997)	15,374,957.73	-	-	15,374,957.73	-	$ -	-	-
Policy Year 1998 (1/1/1998 - 12/31/1998)	45,272,300.96	-	-	45,272,300.96	-	$ -	-	-
Policy Year 1999 (1/1/1999 - 12/31/1999)	51,113,775.04	-	-	51,113,775.04	0.00	$ -	-	-
Policy Year 2000 (1/1/2000 - 12/31/2000)	28,800,447.19	-	-	28,800,447.19	0.00	$ -	-	-
Policy Year 2001 (1/1/2001 - 12/31/2001)	28,945,261.55	-	-	28,945,261.55	0.00	$ -	-	-
Policy Year 2002 (1/1/2002 - 12/31/2002)	27,650,087.66	-	265.02	27,649,822.64	17,359.84	$ 526.53	265.02	17,621.35
Policy Year 2003 (1/1/2003 - 12/31/2003)	22,780,284.60	-	4,499.82	22,775,784.78	65,741.39	$ 4,071.88	4,499.82	65,313.45
Policy Year 2004 (1/1/2004 - 12/31/2004)	43,183,384.08	-	11,118.69	43,172,265.39	185,426.81	$ 11,666.03	11,118.69	185,974.15
Policy Year 2005 (1/1/2005 - 12/31/2005)	26,523,340.00	-	15,775.77	26,507,564.23	165,016.37	$ 14,952.90	15,775.77	164,193.50
Policy Year 2006 (1/1/2006 - 12/31/2006)	12,113,825.95	-	10,420.53	12,103,405.42	67,106.92	$ 9,689.13	10,420.53	66,375.52
Policy Year 2007 (1/1/2007 - 12/31/2007)	18,776,639.74	-	20,721.76	18,755,917.98	189,770.03	$ 21,582.23	20,721.76	190,630.50
Policy Year 2008 (1/1/2008 - 5/31/2008)	10,085,408.45	-	3,782.04	10,081,626.41	134,359.93	$ 3,872.24	3,782.04	134,450.13
Policy Year 2009 (3/1/2009 - 12/31/2009)	2,041,997.02	-	12,203.91	2,029,793.11	38,968.50	$ 12,522.65	12,203.91	39,287.24
Total All Policy Years	$ 348,599,078.47	$ -	$ 78,787.54	$ 348,520,290.93	$ 863,749.79	$ 78,883.59	$ 78,787.54	$ 863,845.84

United Guaranty Residential Insurance Company
Contingency Reserve Calculation
Atrium Re #3-44
September 30, 2012

Year Earned

Earned Premium	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total	
Policy Year 1994	$ 216,043.58	$ 629,077.60	$ 559,792.63	$ 562,712.45	$ 438,503.36	$ 317,439.67	$ 214,766.27	$ 121,776.43	$ 36,599.91	$ 1,347.51	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,098,059.41	
Policy Year 1995	437,211.16	884,715.00	1,003,012.88	701,344.12	612,095.99	407,989.05	279,609.41	169,287.93	77,587.63	53,214.46	80.37	-	-	-	-	-	-	4,626,148.00	
Policy Year 1996	339,969.54	1,001,495.52	1,604,006.97	2,068,794.91	1,403,382.85	786,420.82	502,398.39	241,881.16	127,221.28	99,318.81	36,737.91	1,532.93	-	-	-	-	-	8,213,161.09	
Policy Year 1997		559,027.84	3,513,935.60	3,772,467.42	2,652,349.84	2,164,384.82	1,368,372.30	653,303.15	304,924.28	211,081.23	117,116.63	57,994.62	-	-	-	-	-	15,374,957.73	
Policy Year 1998			1,598,397.15	10,629,028.44	10,609,237.42	8,705,988.40	6,294,548.98	3,400,411.38	1,704,417.61	1,169,366.50	596,828.48	386,987.10	189,020.96	158.68	-	(2,283.12)	(9,807.02)	45,272,300.96	
Policy Year 1999				3,516,027.17	14,227,215.31	13,252,170.66	9,328,104.66	4,607,628.77	2,481,276.80	1,582,328.60	855,494.32	615,914.59	458,277.68	189,336.48	-	-	-	51,113,775.04	
Policy Year 2000					2,772,619.13	11,558,691.86	7,775,280.11	3,110,006.37	1,344,063.88	831,459.43	442,957.75	344,591.89	272,387.44	227,919.90	120,471.18	(1.75)	-	28,800,447.19	
Policy Year 2001						2,409,440.09	10,016,384.11	6,775,008.40	3,445,610.81	2,204,947.46	1,180,606.63	926,219.48	727,705.95	596,372.03	456,469.62	206,522.33	(25.36)	28,945,261.55	
Policy Year 2002							1,670,277.95	7,659,166.53	5,921,479.91	4,311,613.84	2,199,464.95	1,688,878.52	1,319,600.09	1,075,267.32	836,231.37	668,238.23	299,603.93	27,649,822.64	
Policy Year 2003								1,000,980.29	5,120,207.88	5,452,813.88	2,847,111.23	2,187,451.92	1,761,080.46	1,494,572.96	1,243,806.43	1,036,784.78	630,974.95	22,775,784.78	
Policy Year 2004									1,935,812.23	11,673,618.21	7,365,915.31	5,689,025.08	4,627,940.91	3,942,054.44	3,349,544.54	2,792,104.19	1,796,250.48	43,172,265.39	
Policy Year 2005										2,392,431.52	5,475,581.24	4,570,105.51	3,890,426.84	3,371,905.17	2,819,130.71	2,413,777.17	1,574,206.07	26,507,564.23	
Policy Year 2006											1,272,584.48	2,818,570.63	2,332,867.96	1,974,690.96	1,640,463.11	1,278,875.62	785,352.66	12,103,405.42	
Policy Year 2007												1,320,056.75	4,621,898.97	4,191,478.79	3,632,942.00	3,065,530.17	1,924,011.30	18,755,917.98	
Policy Year 2008													1,941,982.76	2,570,248.16	2,304,159.58	1,973,674.70	1,291,561.21	10,081,626.41	
Policy Year 2009														266,854.78	724,111.79	640,734.84	398,091.70	2,029,793.11	
Total Earned Premium	$ 993,224.28	$ 3,074,315.96	$ 8,279,145.23	$ 21,250,374.51	$ 32,715,403.90	$ 39,602,525.37	$ 37,449,742.18	$ 27,739,450.41	$ 22,499,202.22	$ 29,983,541.45	$ 22,390,479.30	$ 20,607,329.02	$ 22,143,190.02	$ 19,900,859.67	$ 17,127,330.33	$ 14,073,957.16	$ 8,690,219.92	$ 348,520,290.93	$ -

Contingency Reserves	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total	
Beginning Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,356,751.10	$ 13,606,352.22	$ 28,598,122.94	$ 39,793,362.58	$ 50,097,027.10	$ 61,168,622.11	$ 71,119,051.94	$ 79,682,717.11	$ 86,719,695.70		
Additions:																			
Policy Year 1994	$ 108,021.79	$ 314,538.80	$ 279,896.31	$ 281,356.23	$ 219,251.68	$ 158,719.84	$ 107,383.13	60,888.22	$ 18,299.95	$ 673.76	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,549,029.71	$ 18,973.71
Policy Year 1995	218,605.58	442,357.50	501,506.44	350,672.06	306,048.00	203,994.53	139,804.70	84,643.96	38,793.82	26,607.23	40.18	-	-	-	-	-	-	2,313,074.00	65,441.23
Policy Year 1996	169,984.77	500,747.76	802,003.49	1,034,397.45	701,691.43	393,210.41	251,199.19	120,940.58	63,610.64	49,659.41	18,368.95	766.47	-	-	-	-	-	4,106,580.55	132,405.47
Policy Year 1997		279,513.92	1,756,967.80	1,886,233.71	1,326,174.92	1,082,192.41	684,186.15	326,651.58	152,462.14	105,540.61	58,558.32	28,997.31	-	-	-	-	-	7,687,478.87	408,442.91
Policy Year 1998			799,198.58	5,314,514.22	5,304,618.71	4,352,994.20	3,147,274.49	1,700,205.69	852,208.80	584,683.25	298,414.24	193,493.55	94,510.48	79.34	-	(1,141.56)	(4,903.51)	22,636,150.48	1,954,460.06
Policy Year 1999				1,758,013.59	7,113,607.66	6,626,085.33	4,664,052.32	2,303,814.39	1,240,638.40	791,164.30	427,747.16	307,957.29	229,138.84	94,668.24	-	-	-	25,556,887.52	3,091,314.23
Policy Year 2000					1,386,309.57	5,779,345.93	3,887,640.05	1,555,003.19	672,031.94	415,729.71	221,478.88	172,295.94	136,193.72	113,959.95	60,235.59	(0.87)	-	14,400,223.60	1,791,924.86
Policy Year 2001						1,204,720.05	5,008,192.05	3,387,504.20	1,722,805.41	1,102,473.73	590,303.31	463,109.74	363,852.98	298,186.01	228,234.81	103,261.17	(12.68)	14,472,630.78	4,872,214.48
Policy Year 2002						-	835,138.98	3,829,583.26	2,960,739.96	2,155,806.92	1,099,732.47	844,439.26	659,800.05	537,633.66	418,115.68	334,119.12	149,801.96	13,824,911.32	11,016,450.03
Policy Year 2003								500,490.15	2,560,103.94	2,726,406.94	1,423,555.61	1,093,725.96	880,540.23	747,286.48	621,903.22	518,392.39	315,487.47	11,387,892.39	11,387,892.39
Policy Year 2004									967,906.12	5,836,809.10	3,682,957.66	2,844,512.54	2,313,970.45	1,971,027.22	1,674,772.27	1,396,052.10	898,125.24	21,586,132.70	21,586,132.70
Policy Year 2005										1,196,215.76	2,737,790.62	2,285,052.76	1,945,213.42	1,685,952.58	1,409,565.36	1,206,888.58	787,103.04	13,253,782.12	13,253,782.12
Policy Year 2006											636,292.24	1,409,285.32	1,166,433.98	987,345.48	820,231.55	639,437.81	392,676.33	6,051,702.71	6,051,702.71
Policy Year 2007												660,028.38	2,310,949.48	2,095,739.40	1,816,471.00	1,532,765.08	962,005.65	9,377,958.99	9,377,958.99
Policy Year 2008													970,991.38	1,285,124.08	1,152,079.79	986,837.35	645,780.61	5,040,813.21	5,040,813.21
Policy Year 2009													-	133,427.39	362,055.90	320,367.42	199,045.85	1,014,896.56	1,014,896.56
Total Additions	$ 496,612.14	$ 1,537,157.98	$ 4,139,572.62	$ 10,625,187.26	$ 16,357,701.97	$ 19,801,262.70	$ 18,724,871.06	$ 13,869,725.22	$ 11,249,601.12	$ 14,991,770.72	$ 11,195,239.64	$ 10,303,664.52	$ 11,071,595.01	$ 9,950,429.83	$ 8,563,665.17	$ 7,036,978.59	$ 4,345,109.96	$ 174,260,145.51	$ 91,064,805.66
Reversals:																			
Policy Year 1994	(108,021.79)	(314,538.80)	(279,896.31)	(281,356.23)	(219,251.68)	(158,719.84)	(107,383.13)	(60,888.22)										$ (1,530,056.00)	
Policy Year 1995	(218,605.58)	(442,357.50)	(501,506.44)	(350,672.06)	(306,048.00)	(203,994.53)	(139,804.70)	(84,643.96)										(2,247,632.77)	
Policy Year 1996	(169,984.77)	(500,747.76)	(802,003.49)	(1,034,397.45)	(701,691.43)	(393,210.41)	(251,199.19)	(120,940.58)										(3,974,175.08)	
Policy Year 1997		(216,629.39)	(1,756,967.80)	(1,886,233.71)	(1,326,174.92)	(1,082,192.41)	(684,186.15)	(326,651.58)										(7,279,035.96)	
Policy Year 1998		(62,884.53)	(799,198.58)	(5,314,514.22)	(5,304,618.71)	(4,352,994.20)	(3,147,274.49)	(1,700,205.69)										(20,681,690.42)	
Policy Year 1999				(1,758,013.59)	(7,113,607.66)	(6,626,085.33)	(4,664,052.32)	(2,303,814.39)										(22,465,573.29)	
Policy Year 2000					(1,386,309.57)	(5,779,345.93)	(3,887,640.05)	(1,555,003.19)										(12,608,298.74)	
Policy Year 2001						(1,204,720.05)	(5,008,192.05)	(3,387,504.20)										(9,600,416.30)	
Policy Year 2002							(835,138.98)	(1,973,322.31)										(2,808,461.29)	
Policy Year 2003																		0.00	
Total Reversals	$ (496,612.14)	$ (1,537,157.98)	$ (4,139,572.62)	$ (10,625,187.26)	$ (16,357,701.97)	$ (19,801,262.70)	$ (18,724,871.06)	$ (11,512,974.12)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ (83,195,339.85)	
Ending Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,356,751.10	$ 13,606,352.22	$ 28,598,122.94	$ 39,793,362.58	$ 50,097,027.10	$ 61,168,622.11	$ 71,119,051.94	$ 79,682,717.11	$ 86,719,695.70	$ 91,064,805.66	$ 91,064,805.66	

** Reduced by $36,200,820 in September 2009 due to excess loss.

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United Guaranty Residential Insurance Company
Ceded Risk In Force and Loss Experience
Atrium Re #3-44
September 30, 2012

Policy Year / Certificate Effective Dates Covered	(1) UGI Net Losses Paid Since Inception	(2) UGI Gross Case Loss Reserves	(3) UGI IBNR Reserves	(4)=(1)+(2)+(3) UGI Incurred Losses Since Inception Plus Reserves	(5) UGI Original Risk	(6) Total Losses To Be Incurred Before Reinsurer Layer	(7) Total Losses To Be Incurred By Reinsurer	(8) Upper Limit of Reinsurer Layer	(9) Paid Losses Ceded Inception To Date To Reinsurer	(10) Case Loss Reserves Ceded To Reinsurer	(11) IBNR Reserves Ceded To Reinsurer	(12) Losses Incurred To Date By Reinsurer	(13) Premiums Earned To Date By Reinsurer
Policy Year 1994 (10/1/93-12/31/1994)	$ 1,942,263	$ 5,912	$ 296	$ 1,948,471	$ 227,962,492	$ 14,817,562	$ 13,677,750	$ 28,495,312	$ -	$ -	$ -	$ -	$ 3,098,059
Policy Year 1995	1,841,293	-	-	1,841,293	286,058,676	18,593,814	17,163,521	35,757,335	-	-	-	-	4,626,148
Policy Year 1996 (1/1/1996-3/31/1997)	1,911,530	-	-	1,911,530	467,383,501	30,379,928	28,043,010	58,422,938	-	-	-	-	8,213,161
Policy Year 1997 (4/1/1997-12/31/1997)	2,845,777	-	-	2,845,777	479,888,947	19,195,558	47,988,895	67,184,453	-	-	-	-	15,374,958
Policy Year 1998	5,966,652	91,349	4,567	6,062,568	1,199,138,913	47,965,557	119,913,891	167,879,448	-	-	-	-	45,272,301
Policy Year 1999	11,214,468	201,385	10,069	11,425,922	1,498,053,602	59,922,144	149,805,360	209,727,504	-	-	-	-	51,113,775
Policy Year 2000	10,158,903	251,732	12,587	10,423,222	1,294,769,736	51,790,789	129,476,974	181,267,763	-	-	-	-	28,800,447
Policy Year 2001	9,401,333	786,732	39,337	10,227,402	1,091,927,028	43,677,081	109,192,703	152,869,784	-	-	-	-	28,945,262
Policy Year 2002	11,958,962	2,558,448	127,922	14,645,332	908,399,576	36,335,983	90,839,958	127,175,941	-	-	-	-	27,649,823
Policy Year 2003	13,685,192	4,700,037	235,002	18,620,231	505,202,659	20,208,106	50,520,266	70,728,372	-	-	-	-	22,775,785
Policy Year 2004	49,905,114	11,976,178	598,809	62,480,101	844,853,686	33,794,147	84,485,369	118,279,516	16,110,967	11,976,178	598,809	28,685,954	43,172,265
Policy Year 2005	52,199,862	14,314,454	715,723	67,230,039	463,147,324	18,525,893	46,314,732	64,840,625	33,673,969	12,640,763	-	46,314,732	26,507,564
Policy Year 2006	37,837,857	8,392,974	419,649	46,650,480	219,080,731	8,763,229	21,908,073	30,671,302	21,908,073	-	-	21,908,073	12,103,405
Policy Year 2007	57,223,898	17,444,710	872,236	75,540,844	373,627,303	14,945,092	37,362,730	52,307,822	37,362,730	-	-	37,362,730	18,755,918
Policy Year 2008	18,448,706	6,742,397	337,120	25,528,223	237,967,784	9,518,711	23,796,779	33,315,490	8,929,995	6,742,397	337,120	16,009,512	10,081,626
Policy Year 2009	345,706	462,039	23,102	830,847	116,791,262	4,671,650	7,007,476	11,679,126	-	-	-	-	2,029,793
Total All Policy Years	$ 286,887,516	$ 67,928,347	$ 3,396,419	$ 358,212,282	$ 10,214,253,220	$ 433,105,244	$ 977,497,487	$ 1,410,602,731	$ 117,985,734	$ 31,359,338	$ 935,929	$ 150,281,001	$ 348,520,290

Notes:
Attachment point for Policy Year 1-3 is 6.5%, with an upper limit of 12.5%
Attachment point for Policy Year 4 - 15 is 4%, with an upper limit of 14%
Attachment point for Policy Year 16 forward is 4%, with an upper limit of 10%

Gross IBNR **5.0%**
IBNR is 5% as of 12/1/2010

Paid Loss/Original Risk Ratio (1)/(5):	
Policy Year 1	0.85%
Policy Year 2	0.64%
Policy Year 3	0.41%
Policy Year 4	0.59%
Policy Year 5	0.50%
Policy Year 6	0.75%
Policy Year 7	0.78%
Policy Year 8	0.86%
Policy Year 9	1.32%
Policy Year 10	2.71%
Policy Year 11	5.91%
Policy Year 12	11.27%
Policy Year 13	17.27%
Policy Year 14	15.32%
Policy Year 15	7.75%
Policy Year 16	0.30%

Incurred Loss/EP Ratio (12)/(13):		
Policy Year 1	0.00%	
Policy Year 2	0.00%	1,568,749.00
Policy Year 3	0.00%	
Policy Year 4	0.00%	
Policy Year 5	0.00%	
Policy Year 6	0.00%	
Policy Year 7	0.00%	
Policy Year 8	0.00%	
Policy Year 9	0.00%	
Policy Year 10	0.00%	
Policy Year 11	66.45%	
Policy Year 12	174.72%	
Policy Year 13	181.01%	
Policy Year 14	199.21%	
Policy Year 15	158.80%	
Policy Year 16	0.00%	

United Guaranty Residential Insurance Company
Original Accumulated Balances
Atrium Re #3-44
September 30, 2012

Trust Account Calculation - 2nd Quarter 2007
Assuming Capital Release for 2001 and Prior
and Contingency Reserve Release on a Calendar Year Basis

	Gross Original Risk	Reinsurer Layer	2002 & after @ 20%	Contingency Reserve	Unearned Premium	Loss Reserves	Captial Required	Capital Required For Release of Dividends
		(cont. resvs are required for 2002 and after, but not used in this calc.)						
1993-1994	227,962,492	13,677,750		18,974	-	-	1,367,775	19,353
1995	286,058,676	17,163,521		65,441	-	-	1,716,352	66,750
1996	467,383,501	28,043,010		132,405	-	-	2,804,301	135,054
1997	479,888,947	47,988,895		408,443	-	-	4,798,890	416,612
1998	1,199,138,913	119,913,891		1,954,460	-	-	11,991,389	1,993,549
1999	1,498,053,602	149,805,360		3,091,314	-	-	14,980,536	3,153,141
2000	1,294,769,736	129,476,974		1,791,925	-	-	12,947,697	1,827,763
2001	1,091,927,028	109,192,703		4,872,214	-	-	10,919,270	4,969,659
2002	908,399,576	90,839,958	18,167,992	11,016,450	265	-	9,084,261	18,531,622
2003	505,202,659	50,520,266	10,104,053	11,387,892	4,500	-	5,056,526	10,310,724
2004	844,853,686	84,485,369	16,897,074	21,586,133	11,119	12,574,987	21,034,643	30,072,843
2005	463,147,324	46,314,732	9,262,946	13,253,782	15,776	12,640,763	17,288,012	22,357,875
2006	219,080,731	21,908,073	4,381,615	6,051,703	10,421	-	2,201,228	4,479,876
2007	373,627,303	37,362,730	7,472,546	9,377,959	20,722	-	3,756,995	7,643,133
2008	237,967,784	23,796,779	4,759,356	5,040,813	3,782	7,079,517	9,462,977	12,079,508
2009	116,791,262	7,007,476	1,401,495	1,014,897	12,204	-	712,952	1,441,973
	10,214,253,220	977,497,487	72,447,077	91,064,806	78,788	32,295,267	130,123,803	119,499,434
				-		-		

Release of Funds

Policy Years 2002 & Later: Greater of:			
a)20% of Reinsurance Layer 2002 & later		72,447,077	78,729,629
b) Contingency Reserves		78,729,629	
Contingency Reserve 2001 & prior			12,335,177
Unearned Premium			78,788
Reinsurer's Loss Reserves			32,295,267
			123,438,860
			x 102%
Total Requirement			125,907,637
Balance @ 9/30/2012	126,061,022		
Trust Excess/(Deficient)			153,384

United Guaranty Residential Insurance Company
Trust Deposits
Atrium Re #3-44
September 30, 2012

Month	Year	Premium Deposit	Losses Paid	Capital Deposit	Dividend/ Interest Income (1)	Accrued Interest	Gain (Loss) on Sales	Fee Reimburse	FIT & Operating Expense	Excess Funds	Trust Fees	Cash Basis Ending Balance	Market Value	Book
12	97			$ 460,000.00								$ 460,000.00	$ 460,000.00	
2	98	$ 1,501,211.83										1,961,211.83	1,961,211.83	
3	98											1,961,211.83	1,961,211.83	
5	98	1,722,319.68						$ 250.00			$ (250.00)	3,683,531.51	3,717,269.44	
6	98											3,683,531.51	3,733,360.69	
7	98				$ 12,133.79							3,695,665.30	3,749,544.27	
8	98	1,926,175.40			35,770.83							5,657,611.53	5,696,571.90	
9	98											5,657,611.53	5,728,802.11	
10	98				1,034.32							5,658,645.85	5,752,604.49	
11	98	2,080,027.00			45,045.98							7,783,718.83	7,888,702.98	
12	98	1,256,738.00										9,040,456.83	9,145,440.98	
1	99				11,747.15							9,052,203.98	9,177,334.81	
2	99	3,763,661.50			88,402.89							12,904,268.37	12,969,386.93	
3	99											12,904,268.37	13,025,937.98	
4	99				975.39			4,316.97			(4,316.97)	12,905,243.76	13,077,438.43	
5	1999	3,845,026.75			85,235.84							16,835,506.35	16,972,389.87	
6	1999				1,187.30							16,836,693.65	17,037,311.97	
7	1999				39,789.75			2,184.25			(2,184.25)	16,876,483.40	17,109,407.25	
8	1999	4,949,562.93			162,873.58							21,988,919.91	21,988,919.91	
9	1999											21,988,919.91	22,229,067.75	
10	1999				1,124.21							21,990,044.12	22,229,068.75	
11	1999	4,101,150.71			179,689.11							26,270,883.94	26,501,998.72	
12	1999				32,041.27							26,302,925.21	26,626,187.61	
1	2000				12,726.31							26,315,651.52	26,732,224.88	
2	2000	5,443,649.73			306,499.85							32,065,801.10	32,303,706.98	
3	2000											32,065,801.10	32,470,424.76	
4	2000				1,558.61							32,067,359.71	32,622,197.85	
5	2000	6,872,198.34		17,000,000.00	316,496.50			9,895.79			(9,895.79)	56,256,054.55	56,766,505.16	
6	2000				36,702.17							56,292,756.72	57,077,769.75	
7	2000				16,487.54							56,309,244.26	57,325,861.11	
8	2000	7,045,461.77			537,710.67			4,652.77			(4,652.77)	63,892,416.70	64,683,277.22	
9	2000											63,892,416.70	65,041,083.80	
10	2000				1,844.77							63,894,261.47	65,362,102.29	
11	2000	7,586,745.53			1,126,671.08							72,607,678.08	73,334,796.89	
12	2000				43,484.69			16,435.99			(16,435.99)	72,651,162.77	73,790,412.25	
1	2001				18,342.09							72,669,504.86	74,257,440.98	
2	2001	7,743,210.05			799,827.38							81,212,542.29	82,341,085.14	
3	2001							9,857.18			(9,857.18)	81,212,542.29	82,761,104.08	
4	2001			11,510,000.00	2,021.17							92,724,563.46	94,633,612.30	
5	2001	8,006,032.89			1,412,807.00							102,143,403.35	103,019,685.17	
6	2001				41,577.72							102,184,981.07	103,320,458.64	
7	2001				15,430.25			12,379.20			(12,379.20)	102,200,411.32	103,644,066.33	
8	2001	9,632,119.43			833,401.49							112,665,932.24	113,669,015.27	
9	2001							13,555.51			(13,555.51)	112,665,932.24	114,153,490.62	
10	2001				394,885.87							113,060,818.11	114,451,433.63	
11	2001	8,460,973.55			817,401.36							122,339,193.02	123,160,008.01	
12	2001				26,001.66			14,781.43			(14,781.43)	122,365,194.68	123,346,653.73	
1	2002				11,004.17							122,376,198.85	123,515,369.72	
2	2002	8,503,746.80			767,080.73							131,647,026.38	132,191,199.49	
3	2002							16,014.42			(16,014.42)	131,647,026.38	132,368,827.86	
4	2002				234,029.53							131,881,055.91	132,601,022.60	
5	2002	8,334,872.14			489,408.26							140,705,336.31	141,168,658.81	
6	2002				13,607.43							140,718,943.74	141,399,751.43	
7	2002				5,072.24							140,724,015.98	141,618,373.67	
8	2002	7,617,118.85			480,512.49							148,821,647.32	149,398,716.87	
9	2002											148,821,647.32	149,655,212.31	
10	2002				211,653.66							149,033,300.98	149,880,138.13	
11	2002	7,547,996.06			594,832.86							157,176,129.90	157,656,605.66	
12	2002			15,500,000.00	49,515.91		0.87		(32,800,000.00)			139,925,646.68	140,536,007.18	
1	2003				5,505.63							139,931,152.31	140,686,952.78	
2	2003	7,152,510.46			481,541.92							147,565,204.69	147,954,467.59	
3	2003							18,185.87			(18,185.87)	147,565,204.69	148,131,277.14	
4	2003				165,890.74							147,731,095.43	148,266,740.47	
5	2003	6,616,135.38			268,537.87							154,615,768.68	155,034,431.22	
6	2003				103,417.90			19,033.34			(19,033.34)	154,719,186.58	155,231,546.34	
7	2003				3,871.37							154,723,057.95	155,336,654.60	
8	2003	5,731,229.15			409,863.90							160,864,151.00	161,186,843.78	
9	2003							19,967.08			(19,967.08)	160,864,151.00	161,359,756.11	
10	2003				122,481.60							160,986,632.60	161,484,799.67	
11	2003	4,329,811.04			250,363.91							165,566,807.55	165,953,359.54	
12	2003				118,503.19			20,635.60	(10,500,000.00)		(20,635.60)	155,185,310.74	155,619,096.98	
1	2004				3,067.15							155,188,377.89	155,738,425.94	
2	2004	4,154,648.16			339,056.21							159,682,082.26	160,002,631.07	
3	2004							20,042.30			(20,042.30)	159,682,082.26	160,148,385.75	
4	2004				108,047.41							159,790,129.67	160,268,233.78	
5	2004	6,036,053.85			258,188.05							166,084,371.57	166,397,169.48	
6	2004				84,623.30							166,168,994.87	166,500,952.05	
7	2004				3,033.90							166,172,028.77	166,705,724.10	
8	2004	4,601,677.70			350,027.06			20,408.53			(20,408.53)	171,123,733.53	171,522,958.17	
9	2004							21,363.22			(21,363.22)	171,123,733.53	171,722,087.23	
10	2004				113,359.84							171,237,093.37	171,946,562.07	
11	2004	4,878,989.34			341,965.17							176,458,047.88	177,045,711.27	
12	2004				145,160.35							176,603,208.23	177,389,051.50	
1	2005				5,306.31			22,043.32			(22,043.32)	176,608,514.54	177,683,492.60	
2	2005	5,248,652.77			659,036.26				(6,972,000.00)			175,544,203.57	176,221,900.27	
3	2005											175,544,203.57	176,625,400.87	
4	2005 (2)				207,015.68		0.29					175,751,219.54	177,050,471.20	
5	2005	5,458,126.89			679,072.25			22,760.44			(22,760.44)	181,888,418.68	183,009,760.39	
6	2005			2,309,849.00	212,964.27			22,681.31		(2,309,849.00)	(22,681.31)	182,101,382.95	183,397,094.79	
7	2005				8,442.26							182,109,825.21	183,814,202.98	
8	2005	5,362,675.88			1,040,927.77							188,513,428.86	189,763,857.11	
9	2005				102,246.14			23,476.78		(7,000,000.00)	(23,476.78)	181,615,675.00	183,337,722.34	
10	2005				215,925.25							181,831,600.25	183,786,556.35	
11	2005	5,244,059.48			1,125,219.46					(4,000,000.00)		184,200,879.19	185,675,813.00	
12	2005				274,489.10			23,498.32			(23,498.32)	184,475,368.29	186,335,125.75	
1	2006				11,177.83							184,486,546.12	186,867,474.15	
2	2006	5,100,571.50			1,461,319.21							191,048,436.83	192,588,102.87	
3	2006				101,185.30					(5,800,000.00)		185,349,622.13	187,551,640.21	
4	2006				168,070.68							185,517,692.81	188,189,318.15	
5	2006	5,104,865.91			1,566,568.02							192,189,126.74	194,082,544.67	

United Guaranty Residential Insurance Company
Trust Deposits
Atrium Re #3-44
September 30, 2012

Month	Year	Premium Deposit	Losses Paid	Capital Deposit	Dividend/ Interest Income (1)	Accrued Interest	Gain (Loss) on Sales	Fee Reimburse	FIT & Operating Expense	Excess Funds	Trust Fees	Cash Basis Ending Balance	Market Value	Book	
6	2006				381,742.30			24,048.67			(24,048.67)	192,570,869.04	194,872,393.35		
7	2006				16,549.87			-			-	192,587,418.91	195,635,508.29		
8	2006	5,100,158.07			1,948,463.38			-			-	199,636,040.36	201,645,172.05		
9	2006				-			24,979.44			(24,979.44)	199,636,040.36	202,537,755.03		
10	2006				207,884.16							199,843,924.52	203,292,876.43		
11	2006	4,855,510.25			2,001,998.43					(11,000,000.00)		195,701,433.20	197,983,416.52		
12	2006				468,536.84							196,169,970.04	198,916,492.95		
1	2007				326,178.39					(14,000,000.00)		182,496,148.43	185,642,562.95		
2	2007	4,716,320.60			1,995,903.18							189,208,372.21	191,106,354.04		
3	2007				862,887.83					(52,563,805.00)		137,507,455.04	139,187,419.94		
4	2007				116,343.84							137,623,798.88	139,771,252.61		
5	2007	4,550,139.55			740,502.54							142,914,440.97	144,959,184.46		
6	2007				471,679.72							143,386,120.69	145,551,680.87		
7	2007				20,122.58			18,021.41			(18,021.41)	143,406,243.27	146,099,217.98		
8	2007	4,464,710.18			2,169,053.80							150,040,007.25	151,682,738.75		
9	2007							18,762.40			(18,762.40)	150,040,007.25	152,219,296.00		
10	2007				120,121.91							150,160,129.16	152,712,905.84		
11	2007	4,482,081.62			841,278.15							155,483,488.93	157,961,858.19		
12	2007				470,923.69			19,564.11			(19,564.11)	155,954,412.62	158,373,630.26		
1	2008				275,208.39							156,229,621.01	159,074,388.81		
2	2008	4,704,078.95			2,008,635.28							162,942,335.24	164,177,849.94		
3	2008							20,409.30			(20,409.30)	162,942,335.24	164,619,312.11	162,971,454.00	(29,118.76)
4	2008				101,409.11							163,043,744.35	164,801,279.86		
5	2008	4,749,771.54			744,647.48							168,538,163.37	169,618,968.49		
6	2008				325,300.80			21,075.16			(21,075.16)	168,863,464.17	169,899,603.45		
7	2008				139,187.37							169,002,651.54	170,246,073.08		
8	2008	5,034,127.06			917,005.53							174,953,784.13	175,588,640.36		
9	2008							21,805.76			(21,805.70)	174,953,784.19	176,207,819.07	174,982,903.00	(29,118.81)
10	2008				38,818.44							174,992,602.63	176,517,652.07		
11	2008	4,992,655.20			400,915.50							180,386,173.33	181,834,554.45	180,415,292.71	(29,119.38)
12	2008				218,216.99			22,539.71			(22,539.71)	180,604,390.32	181,916,823.61	180,633,509.70	(29,119.38)
1	2009				113,942.58							180,718,332.90	181,891,536.77	180,746,453.04	(28,120.14)
2	2009	4,815,797.82			897,554.61							186,431,685.33	186,749,659.23	186,459,274.01	(27,588.68)
3	2009							23,261.44			(23,261.44)	186,431,685.33	186,860,018.53	186,460,804.71	(29,119.38)
4	2009				36,775.88							186,468,461.21	186,944,139.97	186,497,580.59	(29,119.38)
5	2009	6,180,917.31	(728,118.00)		239,548.34							192,160,808.86	192,440,005.86	192,189,928.21	(29,119.35)
6	2009	1,493,683.50	(482,500.00)		22,409.08			23,818.02			(23,818.02)	193,194,401.44	193,482,586.26	193,223,520.79	(29,119.35)
7	2009	1,477,077.45	(471,498.00)		19,259.05							194,219,239.94	194,533,389.24	194,248,359.29	(29,119.35)
8	2009	1,321,443.74	(100,202.00)		199,733.64			(200.00)				195,640,015.32	195,840,091.78	195,669,134.67	(29,119.35)
9	2009	1,584,231.68	(18,660.00)		-			200.00				197,205,787.00	197,474,942.21	197,234,906.35	(29,119.35)
10	2009	1,436,302.06	(90,802.00)		10,135.63							198,561,422.69	198,852,084.21	198,590,542.04	(29,119.35)
11	2009				88,395.94							198,649,818.63	198,884,910.06	198,678,937.98	(29,119.35)
12	2009	2,839,174.68	(358,896.00)		32,249.19							201,162,346.50	201,373,123.60	201,191,465.85	(29,119.35)
1	2010				16,392.85							201,178,739.35	201,397,132.49	201,207,858.70	(29,119.35)
2	2010	2,736,738.03	(484,672.00)		140,545.41							203,571,350.79	203,650,427.09	203,600,473.14	(29,122.35)
3	2010	1,257,944.38	(879,454.00)		3,291.56							203,953,132.73	204,038,284.19	203,982,255.08	(29,122.35)
4	2010	1,370,566.81	(1,423,046.00)		19,600.12	(186,096.28)						203,734,157.38	203,934,671.65	203,763,279.73	(29,122.35)
5	2010	1,337,787.12	(441,723.00)		132,755.57	(315,687.41)	13,438.60					204,460,728.26	204,911,196.98	204,489,850.61	(29,122.35)
6	2010	1,315,997.50	(806,635.00)		305,876.30	(51,161.58)						205,224,805.48	206,332,276.57	205,253,927.83	(29,122.35)
7	2010 (2)				155,438.90	(106,827.17)	4,590.00					205,278,007.21	206,885,114.76	205,307,129.56	(29,122.35)
8	2010	2,593,654.75	(3,762,406.00)		178,965.71	5,161.19	17,460.25					204,310,843.11	206,099,579.79	204,339,965.46	(29,122.35)
9	2010	1,245,022.49	(1,363,065.00)		316,947.88	(39,606.56)	(1,710.20)					204,468,431.72	206,471,562.28	204,497,554.07	(29,122.35)
10	2010 (3)				230,571.02		5,246.00					204,704,248.74	207,087,306.46	204,733,371.09	(29,122.35)
11	2010	2,462,374.35	(10,434,900.00)		437,817.92		36,575.00					197,206,116.01	198,598,517.56	197,235,238.36	(29,122.35)
12	2010	1,140,612.70	(10,805,895.00)		548,248.62		1,166.19					188,090,248.52	188,347,625.59	188,119,370.87	(29,122.35)
1	2011	1,157,316.66	(4,034,199.00)		179,665.09		(3,647.27)					185,389,384.00	185,695,834.40	185,418,506.35	(29,122.35)
2	2011	1,196,616.42	(4,291,950.00)		262,011.81		-					182,556,062.23	182,408,884.52	182,585,184.58	(29,122.35)
3	2011	1,117,458.42	(4,728,907.00)		312,148.33		(108,165.93)					179,148,596.05	178,835,712.98	179,177,718.40	(29,122.35)
4	2011	1,108,029.41	(5,110,991.00)		321,563.57		(23,817.53)					175,443,380.50	175,783,491.93	175,472,502.85	(29,122.35)
5	2011	1,097,828.55	(5,148,539.00)		374,247.60		(24,949.07)					171,741,968.58	172,637,619.93	171,771,090.93	(29,122.35)
6	2011	1,064,877.17	(5,008,328.00)		312,980.31		66,117.08					168,177,615.14	168,773,199.24	168,206,737.49	(29,122.35)
7	2011	1,039,687.78	(4,505,688.00)		142,662.47		77,651.25					164,931,928.64	165,920,147.23	164,961,050.99	(29,122.35)
8	2011	1,033,726.04	(4,383,906.00)		304,280.19		(65,448.06)					161,820,580.81	163,349,819.10	161,849,703.16	(29,122.35)
9	2011	1,013,147.14	(3,107,452.00)		326,462.39		(29,284.29)					160,023,454.05	161,266,869.32	160,052,576.40	(29,122.35)
10	2011	1,002,110.09	(3,596,467.00)		210,500.69		48,986.49					157,688,584.32	158,804,792.91	157,717,706.67	(29,122.35)
11	2011	941,432.36	(5,044,249.00)		141,857.54		119,292.85					153,846,918.07	154,662,235.70	153,876,040.42	(29,122.35)
12	2011	984,869.76	(3,712,476.00)		252,485.42		(37,902.48)					151,333,894.77	152,254,617.94	151,363,017.12	(29,122.35)
1	2012	959,202.14	(3,802,164.00)		139,756.76		9,183.45					148,639,873.12	149,841,677.72	148,668,995.47	(29,122.35)
2	2012	913,350.93	(6,217,528.00)		408,973.90		(41,476.98)					143,703,192.97	144,720,230.06	143,732,315.32	(29,122.35)
3	2012	865,815.81	(4,269,877.00)		157,625.47		(10,344.94)					140,446,412.31	141,115,284.84	140,475,534.66	(29,122.35)
4	2012	863,316.95	(2,405,376.00)		169,169.36		85,301.48					139,158,824.10	139,989,111.73	139,187,946.45	(29,122.35)
5	2012	878,274.47	(2,326,409.00)		175,671.54		(206,965.14)			(6,800,000.00)		130,879,395.97	131,928,421.69	130,937,475.47	(58,079.50)
6	2012	867,283.60	(3,054,468.00)		116,625.81		26,724.74					128,835,562.12	129,739,426.30	128,864,519.27	(28,957.15)
7	2012	864,543.60	(3,784,357.00)		168,463.36		73,259.54					126,157,471.62	127,254,744.93	126,186,428.77	(28,957.15)
8	2012	868,789.05	(2,222,832.00)		209,046.05		(9,415.00)					125,003,059.72	126,085,376.79	125,032,016.87	(28,957.15)
9	2012				69,111.16		(4,937.16)					125,067,233.72	126,061,021.56	125,096,190.87	(28,957.15)
		$ 297,056,562.19	$ (113,408,635.00)	$ 46,779,849.00	$ 49,062,399.25	$ (694,217.81)	$ 16,930.03	$ 596,705.04	$ (50,272,000.00)	$ (103,473,654.00)	$ (596,704.98)	$ 125,067,233.72			

Notes:

(1) Interest reported on a cash basis.

(2) Wire withdrawal did not take place until Aug	1,716,497,783.00
(3) Wire withdrawal did not take place until Nov	3,465,030.00
(4) Excess funds withdrawal made in May 2012	$1,719,962,813.00
	$1,754,362,069.26

	PolicyYr	ResvStatus	ResvStatusDesc	FREQ	BaseLoanAmt	OriginalRisk	InsuredAmt	CurrentRisk	ReservesAmt
20120930 3-44	1994	3	Foreclosure	1	50,400.00	8,568.00	50,400.00	8,568.00	5,912.00
20120930 3-44	1998	3	Foreclosure	2	266,900.00	80,070.00	266,900.00	80,070.00	55,248.00
20120930 3-44	1998	4	Claims Received	1	125,350.00	37,605.00	125,350.00	37,605.00	36,101.00
20120930 3-44	1999	1	Delinquent	3	307,300.00	92,405.00	307,300.00	92,405.00	24,025.00
20120930 3-44	1999	3	Foreclosure	12	1,001,100.00	274,169.00	1,033,429.00	257,044.00	177,360.00
20120930 3-44	2000	1	Delinquent	3	338,210.00	75,337.00	338,210.00	75,337.00	19,588.00
20120930 3-44	2000	3	Foreclosure	16	1,214,620.00	295,800.00	1,214,620.00	295,800.00	204,100.00
20120930 3-44	2000	4	Claims Received	1	116,850.00	29,213.00	116,850.00	29,213.00	28,044.00
20120930 3-44	2001	1	Delinquent	7	642,385.00	179,306.00	681,355.00	190,997.00	49,659.00
20120930 3-44	2001	2	Pending Foreclosure	2	129,653.00	30,178.00	129,653.00	30,178.00	12,675.00
20120930 3-44	2001	3	Foreclosure	41	3,600,773.00	1,046,072.00	3,613,391.00	1,049,857.00	724,398.00
20120930 3-44	2002	1	Delinquent	44	4,660,353.05	1,448,593.00	4,660,353.00	1,448,593.00	376,636.00
20120930 3-44	2002	2	Pending Foreclosure	9	757,425.00	238,606.00	741,843.00	233,472.00	98,059.00
20120930 3-44	2002	3	Foreclosure	76	8,619,568.90	2,652,000.00	8,663,123.00	2,662,983.00	1,837,459.00
20120930 3-44	2002	4	Claims Received	7	750,600.30	250,641.00	767,502.00	256,556.00	246,294.00
20120930 3-44	2003	1	Delinquent	110	13,099,587.00	4,080,772.00	13,067,721.00	4,072,903.00	1,058,959.00
20120930 3-44	2003	2	Pending Foreclosure	9	1,009,990.00	344,463.00	1,032,847.00	352,463.00	148,032.00
20120930 3-44	2003	3	Foreclosure	109	14,305,899.75	4,381,714.00	14,519,741.00	4,448,982.00	3,069,800.00
20120930 3-44	2003	4	Claims Received	13	1,413,107.00	440,671.00	1,413,711.00	440,882.00	423,246.00
20120930 3-44	2004	1	Delinquent	252	29,763,641.34	9,531,738.00	29,750,261.00	9,528,929.00	2,477,537.00
20120930 3-44	2004	2	Pending Foreclosure	26	4,247,544.00	1,348,611.00	4,308,130.00	1,365,705.00	573,596.00
20120930 3-44	2004	3	Foreclosure	281	36,468,732.50	11,575,583.00	36,913,200.00	11,708,591.00	8,078,945.00
20120930 3-44	2004	4	Claims Received	20	2,657,116.50	879,744.00	2,661,719.00	881,355.00	846,100.00
20120930 3-44	2005	1	Delinquent	221	30,915,292.72	9,534,735.00	31,099,116.00	9,587,536.00	2,492,771.00
20120930 3-44	2005	2	Pending Foreclosure	25	4,019,930.00	1,339,193.00	4,045,625.00	1,347,266.00	565,853.00
20120930 3-44	2005	3	Foreclosure	272	45,307,162.82	14,265,548.00	45,599,087.00	14,360,779.00	9,908,956.00
20120930 3-44	2005	4	Claims Received	35	4,359,672.00	1,397,637.00	4,374,990.00	1,402,998.00	1,346,874.00
20120930 3-44	2006	1	Delinquent	116	18,248,143.00	5,646,159.00	18,475,510.00	5,721,366.00	1,489,232.00
20120930 3-44	2006	2	Pending Foreclosure	11	1,972,689.00	559,708.00	1,971,618.00	559,527.00	235,002.00
20120930 3-44	2006	3	Foreclosure	163	26,646,289.50	7,727,988.00	26,889,716.00	7,789,795.00	5,374,970.00
20120930 3-44	2006	4	Claims Received	29	4,100,899.00	1,338,233.00	4,129,172.00	1,347,681.00	1,293,770.00
20120930 3-44	2007	1	Delinquent	260	41,120,694.32	11,060,874.00	41,471,195.00	11,159,242.00	2,901,412.00
20120930 3-44	2007	2	Pending Foreclosure	22	3,295,625.00	813,343.00	3,367,768.00	832,518.00	349,659.00
20120930 3-44	2007	3	Foreclosure	360	60,746,028.18	15,839,603.00	61,519,437.00	16,050,281.00	11,074,702.00
20120930 3-44	2007	4	Claims Received	65	10,999,485.50	3,203,260.00	11,152,752.00	3,248,898.00	3,118,937.00
20120930 3-44	2008	1	Delinquent	111	18,818,326.72	5,260,668.00	18,950,962.00	5,296,574.00	1,377,110.00
20120930 3-44	2008	2	Pending Foreclosure	10	1,721,024.00	519,154.00	1,721,024.00	519,154.00	218,045.00
20120930 3-44	2008	3	Foreclosure	118	21,906,046.24	5,857,691.00	22,059,210.00	5,897,043.00	4,068,955.00
20120930 3-44	2008	4	Claims Received	25	3,848,655.00	1,098,875.00	3,924,309.00	1,123,219.00	1,078,287.00
20120930 3-44A	2009	1	Delinquent	10	1,754,200.00	381,908.00	1,754,200.00	381,908.00	99,296.00
20120930 3-44A	2009	2	Pending Foreclosure	2	361,950.00	108,585.00	361,950.00	108,585.00	45,606.00
20120930 3-44A	2009	3	Foreclosure	6	1,508,430.00	371,028.00	1,508,430.00	371,028.00	256,010.00
20120930 3-44A	2009	4	Claims Received	2	254,695.00	63,674.00	254,695.00	63,674.00	61,127.00
									67,928,347
									-
				38	423,573,069	124,784,528	427,129,100	125,792,365	67,466,308
				344	3,879,275	925,195	3,879,275	925,195	462,039
									67,928,347

1 Deliquent
2 Pending Foreclosure
3 Foreclosure
4 Claim Received

TRUST SUMMARY
Atrium Re #3-44
September 30, 2012

Market Value	Reinsurer Risk Layer	Ceded UPR Loss Reserves	Contingency Reserves	Capital Deposit Required	Capital Deposit Made	Premiums less Paid Losses	Net Investment Income	Withdrawals for Operating Exp and FIT	Excess Funds (dividend) Withdrawals	Min req. for expenses	Min req. for excess funds
126,061,022	$ 977,497,487	32,374,055	91,064,806	$ 130,123,803.24	46,779,849.00	183,647,927.19	48,385,111.53	$ 50,272,000.00	103,473,654.00		125,907,637

check -

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Updated for 9/30/2012											Non Agency			US		Total
Not updated on the non-qtr end months	CUSIP Number	Letter of Credit	Cash Equivalents	Mutual Funds	Accrued Income	Treasury Securities	US Government Bonds	FNMA/ GSE Securities	US Government Tax and Loss Bonds		Residential MBS	Commercial ABS/MBS	Municipal US Obligations	Corporate Obligations	Foreign Obligations	Market Value
COLGATE PALMOLIVE CO 1.250% 5/01/14	19416QDT4													1,116,610.00		1,116,610.00
FHLB 0.600% 8/06/15	313380AG2					228,154.99										228,154.99
FHLMC MTN 0.500% 8/28/15	3134G3ZA1					2,005,800.00										2,005,800.00
FHLMC 0.500% 2/24/15	3134G3NL0					2,002,960.00										2,002,960.00
FHLMC 2.875% 2/09/15	3137EACH0					1,905,912.00										1,905,912.00
FNMA 0.750% 12/19/14	3135G0FY4					1,604,691.60										1,604,691.60
FNMA 1.250% 1/30/17	3135G0GY3					1,180,509.50										1,180,509.50
FNMA 1.250% 9/28/16	3135G0CM3					2,146,848.00										2,146,848.00
FNMA 1.625% 10/26/15	31398A4M1					4,229,164.80										4,229,164.80
FNMA 2.375% 7/28/15	31398AU34					2,374,942.50										2,374,942.50
FNMA 3.000% 9/16/14	31398AYY2					653,449.00										653,449.00
GOOGLE INC 1.250% 5/19/14	38259PAA0													2,536,900.00		2,536,900.00
Johnson & Johnson	478160AU8													1,779,788.00		1,779,788.00
JOHNSON & JOHNSON 1.200% 5/15/14	478160AX2													887,836.25		887,836.25
Mass Mutual Global Funding	57629WAX8													1,001,560.00		1,001,560.00
Mass Mutual Global Funding	57629wbk5													569,360.00		569,360.00
Microsoft Corp	594918AG9													2,074,980.00		2,074,980.00
MICROSOFT CORP 2.950% 6/01/14	594918AB0													782,137.50		782,137.50
New York Life Global Funding	64952WAW3													1,375,868.00		1,375,868.00
New York Life Global Funding	64952wax1													1,268,712.50		1,268,712.50
NEW YORK LIFE GL 1.300% 1/12/15	64952WBE2													533,169.00		533,169.00
Novartis Capital Corportation	66989HAB4													2,018,180.00		2,018,180.00
PRIVATE EXPORT FUND 3.050% 10/15/14	742651DH2													2,105,980.00		2,105,980.00
PROCTER & GAMBLE CO 1.800% 11/15/15	742718DS5													1,119,679.20		1,119,679.20
Proctor and Gamble Company	742718DM8													2,139,600.00		2,139,600.00
NEW YORK LIFE GLBL 0.750% 7/24/15	64952WBH5													1,300,793.00		1,300,793.00
PRIVATE EXPT FNDG 5.450% 9/15/17	742651DE9													1,219,730.00		1,219,730.00
WAL-MART STORES 1.625% 4/15/14	931142DA8													2,851,520.00		2,851,520.00
3M COMPANY 1.375% 9/29/16	88579YAD3													1,667,298.75		1,667,298.75
USAA CAPITAL CORP 1.050% 9/30/14	90327QCV9													1,157,486.50		1,157,486.50
CHEVRON CORP 3.950% 3/03/14	166751AH0													1,469,720.00		1,469,720.00
U.S. TREASURY NOTES 2.000% 4/30/16	912828QF0					2,113,900.00										2,113,900.00
US Treasury Note	912828NV8					3,287,008.00										3,287,008.00
US TREASURY NOTE 1.000% 8/31/16	912828RF9					2,553,125.00										2,553,125.00
US TREASURY NOTE 2.375% 2/28/15	912828MR8					1,911,564.20										1,911,564.20
US Treasury Note	912828PF1					2,467,406.25										2,467,406.25
US Treasury Note	912828KS8					2,153,120.00										2,153,120.00
U.S. TREASURY NOTES 1.250% 10/31/15	912828PE4					4,523,420.00										4,523,420.00
US TREASURY NOTE 1.750% 7/31/15	912828NP1					5,099,087.00										5,099,087.00
U.S. TREASURY NOTES 1.875% 8/31/17	912828NW6					1,645,294.00										1,645,294.00
US TREASURY NOTE 2.125% 2/29/16	912828QJ2					1,674,183.80										1,674,183.80
U.S. TREASURY BILLS 1/03/13	9127956Z9					2,699,460.00										2,699,460.00
U.S. TREASURY BILLS 1/17/13	9127957B1					12,297,171.00										12,297,171.00
U.S. TREASURY BILLS 1/31/13	9127957D7					8,367,405.30										8,367,405.30
U.S. TREASURY BILLS 2/07/13	9127955Z0					9,496,485.00										9,496,485.00
U.S. TREASURY BILLS 2/14/13	9127957F2					6,997,130.00										6,997,130.00
U.S. TREASURY BILLS 2/21/13	9127957G0					6,097,255.00										6,097,255.00
XTO ENERGY INC 5.000% 1/31/15	98385XAF3													609,059.00		609,059.00
XTO ENERGY INC 5.750% 12/15/13	98385XAS5													2,337,170.00		2,337,170.00
WILMINGTON PRIME MONEY MKT CL ADMN	97181C407		422,436.92													422,436.92
Principal Cash																-
																-
Total		-	422,436.92	-	-	91,715,446.94	-	-	-	-	-	-	33,923,137.70	-		126,061,021.56
																-

EXHIBIT 12

Investigating captive mortgage reinsurance.

Mortgage Banking - February 1, 1998
Michael C. Schmitz

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citation details

Lenders should do their homework before diving into reinsurance.

Banks and other mortgage lenders have recently begun participating more in the insurance of default risk on their originations. This interest can be attributed to several factors that relate to developments in both mortgage lending as well as the mortgage insurance business.

Among the specific factors driving the trend are:

* Consolidation in banking and mortgage lending producing fewer and larger competitors that are more diverse and thus better suited to retain default risk and negotiate risk-sharing contracts with mortgage insurers;

* Mortgage insurance has recently been a profitable line of business; and

* Such arrangements move lenders further into the insurance industry in a coverage that is incidental to lending activities.

Captive reinsurance arrangements are becoming a popular vehicle for lenders to self-insure mortgage-insurance (MI) risk on mortgages they originate. In such an arrangement, the lender establishes a reinsurance company subsidiary (captive). The captive assumes MI risk written by a direct mortgage insurance company (direct writer) on loans originated by the lender. As consideration for the risk transfer, the direct writer cedes a portion of the MI premium to the captive.

As of late 1997, at least six national banks have received federal approval from the Office of the Comptroller of the Currency (OCC) to form a mortgage reinsurance subsidiary. Additional reinsurance subsidiaries have been established by mortgage lenders that are not subject to OCC oversight. As many as 50 or more of these companies may ultimately be formed by lenders and direct writers, according to Standard & Poor's (S&P), an agency responsible for rating the claims-paying ability of insurance companies.

If you are a sizable player in the mortgage lending market, the chances are good that these opportunities have attracted your attention. However, given the complexity of such arrangements and the variety of options available, the captive mortgage reinsurance arena should not be pursued without a carefully constructed strategy. Attention to the following eight considerations can help chart a course appropriate for a particular lender.

* Volatility of MI losses;

* Lender's appetite for risk;

* Performance of lender's loan portfolio;

* Risk profile of lender's loan portfolio;

* Reinsurance structures;

4

* Capital required;

* HUD compliance; and

* Reinsurance protection for the captive.

Each of these considerations is briefly discussed below.

Volatility of MI losses

During the 1990s, fueled by low losses and a strong economy, mortgage insurers' profits have soared. The five-year return on equity for the industry from 1992 to 1996 was 18.4 percent, according to S&P. During the same five-year period, the annual return on revenue for the industry peaked at 51 percent in 1996 and never fell below 25 percent.

However, the losses experienced by the MI industry during the 1980s are just as noteworthy as were its profits in the 1990s. Loss ratios represent a key measure of insurance underwriting results and are calculated by dividing incurred losses by earned premiums. Figure 1 displays a graph of the MI industry's calendar-year loss ratio for the 15-year period from 1980 to 1995. The industry saw losses rise sharply in the mid-1980s, peaking at a loss ratio of 192 percent in 1987. In other words, the industry incurred $1.92 of losses for every $1.00 of premium revenue in 1987. This period of heavy MI losses was largely a result of the boom and bust residential real estate market in the south central "oil patch" region of the United States.

Providing MI coverage is clearly a risky venture. Insurers set fixed premiums up front for coverage that frequently extends for seven to 10 years or more. Economic factors have a marked effect on mortgage default rates and therefore on MI losses. Lenders must be prepared for this risk if they intend to pursue a captive mortgage reinsurance arrangement.

Appetite for risk

Given the volatility associated with MI losses, it is critical that lenders assess their own appetite for risk before entering into a captive mortgage reinsurance arrangement. The large profits enjoyed by insurers in recent years will not continue indefinitely. MI margins compensate insurers for the risk associated with the coverage and allow for the accumulation of capital during the profitable cycles to establish a cushion for the high loss levels that can accompany adverse economic conditions. Lenders must be sure they are prepared to make a long-term commitment to the venture before spending the time it takes to establish the reinsurance subsidiary and negotiate the contract terms.

Many lenders have established subsidiaries to manage their expanding insurance services. Some already participate in the underwriting risk of other insurance coverages incidental to banking, such as credit life insurance and credit card unemployment coverage. MI reinsurance should be considered within the context of other insurance ventures being undertaken to determine the organization's appetite for the risk of reinsuring MI coverage. Lenders with a strong appetite for risk will welcome the opportunity to reinsure MI coverage and will prefer structures with larger reinsurance premium levels and correspondingly greater risk.

Performance of lender's loan portfolio

A lender should examine the past performance of its portfolio of high loan-to-value ratio (LTV) loans when considering a reinsurance arrangement. Lenders whose mortgage underwriting quality has exceeded that of their peers will likely be more eager to participate in insuring their future loan performance. Furthermore, these lenders will find the MI companies enthusiastic about discussing reinsurance arrangements with their valued customers.

The lender's mortgages can be compared against benchmarks such as the performance of the average loans insured by the MI companies currently guaranteeing the lender's portfolio. Lenders can request reports from their current insurers that examine the lender's delinquency and claim rates by year of loan origination relative to the insurer's aggregate results.

Claim rates represent the percentage of loan originations for a book-year that have resulted in a claim as of a certain evaluation date. Likewise, delinquency rates represent the percentage of book-year loan originations that are currently delinquent. Both statistics are routinely monitored by insurers. Generally, claim rates are the more accurate measure of the actual performance of each book-year of insured loans. However, the claim rate for recent book-years will typically offer little value because the majority of MI claims usually occur from three to seven years after loan origination.

Therefore, delinquency rates are used as a barometer of future claim activity because some of the loans that are currently delinquent will eventually result in a claim. The relationship between origination-year age and the typical pattern of claim activity makes it critical that comparisons be made at comparable stages of maturity (i.e., on a book-year basis with a common evaluation date).

Generally, the lower a lender's delinquency and claim rates relative to the insurer's averages, the more profitable that business is to the insurer. Before drawing any definite conclusions about the quality of its insured loans based on a delinquency and claim rate comparison, a lender must also consider other characteristics of the loans in its portfolio of originations. For example, a lender insuring a disproportionate share of 85 percent LTV loans relative to the insurer's total book will likely have a lower claim rate since higher LTV loans are riskier. However, this lender will not necessarily be a more profitable customer to the insurer because the premium rates charged for 85 percent LTV loans are lower than for higher LTV loans. This highlights the need to examine the risk profile of a lender's loan portfolio.

Risk profile of lender's loan portfolio

As a lender's mortgage origination volume increases, the portfolio becomes more diverse and the risk of insuring (and reinsuring) the portfolio decreases. MI companies insure the loans of many lenders in order to reduce risk through diversification. However, a lender's captive is restricted to reinsuring only the lender's mortgages. Therefore, lenders with larger and more diverse origination volume are better suited to accept a larger piece of the risk pie.

Lenders should examine their loan distribution by LTV and loan type to assess the diversity of this risk. Lenders with higher concentrations than the industry of adjustable rate mortgages (ARMs) or loans with LTVs greater than 95 percent represent a greater risk than a more balanced portfolio.

However, there is probably no factor more important to the diversification of a lender's MI risk than the geographical distribution of the lender's originations. Geographical diversification is so critical that regulators have placed limitations on insurers' concentrations within a given Standard Metropolitan Statistical Area (SMSA). The National Association of Insurance Commissioners' (NAIC) Mortgage Guaranty Insurance Model Act limits an insurer's concentration to 20 percent of its insurance in force in any single SMSA.

The MI industry took a beating in the 1980s largely as a result of a regional economic event (the residential real estate depression of the oil patch states). Insurers' ability to withstand the losses of this period depended on their national diversification because the profitability of business in other regions partially diluted the catastrophic losses in the south central region. Likewise, larger and more geographically diverse lenders will be better suited to assume higher levels of risk.

Reinsurance structures

Myriad different reinsurance arrangements can be structured to meet a lender's particular appetite for risk. Contracts are typically structured to include mortgages originated by the lender during a three- to

five-year origination period. The reinsurer receives premium revenue and is responsible for reinsured losses for a runoff period typically lasting 10 years for each origination year. The reinsurer may also be responsible for a ceding commission to the direct insurer. Ceding commissions are typically used in reinsurance contracts to compensate the direct insurer for its expenses associated with the underwriting and administration of coverage as well as claim settlement costs. While some captive mortgage reinsurance contract specify a separate ceding commission, others include a reinsurance premium quote on a net of ceding commission basis.

Generally, reinsurance structures can be broadly classified into the following two varieties: quota share and excess of loss.

In a quota-share arrangement, the primary insurer and reinsurer share all losses and premium on a pro-rata basis according to the specified quota-share percentage. In an excess-of-loss arrangement, the reinsurer is responsible for all losses once the primary insurer's losses reach a specified level referred to as the attachment point. The reinsurer pays the primary insurer for all losses in excess of the attachment point up to the reinsurer's overall policy limit. No losses are reimbursed by the reinsurer if losses do not exceed the attachment point. As of late 97, most captive mortgage reinsurance arrangements have been on an excess-of-loss basis.

The corridor of losses reinsured by a lender can be defined in several ways. The primary insurer's direct loss ratio for loans subject to the contract can provide the basis for the reinsurer's layer. For instance, the reinsurer might cover losses exceeding 75 percent of the direct insurer's premium up to 110 percent of direct premium; (i.e., between direct loss ratios of 75 percent and 110 percent). Alternatively, the reinsured layer can be specified based on the direct risk insured by the primary insurer.

Regardless of how the reinsurer's layer of risk is specified, it is typically set at a level sufficiently higher than expected losses so that the reinsurer is expected to incur no losses in the majority of years. For example, the reinsurer may be expected to be loss-free for three out of four years of mortgage originations. However, the reinsurer's losses may be expected to consume the entire reinsured layer roughly 1 out of every four years. The one adverse origination year may produce losses up to four or five times as large as the reinsurance premium. In other words, the reinsurer is typically participating in a loss layer penetrated only in adverse loss cycles.

By contrast, a quota-share arrangement provides a reinsurer with a pro-rata share of risk that basically behaves identically to the direct risk insured by the mortgage insurer. The exposure covered by the direct insurer and reinsurer have the same risk profile just in different sizes reflecting the quota-share percentage. Unlike excess-of-loss participation, the reinsurer participates in all insured layers, including those associated with adverse underwriting cycles and layers of expected loss levels.

This feature may be particularly appealing if the lender believes average loss levels can be managed through mortgage lending underwriting standards but that catastrophic loss levels are virtually uncontrollable due to economic forces outside the lender's control. Such a lender would likely want to participate in the more manageable layers of loss included in a quota-share agreement, and possibly purchase aggregate excess insurance for the captive's exposure in the catastrophic claim layers. Quota-share arrangements are relatively new and less common than excess-of-loss arrangements. The appropriate maximum allowable quota-share level reinsured by lenders is a hot topic of debate by regulators. Vermont, which regulates many captives including several mortgage reinsurers domiciled in the state, has recently indicated that it may permit arrangements where the quota share is 25 percent or lower. The insurance commissioners for the states of North Carolina and Wisconsin have recently taken a similar view. However, the OCC has given banks approval to reinsure up to quota share levels of 50 percent. The OCC has indicated it would separately consider any banks seeking quota-share arrangements of more than that percent.

Capital required

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Lenders must be prepared to contribute capital to the captive to support the risk of reinsuring a coverage as volatile as mortgage insurance. The capital must be committed to the reinsurer on a long-term basis due to the lengthy runoff period associated with the exposure. While minimum capital levels vary by state of domicile, statutory minimum capitalization for a Vermont captive is $250,000. However, lenders must be willing to contribute additional capital to provide a cushion for adverse years when losses exceed premiums.

At a minimum, the NAIC model act specifies that mortgage insurers are required to maintain capital so that aggregate insured liability (i.e., risk) does not exceed a factor of 25 times the insurer's capital. Risk is defined as coverage on all insured mortgages currently in force. For example, required capital associated with $1 billion of insured loans in force would be approximately $10 million. A lender with a 25 percent quota-share reinsurance contract on these loans would need at least $2.5 million to support this risk (i.e., 25 percent of $10 million).

Capital requirements for captive mortgage reinsurers tend to be more strict than the 25-to-1 standard for the following reasons:

* Lender captives are reinsuring a less geographically diverse portfolio than the aggregate insurance written by primary insurers. The additional risk associated with reinsuring this portfolio requires additional capital;

* Mortgage insurers are typically capitalized above the minimum level (i.e., at a ratio at or below 20 to 1). Additional capital is required to maintain a sufficient financial strength rating to be acceptable primary insurance providers on mortgages pooled by Fannie Mae and Freddie Mac. Primary insurers may similarly require their reinsurers to be sufficiently capitalized so that their rating is not jeopardized by potential insecurity of reinsurance collectibility;

* Lender captives typically reinsure on an excess-of-loss basis. As mentioned earlier, the reinsured layer tends to be above expected losses in the more volatile excess layers. The additional risk associated with such layers of coverage may require additional capital.

Mortgage insurance is a capital-intensive business. However, a portion of the capital required of the reinsurer may be met through sources other than cash, such as a letter of credit. Furthermore, during profitable years, capital will be generated from the reinsurance operations through the accumulation of retained earnings and a contingency reserve.

Mortgage insurers are required to establish a contingency reserve to cover potential loss. This reserve is also required of captive reinsurers. When computing an insurer's capital for purposes of required risk-to-capital thresholds, both the insurer's statutory surplus and its contingency reserve are included.

Under statutory insurance accounting, 50 cents of every mortgage insurance premium dollar must be set aside for 10 years in a contingency reserve. Reserve contributions cannot be released before the 11th year unless the insurer's losses exceed a threshold loss ratio of 35 percent (with state insurance commissioner approval). Net annual contributions to the contingency reserve are tax deductible as long as the deferred tax (which will be earned as revenue upon release in year eleven) is funded with noninterest-bearing tax and loss bonds.

The contingency reserve and capital requirements emphasize the long-term commitment required to reinsure mortgage insurance risk.

HUD compliance

A lender will want to be comfortable that its reinsurance arrangement does not violate section 8 of the Real Estate Settlement Procedures Act (RESPA). On August 6, 1997, the U.S. Department of Housing and Urban Development (HUD) issued a letter clarifying the applicability of RESPA to captive

reinsurance arrangements. HUD concluded that these arrangements are permissible "so long as payments for reinsurance... are solely payment for goods or facilities actually furnished or for services actually performed."

HUD outlines several factors which will cause additional scrutiny to be given to a captive-reinsurance arrangement and HUD presents the following two-part test to determine if a violation exists.

Test 1. The arrangement meets three requirements that establish that reinsurance is actually being provided; and

Test 2. The compensation paid for the reinsurance shall not exceed the value of the reinsurance.

The factors leading to additional scrutiny and HUD's two-part test are both discussed in detail in the December 1997 Mortgage Banking article "Being Held Captive by HUD." As noted in that article, the most difficult criteria that must be satisfied to establish that reinsurance is being provided (Test I) is that there must be real transfer of risk.

HUD acknowledges that the transfer of risk requirement is clearly satisfied by a quota-share arrangement but states that the transfer of risk requirement can be met in the case of an excess-loss arrangement "if the band of the reinsurer's potential exposure is such that a reasonable business justification would motivate a decision to reinsure that band." Therefore, excess arrangements must be scrutinized more closely to ensure that no RESPA violation exists.

Based on the guidelines outlined by HUD, lenders must be comfortable that their captive reinsurance arrangements do not violate RESPA.

Reinsurance protection for the lender captive

While the notion of a reinsurer purchasing reinsurance of its own may initially seem strange, it is a common practice in other lines of insurance. Known as retrocessions, such coverage allows the reinsurer to assume more risk for a given level of capital.

Lenders may want to consider purchasing reinsurance protection to limit the risk reinsured by its captive, particularly if the lender is pursuing a quota-share arrangement. For example, a lender may favor a quota-share arrangement due to:

* Its definite transfer of risk and the correspondingly stronger case against a RESPA violation; and

* The inclusion of the more predictable and manageable loss layer in the risk reinsured by the lender.

However, the reinsurer may desire reinsurance protection in order to:

* Protect the lender against catastrophic loss scenarios that present a greater risk to lenders with less geographic diversification;

* Reduce the volatility of the financial performance of the captive; and

* Reduce the amount of capital required to support the risk reinsured by the captive.

There are several reinsurers based in the United States and elsewhere (some of whom have served primary mortgage insurers in the past), that represent a third-party option for retrocessional protection to a lender captive. As an unrelated third party to the transactions between the lender and the primary insurer, such a reinsurer could provide protection to the captive while preserving the clean RESPA status afforded by HUD to quota-share arrangements.

Investigating captive mortgage reinsurance.

As mergers and acquisitions in banking and mortgage lending create larger and more diverse lenders, and as banks continue to increase their insurance operations, captive mortgage reinsurance is an idea whose time has come. However, given the nature of the risk, the complexity of the arrangements and the options available, lenders will want to do their homework before they plunge into the captive mortgage reinsurance waters.

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EXHIBIT 14

Profit Margins Using Co-Measures of Risk

Mark J. Homan, FCAS, MAAA, CPCU

Abstract:. Insurance policies cover multiple loss components. Lately, there is a move to determining the premium for a policy by combining the components. This has led to the desire to have profit margins that can be combined. This paper demonstrates that profit margins by component are not additive. Those wishing to introduce rating by peril will need to consider how they will determine profit margins as they combine the underlying loss costs. The Excel worksheet used in the examples will be available on the CAS website.

Keywords. Profit Loads; capital allocation; risk loads

1. INTRODUCTION

There is a trend towards rating multi-peril products (i.e., Homeowners and Business Owners) by peril, or splitting rates between catastrophe and noncatastrophe. So the issue of determining the required profit loads naturally arises. The desire is to have profit loads by component so premiums can be determined by component and added together to get the final rate.

For example, the Florida legislature, recognizing the need for an appropriate return on catastrophe risk, required the Office of Insurance Regulation to determine an appropriate profit margin for the catastrophe portion of the Homeowners rate. While it is important for the industry that the legislature recognizes that catastrophe exposed business requires an appropriate return for the risk, they also took the erroneous view that profit margins can be determined by component.

Clearly, the administration of rates, for both companies and state regulators, would be simpler if profit margins could be determined in an additive manner. However, reality once again is not as simple as we would like.

Unfortunately, additive profit margins by component cannot be developed. One may accept the compromise required to treat profit margins as additive. However, this involves significant compromise in some cases, creating significant differences in prices.

Loss costs, which are based on means, are additive. Profit loads are based on risk, reflecting additional moments of the distribution, and higher moments of distributions are not simply additive. Diversification and correlation impact the profit load for the aggregate risk.

The examples in this paper are based on splits between catastrophe and noncatastrophe portions of the risk. The two loss components are treated as independent. This is reasonable in the author's

experience, but the methodology can be applied to loss distributions that are correlated. All expenses are treated as variable with no volatility. This is a simplifying assumption to isolate and highlight the interplay of the two loss components. The analysis can be extended to reflect expense variability and the risk that expenses represent.

1.1 Research Context

This paper deals primarily with the required profit margins. It also addresses related issues of capital allocation and ROE.

There are a number of papers in the CAS literature on setting required profit margins, or profit loads. These papers identify that catastrophe exposure is a key consideration in determining the required profit margin. These papers deal with how to determine the profit margin for an aggregate exposure, with all risks combined. No papers or presentations were found that addressed the issue of determining profit margins based on risk component.

1.2 Objective

The paper will evaluate two different approaches for determining profit margins by component. Both approaches will show that profit margins by component are not linear, and as a result, they cannot be added together. The expectation is that the paper can refute the concept of additive component profit margins.

1.3 Outline

The first part of the paper will demonstrate why profit loads cannot be determined by peril or component. Then it will demonstrate how to determine the overall required profit margin using a Risk Coverage Ratio (RCR) approach, and then how to allocate the required profit to component based on risk using an approach algorithm named after the developers Ruhm-Mango-Kreps (RMK). It will also demonstrate the limitations or compromises required in this approach.

2. BACKGROUND AND METHODS

The two methods evaluated are RCR and the RMK algorithm. A brief overview of each method will be provided before using the method to evaluate profit margins for the components. Further information on each method is included in the Appendix..

2.1 Profit Margins using RCR

The initial concept used in this paper to determine a profit margin is the RCR. RCR was introduced to the actuarial community in a paper by David Ruhm [1]. Although RCR does not require surplus, as implied by the title of the paper, it is easy to translate the required price into implied surplus to attribute capital. (More information is provided in the Appendix.)

As a reward-to-risk ratio, RCR balances the required return to the risk. In its basic application, RCR is calculated from the distribution of returns on operating cash flows. In this situation, a common adverse event, or minimum threshold is zero. This means that any scenario where the premium and investment income are insufficient to cover all expenses and losses is considered an adverse event. In other words, any operating loss is bad.

RCR has strong appeal for use in pricing as it includes all adverse events in its determination. The risk metric used in the denominator is related to TVAR (Tail Value at Risk), also known as CTE (Conditional Tail Expectation). The key difference is that TVAR is usually demined at a pre-determined percentile level. For RCR, that percentile is dynamic and will vary based on the shape of the distribution for the line.

Since the RCR is a ratio of reward to risk, each line will have the same cost per unit of risk. In other words, the dollars of return required for each dollar of risk will be uniform across all lines of business.

2.2 Using RMK to Allocate Profit Margin

In Section 3.5 that follows, the RMK (Ruhm-Mango-Kreps) algorithm is used to allocate surplus and thus the profit margin to risk component. RMK is an approach that attributes surplus to risk component in proportion to the component's contribution to aggregate risk. It is solely a methodology to allocate surplus, it does not determine the amount of surplus that is required.

The derivation of this algorithm and its properties are covered in papers available through the CAS. An initial paper by Ruhm and Mango [2] provides the foundation and formulas. Another paper by David Clark [3] provides a practical application of the RMK algorithm. Neither paper will be covered in detail here.

RMK requires setting an initial vector outlining risk appetite. In this paper, all scenarios that generate a net loss are assigned the same weight. Depending on a company's risk appetite, there may be events that cause a more extreme loss that should get higher weight. For example, the

weight may be increased in situations where a company is forced to access the capital markets for additional funds. The simpler approach used in this paper works well in practice and adequately outlines the desired concepts. The initial weights then are normalized to average to 1.0, and this becomes the Z-vector discussed in the Mango-Ruhm paper [2].

For the first two examples, since there is only a single loss component, these calculations are uninteresting, but are included to demonstrate that they work in this situation

3. RESULTS AND DISCUSSION

In this section, the required profit load is determined for various combinations of catastrophe and noncatastrophe losses using the Risk Coverage Ratio. Then for the same examples the surplus and profit loads are split to risk component using the RMK algorithm.

3.1 Profit Loads

This section provides a general overview of splitting profit margins into catastrophe loss and noncatastrophe loss components. The examples shown are simplified calculations. Only the volatility in the level of the catastrophe and noncatastrophe loss ratio is reflected. Additional sources of volatility (payment date, interest rate, expense ratio, etc.) are ignored. This allows for illustration of the concepts, without requiring too complex an Excel spreadsheet for the examples. The exhibits show the summary and first 20 scenarios for each simulation. The full Excel spreadsheet is available on the CAS website.

The assumptions used in all examples are shown below:

Expenses	30% (treated as all variable)
Loss Payment	1 year (for both catastrophe and noncatastrophe)
Yield	5.04% before-tax
Tax Rate	35% (ignore tax loss discount)
RCR Target	20

3.2 Separate Profit loads by Component

As a first step, let's look at the profit loads by component for catastrophe separate from noncatastrophe. Exhibit 1A shows the derivation of the required premium for $35 catastrophe loss only with the base assumptions. The catastrophe loss distribution is a sample of 10,000 scenarios

from a vendor catastrophe model using a countrywide distribution. The required premium is $90.85. The target combined ratio is 68.5%, or an underwriting profit margin of 31.5%

Exhibit 1B shows the derivation of the required premium for $60 of noncatastrophe loss with the base assumptions. The noncatastrophe loss distribution is based on a lognormal distribution and also uses 10,000 scenarios. The required premium is $97.32. The target combined ratio is 91.7%, or an underwriting profit margin of 8.3%. Adding the noncatastrophe premium to the catastrophe premium yields a total premium of $188.18. (There is an additional cent from rounding in the Excel spreadsheets.)

Comparing the two combined ratios, or profit margins, it is clear that the higher risk represented by catastrophe losses requires a much higher price per dollar of loss. Since expenses are all variable, the required premium is scaleable with losses. So to more directly compare the two premiums, we can scale the noncatastrophe premium to $35 of noncatastrophe loss. That premium would be $56.77, or $34.08 less than what is required for catastrophe losses.

3.3 Profit Load for Combined Components

Now, let's combine the catastrophe and noncatastrophe distributions and create a single loss distribution and an aggregate return distribution. Exhibit 2 shows the resulting required premium ($174.12) and combined ratio (84.6%) for $35 of catastrophe loss and $60 of noncatastrophe loss. Comparing this premium to the total premium of $188.18 from Exhibits 1A and 1B, one can see that the required premium is less on an aggregate basis than the sum of the premiums from each risk separately. The difference in premium of $14.05 is the diversification benefit. The diversification comes from the fact that a bad year on one distribution can be offset, completely or partially, by a lower than expected year on the other distribution. It should be noted that a low catastrophe year will more often offset a bad noncatastrophe result in the same year than the other way around. This is because the catastrophe distribution has a more extreme tail.

3.3.1 Profit Load with a Different Mix

To further illustrate the effect of looking at combined distributions to develop profit margins versus combining the components, let's look at some different splits between catastrophe and noncatastrophe losses.

Exhibit 3A shows the required premium if there is twice as much in catastrophe loss, or $70. The required premium is $264.07. Comparing this to twice the catastrophe premium plus the

noncatastrophe premium, which is $279.03, we can see the diversification benefit is $14.96. The diversification benefit is better than Exhibit 2, but only by a small amount. In addition, the target combined ratio is 79.2%, lower than in Exhibit 2.

Exhibit 3B shows the required premium if there is half the amount of catastrophe loss, or $17.50. The required premium is now $130.92. Comparing this to half the catastrophe premium plus the noncatastrophe premium, which is $142.75, we can see the diversification benefit drop to $11.83. Now the target combined ratio is 89.2%, up from Exhibit 2.

I will leave it to the curious reader to download the Excel file from the CAS website and verify the following statements. Clearly, as the catastrophe loss goes to zero, the diversification benefit will go to zero as we will only have the noncatastrophe premium as shown in Exhibit 1A. As the catastrophe loss increases, the diversification increases at a decreasing rate.

3.4 Diversification Benefit

The key difference between separate profit margins and a combined profit margin is reflecting the diversification benefit between the components. From Exhibits 2, 3A and 3B, we can see that the diversification benefit is a nonlinear relationship between the two loss distributions. Since this is a nonlinear relationship, it is clear that one cannot determine separate profit margins for catastrophe and noncatastrophe components and then add them together. The diversification benefit must be considered, and it is not a single factor adjustment in all cases.

3.4.1 Special Case – Complete Correlation

There is a special case where component profit margins would be additive. If the two distributions are completely correlated, there is no diversification benefit from combining them. With no diversification benefit, then the profit margins are the sum of the parts.

3.5 Using RMK to allocate Surplus (and profit margin)

The RMK algorithm is an alternate method for attributing surplus based on contribution to risk. From another perspective, it can be viewed as a method for allocating the diversification benefit.

3.5.1 RMK – Still not a Solution to Component Profit Margins

In Exhibit 2-2, the surplus allocation for the example in Exhibit 2 is derived. This shows that within this example, the surplus is needed predominately for the catastrophe risk. The

noncatastrophe risk contributes very little to the operating losses. So the diversification benefit that we discussed above is primarily seen in the noncatastrophe risk. Similar derivations of surplus attribution are shown in Exhibits 3A-2 and 3B-2.

Another way to look at the allocation of diversification benefit is to compare the surplus by component. The surplus indicated for the catastrophe risk only starts at $168.02 (Exhibit 1A), which is reduced only to $160.24 (Exhibit 2-2) in the combined example. In contrast, the required surplus for the noncatastrophe component starts at $61.29 (Exhibit 1B), and this is reduced to $14.53 in the combined example (Exhibit 2-2). This shows that the primary impact of diversification is to reduce the amount of surplus required to support the noncatastrophe risk.

Starting with the allocation of surplus and profit from Example 2, we can try to predict the required profit margins for Examples 3A and 3B. We do this by applying the leverage ratios from Exhibit 2-2 to the liabilities generated in Examples 3A and 3B. This is shown in Exhibit 4. This example shows we would come up short on our estimate of required surplus, and thus profit margin, for both cases.

It is interesting to understand why we are not predicting the correct answer. In both cases, it is because the level of diversification has changed. In Example 3A, we are not getting as much diversification from the noncatastrophe portion of the exposure. Since there is little surplus required for noncatastrophe, the difference in required surplus is moderate. In Example 3B, we have half the catastrophe loss level. Now, the noncatastrophe loss cannot be diversified away as much as in Example 2. In other words, the noncatastrophe risk has more impact on the bottom line, so we need to attribute more surplus to it.

RMK is considered one of the most sophisticated methods of attributing surplus and determining required profit, yet it still cannot provide correct answers for component profit margins that can be used as the mix of risk component changes.

3.5.2 Materiality

Let's shift from the theoretical to the practical. The RCR analysis was sufficient to demonstrate that component profit margins are not additive as risk varies, so why explore the application of RMK? It is because RMK can be used to flex profit margins within a reasonable range of changes in mix by component. The size of the range will depend on one's definition of materiality. Clearly, if there is a theoretical difference that does not translate to a difference in what a policyholder will actually pay (i.e. one that rounds away), then the difference would not be considered material.

For Example 3A, the shortfall is moderate, only $0.78 on the true premium of $264.07. This could very well be determined not to be material. And this is an example where we doubled the catastrophe losses, which is a fairly extreme change. If the increase in catastrophe losses was more moderate, like 10%, the difference would be even smaller and would be more likely to be considered immaterial by many companies.

The examples used in this paper were based on a split between catastrophe and noncatastrophe components. Also, the size of the differences in the split is extreme to more easily demonstrate the points in the paper. While the theoretical conclusions apply equally to more moderate splits, like Homeowners rating by peril, the differences in results are not as great. When the distributions are not as different in shape, then RMK can be used in a broader range without material bias. Or, if the range of changes anticipated in the mix of component is moderate, RMK can be reasonably used.

So, in the end, one may determine that the RMK algorithm creates a practical approach for addressing the component profit margins in certain situations.

4. CONCLUSIONS

Profit margins are based on risk. Risk cannot be evaluated by component in isolation. Risk must be evaluated in the context of the whole, and how the various risks contribute diversification to each other. It is not theoretically possible to create additive component profit margins. However, it is possible using RMK to create profit margins that can be combined within reasonable ranges of mix change.

Acknowledgment

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Supplementary Material

The Excel workbook containing all the examples in the full 10,000 scenario detail is stored on the CAS website.

5. REFERENCES

[1] Ruhm, David L., "Risk Coverage Ratio: A Leverage-Independent Method of Pricing Based on Distribution of Return," *ASTIN Colloquium International Actuarial Association - Brussels, Belgium,* **2001**: Washington.

[2] Mango, Donald F., and Ruhm, David L., "A Risk Charge Calculation Based on Conditional Probability," *ASTIN Colloquium International Actuarial Association - Brussels, Belgium,* **2003**: Berlin.

[3] Clark, David R., "The Reinsurance Applications for the RMK Framework," Casualty Actuarial Society *Forum,* Spring **2005**, 353-366.

Abbreviations and notations

Collect here in alphabetical order all abbreviations and notations used in the paper

RCR, Rick Coverage Ratio

RMK, Ruhm Mango Kreps

ROE, Return on Equity

Biography of the Author

Mark J. Homan is an AVP and Actuary at The Hartford Financial Services Group in Hartford, CT. He is responsible for risk and return modeling, capital allocation support, and ratemaking compliance. He has a degree in Mathematics and Quantitative Methods from the University of St. Thomas, St. Paul, MN. He is a Fellow of the CAS and a Member of the American Academy of Actuaries. He currently is a member of the AAA Natural Catastrophe Subcommittee and has also recently participated on the CAS Professional Education Committee, ERM Subcommittee. He is a frequent presenter at industry symposia and has authored previous papers in the CAS literature dealing with Homeowners pricing.

6. APPENDIX

More information on the two approaches used in this paper is provided in this appendix. Recognizing that most readers will not be familiar with RCR or RMK, more information is provided here. This is not intended to replace reading the original papers, but should provide enough information to put this paper in context.

6.1 Risk Coverage Ratio (RCR)

RCR was introduced to the actuarial community in a paper by David Ruhm [1]. As stated in the title of Mr. Ruhm's article, RCR does not require leverage or surplus. The required price, and associated profit margin, is calculated to meet the target RCR. In addition, once the RCR and price are determined, you can use this information to attribute capital.

As a reward-to-risk ratio, RCR balances the required return to the risk. To calculate the RCR, one must first determine an adverse event threshold. This will define both the reward and the risk. The reward is the average return minus the adverse event. The risk is the probability of being below the adverse event threshold times the average amount below the threshold when it is below.

The basic formula is:

$$RCR = (R-m) / (Pr(x<m)*(m-T)) \tag{6.1}$$

where:

R is average return
m is the adverse event threshold, or minimum return
T is the average of all events below the adverse threshold, or the tail

RCR can be used to attribute capital. After solving for the required price to achieve the target RCR, the expected income from operating flows (O) is known. Given a target return on surplus (ROS) and the yield on surplus (y), it is merely algebra to solve for the surplus.

$$Surplus = O / (ROS - y) \tag{6.2}$$

The yield that is used in this case should be a risk-free or low-risk yield. There is additional investment risk in the actual investment portfolio for most companies, so the actual portfolio yield is usually higher, but also requires additional surplus to support that risk. The actual portfolio yield

can be reflected, but that will require additional modeling to solve for the RCR including portfolio yields and risk. The author recommends the use of LIBOR as a near risk-free yield in determining RCR. LIBOR is the standard rate used in the investment community for modeling, and is available at more durations and time points than Treasury yields.

One of the issues of working with RCR is determining the proper target value. There is no intuitive value that makes sense, nor are there any industry standards that can be used. A recommended approach is to use RCR to attribute surplus for all lines of business and solve for the RCR that attributes all of the company's carried surplus. This becomes the Target RCR value for use in pricing. Using this approach, the total surplus for the company will be attributed, and if all lines are at the target price determined by the RCR, the required return on surplus will be achieved.

6.2 Ruhm-Mango-Kreps (RMK) Algorithm

RMK is a methodology designed to allocate risk charge, and thus capital.

There are some key issues in allocating risk charges, and attributing capital, that the RMK algorithm was created to address. As stated in the paper, "Accounting for aggregate portfolio effects in property-casualty insurance prices has historically created some difficult problems, including:

1) Additivity or sub-additivity of prices;
2) Measuring how much diversification efficiency actually exists;
3) Allocating the diversification benefits back to the individual risks; and
4) Order-dependence."

The authors of the paper go on to state, "The method begins at the aggregate level for evaluating risk, and ends by producing prices for individual risks, effectively allocating the total portfolio risk charge. The result is an internally consistent allocation of diversification benefits, avoiding the difficulties listed above. The method effectively extends any risk-valuation theory used at the aggregate portfolio level to the individual risks comprising the portfolio. The resulting prices are additive, with each risk's price reflecting the degree to which it contributes to total portfolio risk" [2].

RMK starts with an aggregate risk charge, or surplus, determined by some other methodology. RMK is used to distribute the risk charge to component in a consistent manner. Some of the key points from the paper are:

1) The aggregate risk charge is split to the individual risks based on the conditional relationship between the risks' outcomes and the aggregate results for the portfolio.

2) All prices are determined solely by the portfolio-level and the probability structure, so that no other information is required.

3) Correlations between risks (and between each risk and the portfolio) are included in the prices in full detail, via the conditional probabilities. Since diversification is related to these correlations, it is also reflected in the risks through this calculation.

4) Prices produced by this method are additive. The price for each component is made up of its contribution to expected costs and its risk load, or profit margin.

The RMK algorithm requires that you assign a weight to each scenario based on the outcome that reflects the company's risk appetite. In this paper, any loss outcome gets the same weight. The RMK algorithm can handle more complex views on risk, such as assigning higher weights based on the size of the loss. Details on the calculations that are associated with this paper are provided in the Notes to Exhibits section 7.2.

7. NOTES TO EXHIBITS

This section provides more detailed information on the calculations of the various exhibits included in this paper. The Excel file used to develop the exhibits is available from the CAS website.

7.1 RCR Exhibits

The format and formulas in Exhibits 1A, 1B, 2, 3A and 3B are the same. It is just the inputs that vary. So they will be discussed together.

Items

- **Premium (solved)** – This is the premium required to meet the RCR target (below). It is solved for via iteration.
- **Combined (formula)** – Combined ratio determined from average loss and LAE dollars for catastrophe and noncatastrophe in total divided by premium plus the expense ratio.
- **Exp (assumption)** – Expense ratio. All expenses are treated as variable in these examples.
- **Loss (assumption)** – the expected loss and LAE dollars are shown as the average. For each scenario, a lognormal distribution was used to create a loss and LAE figure. The parameters for the lognormal are hypothetical used for these examples. The same distribution is used for all examples, with varying means.
- **Cat Loss (assumption)** – the expected catastrophe loss and LAE dollars are shown as the average. The scenarios for cat loss came from the output of a cat model, manipulated to not reveal any real information. Again, the distribution of cat losses is the same in all examples, just the mean has changed.
- **Loss Lag and Cat Lag (assumption)** – represent the average payment date for the two loss components. A common value of 1.0 years is used for both loss components in these examples.
- **Yield (assumption)** – The yield is the average LIBOR yield for the period of time and duration assumed for investing the flows. A complete discussion of interest rates to use in modeling is beyond the scope of this paper. Suffice it to say that the use of LIBOR to

represent risk-free rates of return is common in the investment and finance community. And that practice has been adopted here. This model can be expanded to look at portfolio yields, but additional capital would be needed to address the increased risk in such a portfolio.

- **Loss Liab and Cat Liab (formula)** – These are the present value of the balance sheet liabilities for noncat loss and LAE and catastrophe loss and LAE, respectively. The formula is shown below:

  Liabilities = Loss * [1 / (1 + Yield(after-tax)) ^ Lag] / (Yield (after-tax)) (7.1)

- **Tax Rate** – Not shown on the exhibits. A 35% tax rate is used in these examples.

- **Net Liab (formula)** – the sum of the loss and cat liabilities. This is the present value of the total balance sheet liabilities. Since both components are on a present value basis, they can be added even if the lags are different.

- **UW Inc (formula)** – The underwriting profit which is the premium minus the sum of expenses, noncatastrophe losses and catastrophe losses, adjusted for taxes.

- **UW Inv Inc (formula)** – this is the investment income on the operating cash flows.

  UW Inv Inc = Net Liab * Yield (After-tax) (7.2)

- **Tot Inc (Formula)** – Total income, the sum of UW Inc and UW Inv Inc

- **ESD (formula)** – expected surplus drawdown. If the total income is negative, this is the complement of the income. It is zero if the income is positive. In other words, it is the amount of the loss when there is a loss. The average ESD is the risk metric used in calculating RCR. It can also be determined as follows:

  Risk = E(ESD) = - Pr(Tot Inc < 0)* E(Tot Inc | Tot Inc < 0) (7.3)

- **RCR (formula) –** Risk Coverage Ratio. Ratio of Total Income to risk, or:

  RCR = Tot Inc / E(ESD) (7.4)

- **Target ROS (assumption) –** this is the return on surplus that the company is targeting.

- **Surplus (formula)** – This is the surplus required by the line to translate the operating return (Tot Inc) to the target ROS. It is determined using formula 6.2, restated below using the variable names from these exhibits.

$$\text{Surplus} = \text{Tot Inc} / (\text{Target ROS} - \text{Yield(after-tax)}) \tag{7.5}$$

7.2 RMK Exhibits

The exhibits that demonstrate the application of the RMK algorithm use a common format and set of formulas. They build on information in the corresponding RCR exhibit and are numbered as such. The three exhibits included are 2-2, 3A-2, and 3B-2.

RMK requires a set of weights that can be based on any underlying view of risk. The weights are normalized to sum to 1.0, termed the Z-vector in the paper. There is no requirement as to what sort of risk preference is used to determine the initial weights. In this paper, a simple set of weights is used so all operating losses get the same weight of 1 + (1/RCR), and the positive results are assigned a small weight of (1/RCR).

To start, the premium is apportioned to the components of expense, catastrophe loss and noncatastrophe loss. Then the underwriting gain/loss from each component for each scenario is determined. (Note that since there is no expense volatility in these examples, the expense component drops out and is not shown.) Next the deviation of the investment income for the scenario from the expected is determined. These two pieces are combined to determine the operating gain contribution for the scenario from each component. These figures are used to allocate the risk charge and then the surplus to the components.

Items

- **Ave ROE (assumption)** – This is the target ROS from the RCR exhibit.
- **Surplus II (assumption)** – Investment Income (II) on Surplus. This is the yield adjusted to after-tax..
- **Avg Op Rtn (formula)** – Average Operating Return. Viewed as either the Avg ROE minus the Surplus II, or can be calculated from the RCR exhibit as the average Tot Inc divided by the average Net Liab.
- **Surplus (assumption)** – this is the figure determined in the RCR exhibit.
- **Risk Chg (assumption)** – Risk Charge. This is average Tot Inc from the RCR exhibit.

Here it is being viewed as the amount of return required to cover the risk, or as the risk charge.

- **Total Op Gain (assumption)** – This is the Tot Inc from the RCR exhibit, reproduced here.

- **Crude Weights (formula)** – This is the initial set of weights, before normalization, used in the RMK formula. In these examples, the weights are 1/RCR if the income is positive, and (1 + 1/RCR) if the income is negative. This puts more weight on the loss scenarios. This represents a simple utility function.
- **Z (formula)** – this is the Z-vector referred to in the Ruhm-Mango paper. It is a normalized set of weights calculated as the Crude Weight / E(Crude Weight).
- **Prem Split (formula)** – In order to determine the contribution to the underwriting gain or loss, the premium needs to be split into component. The split here is based on the average cost for each item. Since expenses do not vary, they are not relevant and the portion of premium for expense is not shown. The calculation is very insensitive to the premium split. However, it is easier to interpret the calculations if a reasonable split of the premium is used initially.

  The formula for loss, with cat loss being similar, is:

  $$\text{Prem Split} = \text{Premium} * E(\text{Loss}) / (E(\text{exp}) + E(\text{loss}) + E(\text{cat loss})) \quad (7.6)$$

The next items are the six columns. Then the formulas used to calculate across each column will be covered.

- **Loss xCat UW Gain (formula)** – This the contribution of the noncatastrophe loss portion to the UW gain or loss. It is calculated as the difference between the premium split for loss and the loss for the scenario, adjusted for taxes.
- **Cat Loss UW Gain (formula)** – Similar to the above, this is the contribution of the cat loss to the UW gain or loss. It is calculated in the difference between the premium split for loss and the loss for the scenario, adjusted for taxes.
- **Loss xCat Inv Gain/Cat Loss Inv Gain (formula)** – This is the contribution to investment income from the scenario. It is the liability times the yield adjusted for taxes. When there is an underwriting loss, this serves as an offset.
- **Loss xCat Op Gain/Cat Loss Op Gain (formula)** – This is the sum of the UW gain or loss plus the investment income for the component.

The following items are calculated for each column, or component. There are two risk factors, noncatastrophe loss and catastrophe loss, in three different levels – underwriting gain/loss, investment gain and total gain/loss.

- **E(R) (formula)** – Average value for the column, or the risk contribution for the component.
- **E(ZR) (formula)** – Average value of the product of the weight (Z) times the risk contribution, or contribution, for each component.
- **Risk Chg (formula)** – the risk charge for the component, which is E(R) minus E (ZR). This is also the contribution to the average operating return from the component, so the sum across all components will equal the average operating return.
- **Surplus (formula)** – The surplus required for that component. This is calculated using the following formula:

$$\text{Surplus} = \text{Risk Chg} / \text{Avg Op Return (total)} \tag{7.6}$$

- **Avg Op Rtn (formula)** – Average Operating Return, is calculated for each item as the risk charge, divided by surplus. Given the formula used to get surplus, it will be equal to the average operating return for the total. So, the average operating return for each component should be the same as the overall average operating return, and this acts as a cross check.
- **Surplus II (assumption)** – the investment income on surplus. This is the same as the yield that was used in the total.
- **Avg ROE (formula)** – average ROE is the sum of the Avg Op Rtn and Surplus II.
- **Tot Und/Tot Inv (formula)** – The sum of the surplus for the risk components, noncatastrophe loss and catastrophe loss, at the underwriting and investment level respectively. Note that investment surplus is negative, as it acts to offset the positive surplus for underwriting.
    - **Leverage Ratios (formula)** – The two leverage ratios are shown, which are ratios of liabilities to surplus. The liabilities from the underlying RCR exhibit for the component are divided by the total surplus for that component. These leverage ratios are then used in other models as the expected catastrophe and noncatastrophe losses vary.

The final section in these exhibits is a summary, and shows how the underwriting profit for the component would be derived.

- **Surplus, Yield and Op Income** – are repeats of the items from earlier columns, shown here to see what is used in the following calculations.
- **Op Inv Inc (formula)** – investment income on operating cash flows. This is the liabilities for the component times the yield.

- **UW Income (formula)** – underwriting income, it is the operating income minus the operating investment income. This split shows the composition of the underwriting profit margin.

Sample Calculations

For Row 1 on Exhibit 2

Premium	174.12	
	Dollars	**Ratio to Premium**
Loss	57.65	33.1%
Cat Loss	19.62	11.3%
Expense		30.0%
Combined Ratio		74.4%
	Pre-Tax	**Post-Tax**
Yield	5.04%	3.28%

Loss Liabilities	55.83	Loss * (1 - 1/(1+ post-tax-yield))/post-tax-yield
Cat Loss Liabilities	19.00	Cat Loss * (1 - 1/(1+ post-tax-yield))/post-tax-yield
Net Liabilities	74.82	Sum of Loss Liabilities and Cat Loss Liabilities
Underwriting Income	29.00	[Premium - (Loss + Cat Loss + Expense)] * (1 - tax rate)
UW Investment Income	2.45	Net Liabilities * post-tax-yield
Total Income	31.45	Sum of UW Income and UW Investment Income

Exhibit 1A

Premium	90.85	Loss Lag	1.000	RCR	20.00
Combined	68.5%	Cat Lag	1.000		
		Yield	5.04%	Target ROS	15.0%
				Surplus	168.02

	Exp	Loss	Cat Loss	Loss Liab	Cat Liab	Net Liab	UW Inc	UW Inv Inc	Tot Inc	ESD
Averages	**0.30**	**0.00**	**35.00**	**0.0**	**33.9**	**33.9**	**18.59**	**1.11**	**19.70**	**0.98**
1	0.30	0.00	19.62	0.0	19.0	19.0	28.59	0.62	29.21	0.00
2	0.30	0.00	90.84	0.0	88.0	88.0	-17.70	2.88	-14.82	14.82
3	0.30	0.00	32.87	0.0	31.8	31.8	19.97	1.04	21.02	0.00
4	0.30	0.00	25.02	0.0	24.2	24.2	25.08	0.79	25.87	0.00
5	0.30	0.00	38.92	0.0	37.7	37.7	16.04	1.23	17.28	0.00
6	0.30	0.00	24.34	0.0	23.6	23.6	25.52	0.77	26.29	0.00
7	0.30	0.00	25.60	0.0	24.8	24.8	24.70	0.81	25.51	0.00
8	0.30	0.00	35.69	0.0	34.6	34.6	18.14	1.13	19.27	0.00
9	0.30	0.00	59.80	0.0	57.9	57.9	2.47	1.90	4.37	0.00
10	0.30	0.00	10.41	0.0	10.1	10.1	34.57	0.33	34.90	0.00
11	0.30	0.00	17.18	0.0	16.6	16.6	30.17	0.54	30.72	0.00
12	0.30	0.00	43.38	0.0	42.0	42.0	13.14	1.38	14.52	0.00
13	0.30	0.00	28.26	0.0	27.4	27.4	22.97	0.90	23.87	0.00
14	0.30	0.00	29.70	0.0	28.8	28.8	22.03	0.94	22.98	0.00
15	0.30	0.00	67.40	0.0	65.3	65.3	-2.47	2.14	-0.34	0.34
16	0.30	0.00	25.96	0.0	25.1	25.1	24.47	0.82	25.29	0.00
17	0.30	0.00	23.56	0.0	22.8	22.8	26.02	0.75	26.77	0.00
18	0.30	0.00	94.33	0.0	91.3	91.3	-19.98	2.99	-16.98	16.98
19	0.30	0.00	15.15	0.0	14.7	14.7	31.49	0.48	31.97	0.00
20	0.30	0.00	55.90	0.0	54.1	54.1	5.01	1.77	6.78	0.00
21	0.30	0.00	20.10	0.0	19.5	19.5	28.27	0.64	28.91	0.00
22	0.30	0.00	46.00	0.0	44.5	44.5	11.44	1.46	12.90	0.00
23	0.30	0.00	36.39	0.0	35.2	35.2	17.69	1.15	18.84	0.00
24	0.30	0.00	34.91	0.0	33.8	33.8	18.65	1.11	19.76	0.00
25	0.30	0.00	19.65	0.0	19.0	19.0	28.56	0.62	29.19	0.00

Exhibit 1B

Premium	97.32	Loss Lag	1.000	RCR	20.00
Combined	91.7%	Cat Lag	1.000		
		Yield	5.04%	Target ROS	15.0%
Cat Premiu	90.85			Surplus	61.29
(From Exh. 1A)					
Total Premium	188.18				

	Exp	Loss	Cat Loss	Loss Liab	Cat Liab	Net Liab	UW Inc	UW Inv Inc	Tot Inc	ESD
Averages	**0.30**	**60.00**	**0.00**	**58.1**	**0.0**	**58.1**	**5.28**	**1.90**	**7.19**	**0.36**
1	0.30	57.65	0.00	55.8	0.0	55.8	6.81	1.83	8.64	0.00
2	0.30	56.99	0.00	55.2	0.0	55.2	7.24	1.81	9.04	0.00
3	0.30	58.41	0.00	56.6	0.0	56.6	6.32	1.85	8.17	0.00
4	0.30	49.37	0.00	47.8	0.0	47.8	12.19	1.57	13.76	0.00
5	0.30	46.47	0.00	45.0	0.0	45.0	14.08	1.47	15.55	0.00
6	0.30	69.27	0.00	67.1	0.0	67.1	-0.74	2.20	1.45	0.00
7	0.30	54.62	0.00	52.9	0.0	52.9	8.78	1.73	10.51	0.00
8	0.30	54.38	0.00	52.7	0.0	52.7	8.94	1.72	10.66	0.00
9	0.30	71.10	0.00	68.8	0.0	68.8	-1.94	2.26	0.32	0.00
10	0.30	57.52	0.00	55.7	0.0	55.7	6.89	1.82	8.72	0.00
11	0.30	75.92	0.00	73.5	0.0	73.5	-5.06	2.41	-2.66	2.66
12	0.30	64.95	0.00	62.9	0.0	62.9	2.07	2.06	4.13	0.00
13	0.30	58.29	0.00	56.4	0.0	56.4	6.40	1.85	8.25	0.00
14	0.30	63.31	0.00	61.3	0.0	61.3	3.13	2.01	5.14	0.00
15	0.30	68.40	0.00	66.2	0.0	66.2	-0.18	2.17	1.99	0.00
16	0.30	64.73	0.00	62.7	0.0	62.7	2.21	2.05	4.26	0.00
17	0.30	63.56	0.00	61.5	0.0	61.5	2.97	2.02	4.99	0.00
18	0.30	50.21	0.00	48.6	0.0	48.6	11.65	1.59	13.24	0.00
19	0.30	46.21	0.00	44.7	0.0	44.7	14.25	1.47	15.71	0.00
20	0.30	68.67	0.00	66.5	0.0	66.5	-0.36	2.18	1.82	0.00
21	0.30	38.50	0.00	37.3	0.0	37.3	19.26	1.22	20.48	0.00
22	0.30	71.73	0.00	69.5	0.0	69.5	-2.34	2.28	-0.06	0.06
23	0.30	56.71	0.00	54.9	0.0	54.9	7.42	1.80	9.22	0.00
24	0.30	57.03	0.00	55.2	0.0	55.2	7.21	1.81	9.02	0.00
25	0.30	79.04	0.00	76.5	0.0	76.5	-7.10	2.51	-4.59	4.59

Exhibit 2

Premium	174.12	Loss Lag	1.000	RCR	20.00
Combined	84.6%	Cat Lag	1.000		
		Yield	5.04%	Target ROS	15.0%
Prior Premium	188.18			Surplus	174.77
Diversification Benefit	14.05				

	Exp	Loss	Cat Loss	Loss Liab	Cat Liab	Net Liab	UW Inc	UW Inv Inc	Tot Inc	ESD
Averages	**0.30**	**60.00**	**35.00**	**58.1**	**33.9**	**92.0**	**17.48**	**3.01**	**20.49**	**1.02**
1	0.30	57.65	19.62	55.8	19.0	74.8	29.00	2.45	31.45	0.00
2	0.30	56.99	90.84	55.2	88.0	143.1	-16.86	4.69	-12.17	12.17
3	0.30	58.41	32.87	56.6	31.8	88.4	19.90	2.90	22.79	0.00
4	0.30	49.37	25.02	47.8	24.2	72.0	30.88	2.36	33.24	0.00
5	0.30	46.47	38.92	45.0	37.7	82.7	23.73	2.71	26.44	0.00
6	0.30	69.27	24.34	67.1	23.6	90.6	18.38	2.97	21.35	0.00
7	0.30	54.62	25.60	52.9	24.8	77.7	27.08	2.54	29.63	0.00
8	0.30	54.38	35.69	52.7	34.6	87.2	20.68	2.86	23.54	0.00
9	0.30	71.10	59.80	68.8	57.9	126.8	-5.86	4.15	-1.71	1.71
10	0.30	57.52	10.41	55.7	10.1	65.8	35.07	2.15	37.23	0.00
11	0.30	75.92	17.18	73.5	16.6	90.1	18.72	2.95	21.67	0.00
12	0.30	64.95	43.38	62.9	42.0	104.9	8.81	3.44	12.25	0.00
13	0.30	58.29	28.26	56.4	27.4	83.8	22.97	2.75	25.72	0.00
14	0.30	63.31	29.70	61.3	28.8	90.1	18.77	2.95	21.72	0.00
15	0.30	68.40	67.40	66.2	65.3	131.5	-9.05	4.31	-4.74	4.74
16	0.30	64.73	25.96	62.7	25.1	87.8	20.28	2.88	23.16	0.00
17	0.30	63.56	23.56	61.5	22.8	84.4	22.60	2.76	25.36	0.00
18	0.30	50.21	94.33	48.6	91.3	140.0	-14.72	4.58	-10.14	10.14
19	0.30	46.21	15.15	44.7	14.7	59.4	39.34	1.95	41.29	0.00
20	0.30	68.67	55.90	66.5	54.1	120.6	-1.74	3.95	2.21	0.00
21	0.30	38.50	20.10	37.3	19.5	56.7	41.14	1.86	42.99	0.00
22	0.30	71.73	46.00	69.5	44.5	114.0	2.71	3.73	6.44	0.00
23	0.30	56.71	36.39	54.9	35.2	90.1	18.72	2.95	21.67	0.00
24	0.30	57.03	34.91	55.2	33.8	89.0	19.47	2.92	22.38	0.00
25	0.30	79.04	19.65	76.5	19.0	95.6	15.07	3.13	18.20	0.00

Exhibit 3A

Premium	264.07	Loss Lag	1.000	RCR	20.00
Combined	79.2%	Cat Lag	1.000		
		Yield	5.04%	Target ROS	15.0%
Prior Premium	279.03			Surplus	339.27
Diversification	14.96				

	Exp	Loss	Cat Loss	Loss Liab	Cat Liab	Net Liab	UW Inc	UW Inv Inc	Tot Inc	ESD
Averages	**0.30**	**60.00**	**70.00**	**58.1**	**67.8**	**125.9**	**35.65**	**4.12**	**39.78**	**1.99**
1	0.30	57.65	39.24	55.8	38.0	93.8	57.17	3.07	60.24	0.00
2	0.30	56.99	181.67	55.2	175.9	231.1	-34.98	7.57	-27.41	27.41
3	0.30	58.41	65.74	56.6	63.7	120.2	39.46	3.94	43.40	0.00
4	0.30	49.37	50.03	47.8	48.4	96.2	55.54	3.15	58.69	0.00
5	0.30	46.47	77.83	45.0	75.4	120.4	39.36	3.94	43.30	0.00
6	0.30	69.27	48.67	67.1	47.1	114.2	43.49	3.74	47.23	0.00
7	0.30	54.62	51.20	52.9	49.6	102.5	51.37	3.36	54.73	0.00
8	0.30	54.38	71.38	52.7	69.1	121.8	38.41	3.99	42.40	0.00
9	0.30	71.10	119.60	68.8	115.8	184.7	-3.81	6.05	2.24	0.00
10	0.30	57.52	20.82	55.7	20.2	75.9	69.23	2.48	71.72	0.00
11	0.30	75.92	34.35	73.5	33.3	106.8	48.48	3.50	51.97	0.00
12	0.30	64.95	86.76	62.9	84.0	146.9	21.54	4.81	26.35	0.00
13	0.30	58.29	56.51	56.4	54.7	111.2	45.53	3.64	49.17	0.00
14	0.30	63.31	59.40	61.3	57.5	118.8	40.39	3.89	44.29	0.00
15	0.30	68.40	134.81	66.2	130.5	196.8	-11.94	6.45	-5.49	5.49
16	0.30	64.73	51.91	62.7	50.3	112.9	44.33	3.70	48.03	0.00
17	0.30	63.56	47.13	61.5	45.6	107.2	48.21	3.51	51.72	0.00
18	0.30	50.21	188.66	48.6	182.7	231.3	-35.11	7.58	-27.54	27.54
19	0.30	46.21	30.30	44.7	29.3	74.1	70.42	2.43	72.85	0.00
20	0.30	68.67	111.79	66.5	108.2	174.7	2.85	5.72	8.57	0.00
21	0.30	38.50	40.20	37.3	38.9	76.2	69.00	2.50	71.49	0.00
22	0.30	71.73	91.99	69.5	89.1	158.5	13.73	5.19	18.93	0.00
23	0.30	56.71	72.78	54.9	70.5	125.4	35.99	4.11	40.10	0.00
24	0.30	57.03	69.81	55.2	67.6	122.8	37.70	4.02	41.73	0.00
25	0.30	79.04	39.31	76.5	38.1	114.6	43.22	3.75	46.98	0.00

Exhibit 3B

Premium	130.92	Loss Lag	1.000	RCR	20.00
Combined	89.2%	Cat Lag	1.000		
		Yield	5.04%	Target ROS	15.0%
Prior Premium	142.75			Surplus	99.39
Diversification	11.83				

	Exp	Loss	Cat Loss	Loss Liab	Cat Liab	Net Liab	UW Inc	UW Inv Inc	Tot Inc	ESD
Averages	**0.30**	**60.00**	**17.50**	**58.1**	**16.9**	**75.0**	**9.19**	**2.46**	**11.65**	**0.58**
1	0.30	57.65	9.81	55.8	9.5	65.3	15.72	2.14	17.86	0.00
2	0.30	56.99	45.42	55.2	44.0	99.2	-7.00	3.25	-3.75	3.75
3	0.30	58.41	16.43	56.6	15.9	72.5	10.92	2.37	13.30	0.00
4	0.30	49.37	12.51	47.8	12.1	59.9	19.35	1.96	21.31	0.00
5	0.30	46.47	19.46	45.0	18.8	63.8	16.72	2.09	18.81	0.00
6	0.30	69.27	12.17	67.1	11.8	78.9	6.63	2.58	9.22	0.00
7	0.30	54.62	12.80	52.9	12.4	65.3	15.74	2.14	17.88	0.00
8	0.30	54.38	17.85	52.7	17.3	69.9	12.62	2.29	14.91	0.00
9	0.30	71.10	29.90	68.8	29.0	97.8	-6.08	3.20	-2.88	2.88
10	0.30	57.52	5.20	55.7	5.0	60.7	18.80	1.99	20.79	0.00
11	0.30	75.92	8.59	73.5	8.3	81.8	4.64	2.68	7.32	0.00
12	0.30	64.95	21.69	62.9	21.0	83.9	3.25	2.75	6.00	0.00
13	0.30	58.29	14.13	56.4	13.7	70.1	12.50	2.30	14.80	0.00
14	0.30	63.31	14.85	61.3	14.4	75.7	8.77	2.48	11.25	0.00
15	0.30	68.40	33.70	66.2	32.6	98.9	-6.80	3.24	-3.56	3.56
16	0.30	64.73	12.98	62.7	12.6	75.2	9.06	2.47	11.52	0.00
17	0.30	63.56	11.78	61.5	11.4	73.0	10.60	2.39	12.99	0.00
18	0.30	50.21	47.17	48.6	45.7	94.3	-3.72	3.09	-0.63	0.63
19	0.30	46.21	7.58	44.7	7.3	52.1	24.61	1.71	26.32	0.00
20	0.30	68.67	27.95	66.5	27.1	93.6	-3.24	3.06	-0.17	0.17
21	0.30	38.50	10.05	37.3	9.7	47.0	28.01	1.54	29.55	0.00
22	0.30	71.73	23.00	69.5	22.3	91.7	-2.00	3.00	1.00	0.00
23	0.30	56.71	18.19	54.9	17.6	72.5	10.88	2.38	13.26	0.00
24	0.30	57.03	17.45	55.2	16.9	72.1	11.15	2.36	13.51	0.00
25	0.30	79.04	9.83	76.5	9.5	86.1	1.80	2.82	4.62	0.00

Profit Margins Using Co-Measures of Risk

Exhibit 2-2

									Leverage Ratios			
				Tot Und	**183.74**	Tot Inv	**(8.97)**	4.00	0.2115			
Avg ROE	15.00%		Avg ROE	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%		Non-Cat	Cat
Surplus II	3.28%		Surplus II	3.28%	3.28%	3.28%	3.28%	3.28%	3.28%	Surplus	14.53	160.24
Avg Op Rtn	11.72%		Avg Op Rtn	11.72%	11.72%	11.72%	11.72%	11.72%	11.72%	Yield	3.28%	3.28%
Surplus	**174.77**		**Surplus**	**15.28**	**168.46**	**(0.75)**	**(8.22)**	**14.53**	**160.24**	Op Income	1.70	18.79
Risk Chg	20.49		Risk Chg	1.791	19.750	-0.087	-0.964	1.70	18.79	Op Inv Inc	1.90	1.11
			E(ZR)	5.331	-15.596	1.991	2.074	7.322	-13.522	UW Income	(0.20)	17.68
			E(R)	7.122	4.154	1.903	1.110	9.025	5.265	Pre-tax Margin	(0.31)	27.19
			Prem Split	70.957	41.391							

	Total Op Gain	0.12280 Crude Weights	Z	Loss xCat UW Gain	Cat Loss UW Gain	Loss xCat Inv Gain	Cat Loss Inv Gain	Loss xCat Op Gain	Cat Loss Op Gain
1	31.4	0.050	0.407	8.647	14.152	1.829	0.622	10.475	14.774
2	-12.2	1.050	8.550	9.075	-32.139	1.808	2.881	10.883	-29.258
3	22.8	0.050	0.407	8.159	5.540	1.853	1.043	10.011	6.583
4	33.2	0.050	0.407	14.034	10.643	1.566	0.794	15.600	11.437
5	26.4	0.050	0.407	15.917	1.609	1.474	1.234	17.391	2.843
6	21.4	0.050	0.407	1.095	11.085	2.197	0.772	3.292	11.857
7	29.6	0.050	0.407	10.616	10.266	1.733	0.812	12.349	11.078
8	23.5	0.050	0.407	10.776	3.705	1.725	1.132	12.501	4.837
9	-1.7	1.050	8.550	-0.096	-11.966	2.255	1.897	2.160	-10.069
10	37.2	0.050	0.407	8.733	20.139	1.825	0.330	10.558	20.469
11	21.7	0.050	0.407	-3.225	15.740	2.408	0.545	-0.817	16.285
12	12.2	0.050	0.407	3.905	-1.292	2.060	1.376	5.965	0.084
13	25.7	0.050	0.407	8.236	8.537	1.849	0.896	10.085	9.434
14	21.7	0.050	0.407	4.972	7.600	2.008	0.942	6.981	8.542
15	-4.7	1.050	8.550	1.659	-16.908	2.170	2.138	3.829	-14.770
16	23.2	0.050	0.407	4.045	10.033	2.053	0.823	6.099	10.857
17	25.4	0.050	0.407	4.809	11.588	2.016	0.747	6.825	12.335
18	-10.1	1.050	8.550	13.488	-34.412	1.593	2.992	15.080	-31.419
19	41.3	0.050	0.407	16.087	17.056	1.466	0.481	17.553	17.536
20	2.2	0.050	0.407	1.483	-9.427	2.178	1.773	3.662	-7.654
21	43.0	0.050	0.407	21.096	13.839	1.221	0.638	22.317	14.477
22	6.4	0.050	0.407	-0.500	-2.994	2.275	1.459	1.775	-1.535
23	21.7	0.050	0.407	9.263	3.252	1.799	1.154	11.062	4.407

Profit Margins Using Co-Measures of Risk

Exhibit 3A-2

									Leverage Ratios				
				Tot Und	**356.67**	Tot Inv	**(17.41)**	9.24	0.2036				
Avg ROE	15.00%		Avg ROE	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%			Non-Cat	Cat
Surplus II	3.28%		Surplus II	3.28%	3.28%	3.28%	3.28%	3.28%	3.28%		Surplus	6.28	332.98
Avg Op Rtn	11.72%		Avg Op Rtn	11.72%	11.72%	11.72%	11.72%	11.72%	11.72%		Yield	3.28%	3.28%
Surplus	**339.27**		**Surplus**	**6.61**	**350.07**	**(0.32)**	**(17.08)**	**6.28**	**332.98**		Op Income	0.74	39.04
Risk Chg	39.78		Risk Chg	0.775	41.042	-0.038	-2.003	0.74	39.04		Op Inv Inc	1.90	2.22
			E(ZR)	9.450	-29.113	1.941	4.223	11.391	-24.890		UW Income	(1.17)	36.82
			E(R)	10.224	11.928	1.903	2.220	12.127	14.149		Pre-tax Margin	(1.79)	56.64
			Prem Split	75.729	88.351								

	Total Op Gain	0.12190 Crude Weights	Z	LxC UW Gain	Cat Loss UW Gain	Loss xCat Inv Gain	Cat Loss Inv Gain	Loss xCat Op Gain	Cat Loss Op Gain
1	60.2	0.050	0.410	11.749	31.923	1.829	1.245	13.578	33.167
2	-27.4	1.050	8.614	12.178	-60.659	1.808	5.763	13.986	-54.896
3	43.4	0.050	0.410	11.261	14.700	1.853	2.085	13.114	16.785
4	58.7	0.050	0.410	17.136	24.906	1.566	1.587	18.702	26.493
5	43.3	0.050	0.410	19.020	6.837	1.474	2.469	20.494	9.306
6	47.2	0.050	0.410	4.197	25.790	2.197	1.544	6.395	27.334
7	54.7	0.050	0.410	13.719	24.151	1.733	1.624	15.451	25.775
8	42.4	0.050	0.410	13.879	11.029	1.725	2.264	15.603	13.293
9	2.2	0.050	0.410	3.007	-20.312	2.255	3.794	5.262	-16.518
10	71.7	0.050	0.410	11.835	43.897	1.825	0.660	13.660	44.557
11	52.0	0.050	0.410	-0.122	35.100	2.408	1.090	2.286	36.189
12	26.4	0.050	0.410	7.007	1.034	2.060	2.752	9.068	3.787
13	49.2	0.050	0.410	11.339	20.694	1.849	1.793	13.188	22.487
14	44.3	0.050	0.410	8.075	18.820	2.008	1.884	10.083	20.704
15	-5.5	1.050	8.614	4.761	-30.197	2.170	4.276	6.931	-25.920
16	48.0	0.050	0.410	7.148	23.686	2.053	1.647	9.201	25.333
17	51.7	0.050	0.410	7.911	26.795	2.016	1.495	9.928	28.290
18	-27.5	1.050	8.614	16.590	-65.204	1.593	5.985	18.183	-59.219
19	72.8	0.050	0.410	19.190	37.731	1.466	0.961	20.656	38.692
20	8.6	0.050	0.410	4.585	-15.235	2.178	3.546	6.764	-11.689
21	71.5	0.050	0.410	24.198	31.298	1.221	1.275	25.420	32.573
22	18.9	0.050	0.410	2.603	-2.368	2.275	2.918	4.878	0.550
23	40.1	0.050	0.410	12.365	10.124	1.799	2.309	14.164	12.433

Profit Margins Using Co-Measures of Risk

Exhibit 3B-2

									Leverage Ratios			
				Tot Und	**104.49**	Tot Inv	**(5.10)**	1.72	0.2586			
Avg ROE	15.00%		Avg ROE	15.00%	15.00%	15.00%	15.00%	15.00%	15.00%		Non-Cat	Cat
Surplus II	3.28%		Surplus II	3.28%	3.28%	3.28%	3.28%	3.28%	3.28%	Surplus	33.87	65.51
Avg Op Rtn	11.72%		Avg Op Rtn	11.72%	11.72%	11.72%	11.72%	11.72%	11.72%	Yield	3.28%	3.28%
Surplus	**99.39**		**Surplus**	**35.61**	**68.87**	**(1.74)**	**(3.36)**	**33.87**	**65.51**	Op Income	3.97	7.68
Risk Chg	11.65		Risk Chg	4.175	8.075	-0.204	-0.394	3.97	7.68	Op Inv Inc	1.90	0.56
			E(ZR)	0.549	-6.697	2.107	0.949	2.656	-5.748	UW Income	2.07	7.13
			E(R)	4.724	1.378	1.903	0.555	6.627	1.933	Pre-tax Margin	3.18	10.96
			Prem Split	67.267	19.620							

	Total Op Gain	0.13420 Crude Weights	Z	LxC UW Gain	Cat Loss UW Gain	Loss xCat Inv Gain	Cat Loss Inv Gain	Loss xCat Op Gain	Cat Loss Op Gain
1	17.9	0.050	0.373	6.249	6.376	1.829	0.311	8.077	6.688
2	-3.8	1.050	7.824	6.677	-16.769	1.808	1.441	8.485	-15.328
3	13.3	0.050	0.373	5.761	2.071	1.853	0.521	7.613	2.592
4	21.3	0.050	0.373	11.636	4.622	1.566	0.397	13.202	5.019
5	18.8	0.050	0.373	13.519	0.105	1.474	0.617	14.993	0.722
6	9.2	0.050	0.373	-1.303	4.843	2.197	0.386	0.894	5.229
7	17.9	0.050	0.373	8.218	4.434	1.733	0.406	9.951	4.840
8	14.9	0.050	0.373	8.378	1.153	1.725	0.566	10.103	1.719
9	-2.9	1.050	7.824	-2.494	-6.682	2.255	0.948	-0.238	-5.734
10	20.8	0.050	0.373	6.335	9.370	1.825	0.165	8.160	9.535
11	7.3	0.050	0.373	-5.623	7.171	2.408	0.272	-3.215	7.443
12	6.0	0.050	0.373	1.507	-1.346	2.060	0.688	3.567	-0.658
13	14.8	0.050	0.373	5.838	3.569	1.849	0.448	7.687	4.017
14	11.2	0.050	0.373	2.574	3.101	2.008	0.471	4.583	3.572
15	-3.6	1.050	7.824	-0.739	-9.153	2.170	1.069	1.431	-8.084
16	11.5	0.050	0.373	1.647	4.317	2.053	0.412	3.701	4.729
17	13.0	0.050	0.373	2.411	5.094	2.016	0.374	4.427	5.468
18	-0.6	1.050	7.824	11.090	-17.905	1.593	1.496	12.682	-16.409
19	26.3	0.050	0.373	13.689	7.828	1.466	0.240	15.155	8.069
20	-0.2	1.050	7.824	-0.915	-5.413	2.178	0.887	1.264	-4.527
21	29.6	0.050	0.373	18.698	6.220	1.221	0.319	19.919	6.539
22	1.0	0.050	0.373	-2.898	-2.196	2.275	0.730	-0.623	-1.467
23	13.3	0.050	0.373	6.865	0.927	1.799	0.577	8.664	1.504

Exhibit 4

	Exh. 2	Exhibit 3A			Exhibit 3B		
	Base	**Estimate**	**Actual**	**Difference**	**Estimate**	**Actual**	**Difference**
Surplus	174.77	335.01	339.27	-1.3%	94.65	99.39	-4.8%
Yield	3.28%	3.28%	3.28%		3.28%	3.28%	
Op Income	20.49	39.28	39.78	-1.3%	11.10	11.65	-4.8%
OP Inv Inc	3.01	4.12	4.12	0.0%	2.46	2.46	0.0%
UW Income	17.48	35.15	35.65	-1.4%	8.64	9.19	-6.0%
Pre-tax Margin	26.89	54.08	54.85		13.29	14.14	
ROE w/estimate		14.85%			14.44%		

EXHIBIT 15

ACTUARIAL STANDARDS BOARD

Actuarial Standard
of Practice
No. 30

Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking

Developed by the
Task Force on Rate of Return of the
Casualty Committee of the
Actuarial Standards Board

Adopted by the
Actuarial Standards Board
July 1997
Updated for Deviation Language Effective May 1, 2011

(Doc. No. 148)

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APPENDIXES

August 1997

TO: Members of Actuarial Organizations Governed by the Standards of Practice of the Actuarial Standards Board and Other Persons Interested in Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking

FROM: Actuarial Standards Board (ASB)

SUBJ: Actuarial Standard of Practice No. 30

This booklet contains the final version of Actuarial Standard of Practice (ASOP) No. 30, *Treatment of Profit and Contingency Provisions and the Cost of Capital in Property/Casualty Insurance Ratemaking*.

First and Second Exposure Drafts

The first draft of this standard was exposed for review in October 1994, with a comment deadline of March 15, 1995. Thirty-one comment letters were received. The second draft of this standard was exposed for review in August 1996, with a comment deadline of December 2, 1996. Ten comment letters were received on the second exposure draft. (For a copy of either exposure draft, please contact the ASB office.) The Task Force on Rate of Return of the ASB's Casualty Committee reviewed and carefully considered all comments received on both exposure drafts. As was the case after the first exposure, the task force revised the second exposure draft after participating in many conference calls and listening to comments made during question-and-answer sessions held at various Casualty Actuarial Society (CAS) meetings.

Substantive Issues

Following the first exposure draft, the task force received a number of comment letters regarding the discussion of rates versus prices. Although several changes were made in the second exposure draft to more clearly indicate that the proposed standard intended only to address the evaluation of costs (i.e., rates), some of the commentators' letters on the second exposure draft still expressed confusion on this point. In response, the task force further revised several sections to make clear that the standard does not address considerations such as marketing goals, competition, and legal restrictions that may affect price.

In addition to the "rates versus prices" issue, several commentators questioned whether the cost of capital is truly equivalent for stock, mutual, and other insurance organizations. After extensive discussion, the task force changed the language of the standard to focus the practitioner on assessing the cost of capital as an opportunity cost and to recognize that all risk transfers have an opportunity cost. The task force also combined section 3.8 with section 3.2 to indicate that the cost of capital may differ for various capital providers due to their differing risk characteristics,

and that such differences play a role in assessing the cost of capital for a specific capital provider. (For a detailed discussion of the comments and the task force's responses to such, please see appendix 2 of this standard.)

The task force is grateful to the many individuals who contributed written comments or participated in the numerous discussions of the proposed standard at CAS meetings. The task force believes that the final standard benefitted significantly from this professional debate.

The ASB voted in July 1997 to adopt the final standard.

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ACTUARIAL STANDARD OF PRACTICE NO. 30

TREATMENT OF PROFIT AND CONTINGENCY PROVISIONS AND THE COST OF CAPITAL IN PROPERTY/CASUALTY INSURANCE RATEMAKING

STANDARD OF PRACTICE

Section 1. Purpose, Scope, Cross References, and Effective Date

1.1 Purpose—According to the *Statement of Principles Regarding Property and Casualty Insurance Ratemaking* (hereafter the *Statement of Principles*) of the Casualty Actuarial Society, insurance rates should provide for the cost of capital through underwriting profit and contingency provisions. This standard of practice provides guidance to actuaries in estimating the cost of capital and evaluating underwriting profit and contingency provisions.

1.2 Scope—This standard of practice applies to all property/casualty insurance coverages. This standard also applies to property/casualty risk financing systems, such as self-insurance, that provide similar coverages. References in the standard to *risk transfer* should be interpreted to include risk financing systems that provide for risk retention in lieu of risk transfer. Further, as is true of the *Statement of Principles*, this standard is limited to defining a *rate* as the estimation of future *costs* and does not address other considerations that may affect a *price*, such as marketing goals, competition, and legal restrictions.

If the actuary departs from the guidance set forth in this standard in order to comply with applicable law (statutes, regulations, and other legally binding authority), or for any other reason the actuary deems appropriate, the actuary should refer to section 4.

1.3 Cross References—When this standard refers to the provisions of other documents, the reference includes the referenced documents as they may be amended or restated in the future, and any successor to them, by whatever name called. If any amended or restated document differs materially from the originally referenced document, the actuary should consider the guidance in this standard to the extent it is applicable and appropriate.

1.4 Effective Date—This standard will be effective with respect to work performed after December 1, 1997.

Section 2. Definitions

The definitions below are defined for use in this actuarial standard of practice.

2.1 Capital—The funds intended to assure payment of obligations from insurance contracts, over and above those funds backing the liabilities.

2.2 Contingency Provision—A provision for the expected differences, if any, between the estimated costs and the average actual costs, that cannot be eliminated by changes in other components of the ratemaking process.

2.3 Cost of Capital—The rate of return that capital could be expected to earn in alternative investments of equivalent risk; also known as *opportunity cost*.

2.4 Insurance Cash Flows—Funds from premiums and miscellaneous (non-investment) income from insurance operations, and payments for losses, expenses, and policyholder dividends. Associated income taxes are recognized when the analysis is on a post-tax basis.

2.5 Insurance Risk—The extent to which the level or timing of actual insurance cash flows is likely to differ from expected insurance cash flows.

2.6 Investment Income—Proceeds (other than the return of principal) derived from the investment of assets, minus investment expenses. Associated income taxes are recognized when the analysis is on a post-tax basis.

2.7 Investment Income from Insurance Operations—The income associated with the investment of insurance cash flows. (This is sometimes referred to as *investment income on policyholder-supplied funds*.)

2.8 Investment Risk—The extent to which the level or timing of actual investment proceeds is likely to differ from what is expected.

2.9 Leverage—A measure of the relative amount of risk to which capital is exposed, typically expressed as the ratio of an exposure measure (such as premium or liabilities) to the capital amount.

2.10 Operating Profit—The sum of underwriting profit, miscellaneous (non-investment) income from insurance operations, and investment income from insurance operations. Associated income taxes are recognized when the analysis is on a post-tax basis.

2.11 Rate—An estimate of the expected value of future costs.

2.12 Total Return—The sum of operating profit and investment income on capital, usually after income taxes, often expressed in percentage terms.

2.13 Underwriting Expenses—All expenses except losses, loss adjustment expenses, investment expenses, policyholder dividends, and income taxes.

2.14 Underwriting Profit—Premiums less losses, loss adjustment expenses, underwriting expenses, and policyholder dividends.

2.15 Underwriting Profit Provision—The provision for underwriting profit in the actuarially developed rate, typically expressed as a percentage of the rate.

Section 3. Analysis of Issues and Recommended Practices

3.1 Estimating the Cost of Capital and the Underwriting Profit Provision—Property/casualty insurance rates should provide for all expected costs, including an appropriate cost of capital associated with the specific risk transfer. This cost of capital can be provided for by estimating that cost and translating it into an underwriting profit provision, after taking leverage and investment income into account. Alternatively, the actuary may develop an underwriting profit provision and test that profit provision for consistency with the cost of capital. The actuary may use any appropriate method, as long as such method is consistent with the considerations in this standard.

For historical and practical reasons, this standard separately discusses the underwriting profit provision, investment income from insurance operations, and investment income on capital. The actuary should keep in mind that evaluation of whether the cost of capital is appropriately recognized does not necessarily require these distinctions.

3.2 Basis for Cost of Capital Estimates—In estimating the cost of capital, the actuary should consider the relationship between risk and return. The methods used for estimating the cost of capital should reflect the risks involved in the risk transfer under consideration. These risks may include insurance, investment, inflation, and regulatory risks, as well as diversification, debt structure, leverage, reinsurance, market structure, and other appropriate aspects of the social, economic, and legal environments.

Thus, the cost of capital is likely to vary from one insurer to another. The actuary should recognize that the capital which is needed to support any risk transfer has an opportunity cost regardless of the source of capital or the structure of the insurer.

3.3 Estimates of Future Costs—Since all components of a rate should be estimates of future costs relating to the risk transfer during the prospective period of time to which the rate applies, capital costs, investment income, income taxes, cash flows, and leverage factors used in calculating the profit provision should all be based on expected future values.

3.4 Parameters of the Risk Transfer —The actuary should recognize that the cost of capital associated with an individual risk transfer may vary, based on the specific parameters of the transfer. To the extent that deductibles, dividend or return of premium plans, reinsurance, etc., affect the risk of the insurer, the cost of capital and the amount of capital needed to support the transaction may be affected.

3.5 Investment Income—There are two elements of investment income that the actuary

should consider: investment income from insurance operations and investment income on capital.

The actuary should assess the investment risk, since the amount and cost of capital should reflect investment risk as well as the risk associated with the insurance cash flows. Investment risk addresses the cost of default, reinvestment risk, and other investment uncertainties. Such risks can result in a significantly different yield than the stated yield rate.

Any of several general approaches may be used by the actuary to estimate investment income, as long as the assumptions are reasonable and appropriate. The investment yield rates used should be appropriate for the cash flow patterns associated with the coverages under consideration. If historical balance sheet and cash flow data are used to project investment income, the data should be adjusted to represent future investment income from the associated coverages.

The actuary may use any of a number of methods for recognizing investment income from insurance operations. Two such approaches are as follows:

a. Methods that estimate investment income based on projected insurance cash flows. The insurance cash flows are projected for each future period, and the expected investment yield rate appropriate for each future period is applied to the insurance cash flow for that period. The investment yield rates should be appropriate for the cash flow patterns associated with the coverages under consideration.

b. Methods that apply an expected investment yield rate to assets representing the liabilities for losses, loss adjustment expenses, and unearned premium net of agents' balances and prepaid expenses. If historic liability-to-premium relationships are used, they should be adjusted to reflect expected future relationships between liabilities and premiums. The actuary should also consider, for example, the effects of growth, changes in expected loss or expense patterns, and the effect of the delayed receipt of investment income. The investment yield rate selected should represent the expected investment yield for the insurer during the period the rates are expected to be in effect.

3.6 Income Taxes—To the extent income taxes are not included in the expense provision, the actuary should use provisions for expected income taxes that are consistent with the earnings expected from the insurance transaction being evaluated.

3.7 Contingency Provision—The actuary should include a contingency provision if the assumptions used in the ratemaking process produce cost estimates that are not expected to equal average actual costs, and if this difference cannot be eliminated by changes in other components of the ratemaking process.

While the estimated costs are intended to equal the average actual costs over time, differences between the estimated and actual costs of the risk transfer are to be expected in any given year. If a difference persists, the difference should be reflected in the ratemaking calculations as a contingency provision. The contingency provision is not intended to measure the variability of results and, as such, is not expected to be earned as profit.

3.8 Use of Different Bases—The cost of capital can be expressed as a percentage of capital, a percentage of assets, a percentage of premium, or other appropriate base. The actuary may choose any such appropriate base. Actuaries may use different bases, which can be converted from one to another. Regardless of which base is used to reflect the cost of capital, the actuary should clearly identify the base used and should document the relevant assumptions.

3.9 Accounting Rules for Comparing the Cost of Capital—The accounting rules employed within any model should be internally consistent. When comparing one industry with another, the actuary should make any necessary adjustments so that costs of capital of industries with different accounting methods can be properly compared.

Section 4. Communications and Disclosures

4.1 Conflict with Law or Regulation—If a law or regulation conflicts with the provisions of this standard, the actuary should develop a rate in accordance with the law or regulation, and disclose any material difference between the rate so developed and the actuarially determined rate to the client or employer.

4.2 Documentation—The actuary should be guided by the provisions of ASOP No. 9, *Documentation and Disclosure in Property and Casualty Insurance Ratemaking, Loss Reserving, and Valuations*.

4.3 Disclosures—The actuary should include the following, as applicable, in an actuarial communication:

a. in addition to the disclosure covered in section 4.1, the disclosure in ASOP No. 41, *Actuarial Communications*, section 4.2, if any material assumption or method was prescribed by applicable law (statutes, regulations, and other legally binding authority);

b. the disclosure in ASOP No. 41, section 4.3, if the actuary states reliance on other sources and thereby disclaims responsibility for any material assumption or method selected by a party other than the actuary; and

c. the disclosure in ASOP No. 41, section 4.4, if, in the actuary's professional judgment, the actuary has otherwise deviated materially from the guidance of this ASOP.

Appendix 1

Background and Current Practices

Note: This appendix is provided for informational purposes, but is not part of the standard of practice.

Background

Historical Procedures—Until the 1970s, it was common practice to include in rate calculations a standard underwriting profit and contingency provision of 2.5% for workers compensation insurance and 5% for other property/casualty lines of insurance (6% for some property lines). These provisions did not explicitly reflect investment income, since there was general agreement at the time that these standard provisions implicitly reflected investment income and insurance risk in a reasonable fashion. However, economic and structural changes in the insurance industry over time began to lead to the explicit recognition of investment income in calculating insurance rates.

Historical Issues—A number of issues have historically accompanied the development and evaluation of the underwriting profit and contingency provisions: (1) how to measure risk and reflect it in the underwriting profit provision, (2) how or whether to measure any systematic variation from expected costs and reflect it in the contingency provision, (3) which accounting rules should be used to measure insurance returns and to compare them with returns in other industries, (4) how or whether to allocate investment income and capital, and (5) how to relate underwriting profit provisions in rates to the cost of capital.

Role of Capital—Capital plays several roles in an insurance transaction, including providing the initial investment in physical plant and equipment and providing working capital. However, the primary role is to assure payment of obligations from insurance contracts, over and above those funds backing the liabilities.

Capital has a value and its use entails a cost. The cost is the expected return the capital could earn in alternative investments of equivalent risk. Judicial decisions dealing with the cost of capital and profit provisions (see, e.g., *Federal Power Commission v. Hope Natural Gas*, 320 U.S. 591 (1944)) provide background and definitions for the determination of the cost of capital in a regulatory setting.

Role of the Underwriting Profit Provision—The underwriting profit provision, together with all other cost and revenue components as defined in section 2.12, provides the risk taker with an expected total return to cover the cost of capital.

Role of the Contingency Provision—A common assumption underlying property/casualty insurance ratemaking is that the expected costs included in the rate calculations will equal the actual costs over the long run. If not, and the expected difference cannot be explicitly attributed

to a specific component of the rate (and thereby eliminated), then this difference is incorporated in the ratemaking process by including a contingency provision.

Current Practices

A method commonly used to develop or test the underwriting profit provision in insurance rates is to estimate the cost of capital and translate that cost into an underwriting profit provision. Some methods currently used to estimate the cost of capital, and financial models to relate that cost to the underwriting profit provision, are described below.

Underwriting profit provisions can also be developed using models that do not directly relate the cost of capital to the underwriting profit provision. Some of these models are also described below.

Inclusion of a particular model in this appendix should not be interpreted as an endorsement, but rather a recognition that such a model is used. Some applications of these models may not be consistent with section 3 of this standard.

Estimating the Cost of Capital—Several techniques are used to estimate the cost of capital. These include, but are not limited to, the following:

1. Comparable Earnings Model—The comparable earnings model is used to analyze historical returns on equity for entities or industries of comparable risk. The cost of capital is related to the average rate of return over a historical period.

2. Discounted Cash Flow Model—One form of the discounted cash flow (DCF) model, the dividend discount model, is used to analyze the current prices and dividend levels of publicly traded securities that pay dividends. The cost of capital is calculated as the sum of the expected first-year dividend yield plus the expected annual growth rate in dividends.

3. Risk Premium Model—The risk premium model is used to analyze the spread in returns for investments of different risk. The cost of capital is estimated as the sum of the expected return on a reference investment plus a margin to reflect relative risk. One widely used form of risk premium analysis is known as the capital asset pricing model (CAPM), in which the reference security is a risk free Treasury security, and the risk margin is determined using a measure of risk known as *beta*, defined as the covariance of an investment's return with returns in capital markets as a whole.

Relating the Cost of Capital to the Underwriting Profit Provision—This section describes various models currently used regarding the relation of the cost of capital to the underwriting profit provision.

1. Models that directly develop an underwriting profit provision are as follows:

a. Net Present Value Model—The net present value (NPV) model is used to discount the estimated net cash flow to the capital provider at a rate equal to the cost of capital. For the purpose of these calculations, *net cash flow* is defined as the residual amounts of cash that flow to and from the equity account, after all policy obligations are met. The net cash flow reflects the timing of each of the individual cash flows, including the commitment and release of capital in support of the insurance transaction. The internal rate of return (IRR) model, a specific application of the general NPV model, uses an iteration technique to calculate the rate(s) of return that will set the net present value of a risk transfer's cash inflows and outflows equal to zero.

b. Other Discounting Models—Other discounting models can be used to estimate the present value of the individual cash flows from the insurance transaction. The present value of the premium and miscellaneous (non-investment) income, before profit, is set equal to the present value of the associated losses, expenses, policy-holder dividends, and income taxes. The present values are estimated using appropriate prospective investment yield rates. A margin can be added to the present value of the premium so that the margin plus the expected investment income on capital generate a post-tax return that, when divided by the required capital, equals the cost of capital.

c. Total Financial Needs Model—Total financial needs models are used to develop the underwriting profit provision such that the sum of underwriting profit, miscellaneous (non-investment) income, investment income from insurance operations, and investment income on capital, after income taxes, will equal the cost of capital. Each of these components is explicitly quantified.

2. Models that do not directly relate the cost of capital to the underwriting profit provision are as follows:

a. State X Model—The State X model (originally appearing in some Insurance Services Office, Inc. rate filings as the *State X method*) is used to estimate the investment income from insurance operations. The method does not, in itself, allow for development of the total return or of a profit provision; it is used merely to develop one component of the total rate of return—the estimated investment income from insurance operations.

b. Risk Adjusted Net Present Value Model—The risk adjusted net present value (RANPV) model is used to estimate the risk adjusted present value of the insurance cash flows. Each of the flows is analyzed for its specific risk, and the otherwise attainable prospective investment yield rate is adjusted by the risk component prior to calculating the present value. Using the RANPV model, one calculates the premium directly, so that the risk adjusted present value of the premium and miscellaneous (non-investment) income equals the risk adjusted present value of the losses, expenses, policyholder dividends, and associated in-

come taxes. The expected underwriting profit in the premium can be derived from the RANPV model by summing all components using their undiscounted values.

c. Growth Requirement Model—The growth requirement model is used to set the level of retained earnings based on the expected future growth rate of the entity or industry.

d. Additional Models—Other models that do not directly relate the cost of capital to the underwriting profit provision include options pricing models, arbitrage pricing models, models based on ruin theory, models based on utility theory, and shareholder value models.

Developing and Evaluating a Contingency Provision—Contingency provisions have been developed in practice using methods that measure differences between expected and actual costs.

Appendix 2

Comments on the 1996 Second Exposure Draft and Task Force Responses

The second draft of this standard was exposed for review in August 1996, with a comment deadline of December 2, 1996. Ten comment letters were received and reviewed carefully by the Task Force on Rate of Return of the ASB's Casualty Committee. Summarized below are the significant issues and questions contained in the comment letters, printed in lightface. The task force's responses appear in **boldface**.

General Observations

Of the ten comment letters received on the second exposure draft, most of the comments were favorable. Even those commentators who provided suggestions for changes seemed pleased with the overall direction the task force took in developing the second exposure draft. Samples of such satisfaction were found in comments such as follows: "I think this is an example of the type of standards that the profession should be developing," "[t]his draft represents an overall improvement over the initial exposure draft," and "the [task force] has taken great pains in carefully defining many critical concepts that our standards omit today." Most of the suggestions for revising text were to further clarify concepts already present within the second exposure draft.

However, it was also evident from the comments that some confusion still exists surrounding the "rate versus price" issue. For example, one commentator believes that the standard should not limit actuarial practice in setting profit margins that are either explicit or implicit in actual prices in the marketplace. The commentator further raises potential legal issues were the actuarial profession to engage in limiting actuarial practice in this area. **The task force agrees with the commentator that the standard does not apply to final (market) prices— the standard is entirely focused on the evaluation of costs. In fact, the task force has consistently and consciously focused on costs (*not* on prices) in its deliberations in consideration of the legal environment and has obtained competent legal advice as appropriate.**

The commentator also questions whether a consensus on acceptable actuarial practice currently exists in this area. **The task force believes such consensus exists and is embodied in the standard. The current syllabus upon which actuarial examinations are based is one indicator that a consensus exists. The extensive presentations and discussions of the proposed standard at Casualty Actuarial Society (CAS) meetings and seminars is another indication that such a consensus exists.**

Section 1. Purpose, Scope, and Effective Date

Section 1.1, Purpose—One commentator thought that the use of the phrase *include the cost of capital* in the first sentence of this section implied that the *Statement of Principles Regarding*

Property and Casualty Insurance Ratemaking of the CAS requires that an explicit provision for the cost of capital be included in rates. **The task force revised the text by replacing *include* with *provide for* to more closely match its understanding of the *Statement of Principles*.**

Section 1.2, Scope—**The task force revised this section to more clearly distinguish between *rate* and *price*. In addition, the task force added language to clarify that the standard applies to property/casualty risk financing systems, such as self-insurance.**

Section 2. Definitions

Section 2.2, Contingency Provision—One commentator suggested clarifying the language in this section to note that, in addition to quantification, a contingency provision might be provided for in other ways. **The task force reworded the section, making it more consistent with section 3.7.** Another commentator questioned the definition's lack of consideration of the potential variance in results. **The task force did not expand the definition, since it believes that the profit provision more appropriately should reflect variance in results.**

Section 2.3, Cost of Capital—Two commentators suggested changes. One suggested inclusion of specific components in the definition; the second suggested that *cost of capital* be defined as the *cost of capital desired by the capital provider*. **The task force did not modify the definition, as section 3.2 references a number of influences on the cost of capital. The task force did, however, revise section 3.2 by including additional explanatory language and believes these revisions to section 3.2 address the concerns raised by the second commentator.**

Section 2.4, Insurance Cash Flows—One commentator suggested changing the title of this section to Net Insurance Cash Flows, while another suggested referencing the treatment of taxes directly rather than indirectly. **The task force modified the language to clarify that miscellaneous (non-investment) income is from insurance operations. The revised section 2.4 also presents the components of insurance cash flow as items in a list to avoid the appearance of a calculation and directly references the treatment of income taxes.**

Section 2.6, Investment Income—Two commentators suggested clarifying the language with respect to the treatment of income taxes. **The task force adopted the suggestions and also adopted consistent language in sections 2.4 and 2.10.**

Section 2.8, Investment Risk—Two commentators pointed out an inconsistency in the usage of the terms *proceeds* and *income* in other definitions. **The task force clarified the text by using the term *proceeds* consistently.**

Section 2.10, Operating Profit, and Section 2.13, Underwriting Profit (now sections 2.10, Operating Profit; 2.13, Underwriting Expenses; and 2.14, Underwriting Profit)—Three commentators questioned the usage of the terms included (or excluded) in these definitions. There also appeared to be some confusion as to which expense items were included in the term *expenses*. **After careful review and discussion of the comments, the task force made changes in these definitions and added a new section (2.13, Underwriting Expenses). The intent of**

the commentators was incorporated in the three definitions, and the task force believes the revisions achieve the clarity and consistency suggested. These definitions are consistent with the categories used in the underwriting and investment exhibit statement of income in the National Association of Insurers Commissioners (NAIC) annual statement blank for property and casualty insurers. Specifically, the definition of *underwriting profit* is consistent with the definition of *net underwriting gain (or loss)* from the NAIC statement blank.

Section 2.12, Total Return—One commentator suggested that the definition include some examples of commonly used bases of total return. **The task force did not make any changes, since it believes the definition is clear as stated.**

Section 3. Analysis of Issues and Recommended Practices

Section 3.1, Estimating the Cost of Capital and the Underwriting Profit Provision—One commentator wanted to change the beginning of the third sentence of this section from *Similarly* to *Alternatively*. **The task force made the change.**

Section 3.2, Basis for Cost of Capital Estimates—One commentator suggested that in the second sentence, the phrase *business activity* be changed to *risk transfer*. **The task force made this change.** Another commentator suggested adding *currency* to the list of risks included and noted that the list could be construed as "limiting or as a checklist of specific requirements." **The task force disagrees. Since the types of risk to consider are many and diverse, the task force believes that it is necessary to provide a reasonable set of examples. The language of the standard (i.e., *These risks may include*) clearly indicates that the list is not exhaustive.**

Another commentator suggested that the reference to the *Hope Natural Gas* case be placed in the background section, i.e., in appendix 1. **The task force agrees and moved the reference accordingly (see the section titled, Role of Capital).**

Note as well that a new paragraph was added to section 3.2 (see the discussion below regarding comments received on section 3.8).

Section 3.3, Estimates of Future Costs—Several commentators disagreed that capital costs should be based upon expected future values, since the cost is dependent on the risk or variability to which it is exposed. **The task force agrees that risk or variability is an element of capital costs. Risk or variability is appropriately considered in deriving the expected value; therefore, no change in the language used is necessary.**

Section 3.4, Risk Sharing (now titled Parameters of the Risk Transfer)—One commentator suggested that the title of this section should be changed, noting that insurance is a risk transfer device, and not a risk sharing device. This commentator also suggested alternative wording to clarify the roles of the two main parties to the insurance transaction: the insured and the insurer. **The task force agrees with the commentator and rewrote the section to indicate that the cost of capital may vary with the specific parameters of the risk transfer.**

Another commentator noted that deductibles, limits, etc., affect the *structure* of the risk transfer rather than the parties involved. **The task force agrees that these factors affect the structure of the risk transfer and believes that the revised language addresses this concern.**

Section 3.5, Investment Income—One commentator suggested a revised second sentence in paragraph two as follows: *Investment risk includes the estimated cost of default and reinvestment risk on the assets associated with the proposed transaction, since such costs can result in a significantly different yield than the stated yield rate*. **The task force agrees with the commentator and changed the text to be substantially similar to the suggested revision.**

This commentator also suggested revising paragraph (b) to add *retention of business* as a subject for the actuary's consideration. **The task force agrees that retention of business may be a consideration, but the standard is not intended to provide an exhaustive list of considerations. The phrase *for example* was added to clarify that the section does not provide a complete list.**

Section 3.6, Income Taxes—One commentator suggested adding the following sentence: *The income tax position of the risk assuming entity, such as tax loss carry forwards, and alternative minimum taxes, may also be relevant to accepting or rejecting the proposed risk transfer*. **The task force disagrees with this suggestion, because it believes this suggestion addresses considerations that are not relevant to the cash flows for the risks being transferred. Therefore, no change was made.**

Section 3.7, Contingency Provision—One commentator suggested adding a sentence which would state that the actuary need not explicitly identify the contingency provision separate from the profit provision, and that the contingency provision is not intended as a risk margin for catastrophic events. **The task force believes the definition of *contingency provision* makes it clear that it is *not* a risk margin for catastrophic events. The task force disagrees that a contingency provision can implicitly be combined with a profit provision, because the two provisions are distinctly different, both subject to explicit determination.**

Another commentator suggested that the use and meaning of a contingency provision was unclear and needed to be clarified in the standard. **The task force believes that, with the clarifying changes made to the second paragraph of this section, the standard adequately explains the use of the contingency provision as a correction factor when the ratemaking process has produced in the past, and is expected to produce in the future, cost estimates not equal to average actual costs.**

Section 3.8, Structure of Insurer—This section of the second exposure draft addressed the structure of the insurer, such as stock, mutual, etc. Several commentators expressed concern that the requirements of the capital providers should be taken into account when considering the cost of the insurance product, and that non-stock organizations might have different requirements than stock companies. One commentator specifically suggested making a greater distinction between the cost of capital and the desired return on capital. **The task force rewrote the text of this section to place greater emphasis on the economic concept of *opportunity cost*, which**

refers specifically to the value of capital in its next best alternative use. Under this definition, the proper cost of capital is the return that the capital could earn in an alternative investment of equivalent risk. The task force does not believe that this differs depending on the ownership structure (i.e., stock, mutual, or other) of the insurer per se. However, as discussed in section 3.4, the actuary's estimate of the cost of capital should reflect characteristics of the risk transfer that may arise due to ownership structure (such as, for example, the availability of policyholder dividends). Note, in addition, that the text of this section was moved to section 3.2 in order to enhance clarity.

One commentator who questioned section 3.8 also wished to add to the standard a new section, which would read as follows:

> *Several of the models used for estimating the underwriting profit provision also permit the actuary to rank potential risk transfer undertakings. An actuary should be prepared to rank the risk versus the reward (the total return, from underwriting and from investment income) for various scenarios involving the allocation of capital towards a certain line of insurance or a specific product.*

The commentator's rationale for this suggestion is that "the actuary of the future may often be called upon to estimate not only the reward (the total return from allocating capital towards a certain line of insurance or a specific product), and not only the associated risk, but also to rank several risk/reward scenarios for a client or employer." **The task force agrees that an actuary can be asked to estimate and rank various risk/reward scenarios for a client or an employer. However, the task force thinks that while this is implicit in the role an actuary plays, the matter is beyond the scope of the standard.**

Appendix 1—Background and Current Practices

Role of the Underwriting Profit Provision—One commentator found the references to *all other cost and revenue components* too vague. **The task force agrees that the reference is not precise, but the next clause of the sentence refers to *total [rate of] return*, which is precisely defined in section 2.12. Hence, no change was made.**

Estimating the Cost of Capital—One commentator suggested adding a parenthetical phrase, *(generally a risk free investment)*, to the description of the risk premium model (in the second sentence of item (3), after the phrase, *reference investment*). **The task force disagrees with this change. In the typical (perhaps the most common) implementation of the risk premium method, the reference security is a long-term utility bond, which is not risk free. Thus, the second sentence was left unchanged. However, the task force did modify the next sentence as follows: *One widely used form of risk premium analysis is known as the capital asset pricing model (CAPM), in which the reference security is a risk free Treasury security, and the risk margin is determined….* This correctly identifies that in the CAPM variant of risk premium analysis, the reference security is risk free.**

Relating the Cost of Capital to the Underwriting Profit Provision—One commentator expressed concern about the use of the singular *rate* in the last sentence of the section that discusses the net present value model, and another suggested alternative wording for clarity, in the definition of the IRR model. **The task force changed *rate* to *rate(s)*, and adopted the proposed wording to note that the IRR calculates the rate(s) of return by setting the net present value of a risk transfer's cash inflows and outflows equal to zero.**

The task force thanks everyone who took the time and made the effort to write comment letters. The input was helpful in developing the final standard.

NEAL DIHORA, KYLE MROTEK, AND MICHAEL SCHMITZ

Quantifying Risk in Mortgage-Backed Securities

THE OPPOSITE SIDE OF RISK MITIGATION is risk exploitation, and there's currently an opportunity on the asset side for insurers and other financial institutions that exploit risk. Asset impairments flow through and affect surplus levels, leading to potential business-funding issues. These losses can also pressure risk-based capital levels. In some circumstances, they can lead to forced decisions such as bankruptcy, mergers, or sales of business lines. A better understanding of the risk embedded on the asset side of the balance sheet should engender confidence to capitalize on the opportunities presented to many institutions. With appropriate analysis and understanding, firms can exploit the current situation to enhance value to their stakeholders.

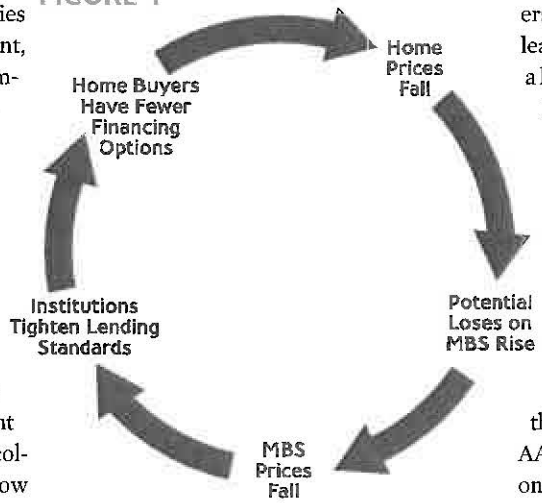
The current economic crisis had its origin in the residential mortgage market, which has certainly suffered severe stress in the past couple of years. What started as a subprime mortgage problem quickly evolved into a broad mortgage crisis with waves of losses in Alt-A mortgages (a cousin of the subprime) and even prime loans. This real-world stress test has inflicted severe pain on many institutions holding assets tied to these markets, including general insurers and particularly life insurance companies. These assets include mortgage-backed securities (MBS), asset-backed securities (ABS), and collateralized debt obligations (CDO). Rising defaults and declining house prices have led to downgrades by the rating agencies and illiquidity. In such an environment, many have questioned the severely impaired market values of these securities as reasonable accounting values and as measures of intrinsic value.

Actuaries with strong expertise in modeling mortgage credit risk are well-positioned to assist both management and boards of directors in making sense out of current market conditions. The key is deriving the discounted cash flows from a given security based on an independent analysis of the underlying loan-level collateral pool, coupled with a cash-flow engine that overlays the security capital structure. This produces the cash flows for the security in question and allows the actuary to quantify the risk associated with uncertain collateral performance.

A Quick Primer on the MBS Market

The MBS market expanded rapidly from the 1990s into the current decade with gross issuance increasing from $318 billion in 1995 to nearly $2.2 trillion by 2005. It was only with the emergence of a more difficult economic environment in recent years that issuance began to decline. In the early years, agency issuers such as Fannie Mae, Freddie Mac, and Ginnie Mae dominated. However, with the emergence of new loan types and dramatically lower interest rates during late 2001 and 2002, non-agency issuers quickly began to take market share, rising from 15 percent of the issuance market in 1995 to 55 percent in 2005. When home prices began falling in 2007 and 2008, these players ran into financial difficulties and rapidly began to lose market share. The deterioration in the secondary market for non-agency securities exacerbated those market-share losses in late 2008 and 2009.

FIGURE 1



Home prices, as measured by the Case-Shiller index, peaked in the middle of 2006. Once they began to decline, options for current and potential homeowners were materially restricted. Secondary markets for MBS over the past year have frozen, with brokers and dealers unwilling to provide liquidity or providing liquidity only with punishing bid-ask spreads. This lack of liquidity and declining home prices are leading to a vicious cycle (illustrated in Figure 1). As home prices fall, the potential losses on MBS rise, resulting in falling prices. The lower prices force institutions holding these assets to recognize losses and tighten standards for making new loans. Current and potential homeowners are left with fewer financing options, leading not only to forced sales but also to a lack of new buyers. This, in turn, causes home prices to fall further.

The erosion of both liquidity and value can be seen in many parts of the market. For example, the interest-rate spread of conventional mortgage loans over Treasuries, which had been in the range of 140 to 160 basis points from 2004 through the middle of 2006, increased to 280 basis points by late 2008. Another example is the value of the Markit ABX.HE index of AAA-rated subprime MBS from the second half of 2007, which further declined

by nearly 65 percent from January 2008 to March 2009. The Federal Reserve's survey on bank lending practices (conducted quarterly among senior loan officers) shows that lending standards have tightened considerably. During 2004 and 2005, the percentage of loan officers constricting their lending standards for residential mortgage loans was negative, indicating that they were loosening standards. By contrast, during the second half of 2008 and early 2009, this survey showed that more than 50 percent of officers were tightening standards. Combined, these factors are causing a dramatic decline in the availability of credit for individuals and corporations.

Managing Risk in the Current Environment

Standard accounting measures use point estimates for valuing mortgage securities on quarterly and annual statements. However, risk quantification for both external and interested internal parties, such as members of boards of directors, necessitates an appreciation for the full range of potential scenarios. For example, a chief risk officer at a large commercial bank may use value-at-risk to assess the impact of "stress" scenarios on the bank's capital levels. One might be tempted to use a normal distribution of outcomes to quantify the risk. However, this may generate a false sense of security. For example, if the daily price changes on the Dow Jones industrial average followed a normal distribution, they would have moved more than 4.5 percent only six times from 1916 to 2003. In fact, this occurred 366 times. This simple example underscores the need for more sophisticated measurements of the range of outcomes for mortgage-credit losses, which like stock market returns don't follow normal returns.

Figure 2 (see Page 86) summarizes the general process in valuing MBS. Loan-level collateral data and economic factors will drive inputs such as credit losses and prepayments. These collateral assumptions are used with a cash-flow model to push the relevant cash flows (interest, principal, prepayments, and losses) through the security capital structure. The output is then discounted to attain a net present value.

The willingness and ability of borrowers will drive prepayments. The most important factor in a willingness to prepay is the difference between the original loan rate and the prevailing available rate. A larger differential generally causes higher numbers of prepayments through refinancing. However, current tight lending standards and declining home values are dampening this impact. Other factors that drive borrower willingness to prepay include loan type (fixed or adjustable rate) and the age of the loan. The ability of borrowers to prepay can be influenced by the equity in their properties, their consumer credit scores, their employment situa-

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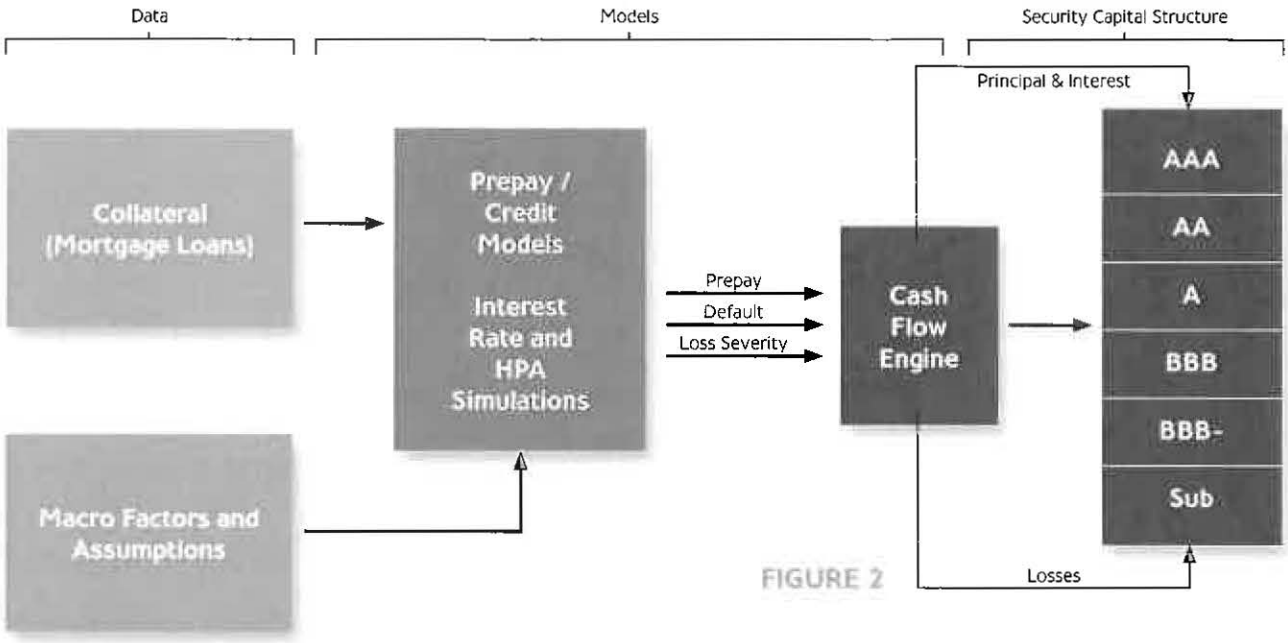


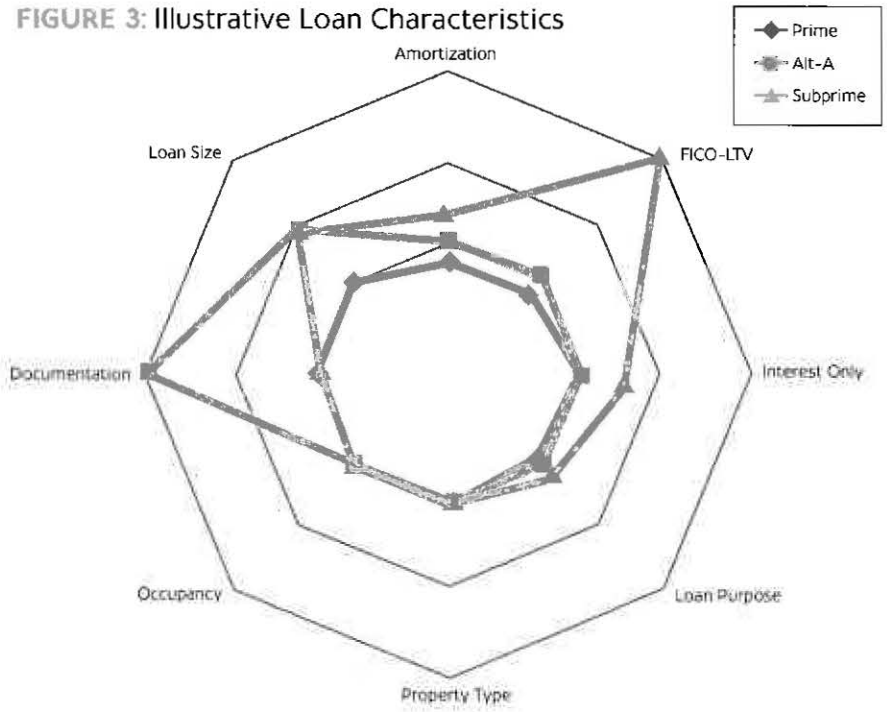
FIGURE 2

tions, and lending standards at financial institutions; all under significant strain because of current economic conditions.

There are many potential loss models that can be used to estimate credit risk/potential losses over the life of the security. We'll limit ourselves to four that are based on models familiar to casualty actuaries: the paid-loss development factor and the Bornhuetter-Ferguson (BF) method, along with using incurred losses instead of paid losses for both methods.

Paid losses can be calculated from the loan-level data provided by trustees or servicers. A loss curve is a measure of the proportion of losses that are paid by loan age. The anticipated losses can be calculated using the paid losses to date and the percent of total losses that would be paid by a certain age.

FIGURE 3: Illustrative Loan Characteristics



Similar calculations can be performed for the incurred-loss method. The incurred method will need to incorporate current delinquencies in the calculation of a probability of default. Incurred-loss curves can be used to estimate total or remaining losses. For example, incurred-loss curves can be estimated by introducing an acceleration to the paid loss curves.

However, the emergence pattern for mortgage-credit losses can be severely distorted by economic conditions, with calendar-year effects influencing the emergence curve at various maturity points for different vintage years. Thus, caution should be exercised in utilizing both paid- and incurred-loss development methods. BF-based methods, in contrast, lend themselves more readily to such projections.

The BF method requires an a priori loss calculation for projecting total collateral losses. This can be derived in two steps using loan-level detail and economic assumptions. The probability of default is derived first, followed by its severity. For example, a loan that has very little documentation is more likely to default than one that has full documentation.

The graph in Figure 3 depicts frequently mentioned loan characteristics, such as consumer credit (FICO) scores, loan-to-value (LTV), loan amortization type (fixed or adjustable rate), interest-only loan, occupancy, loan size, and property type.

These characteristics are used to develop the probability of default for three illustrative loans. In Figure 3, the closer to the center of the graph, the lower the risk factor. Typical characteristics of Alt-A loans are low or no documentation and high loan size, while subprime loans generally have low consumer credit scores.

Once the initial a priori loss is derived, utilizing the loan-level collateral underwriting factors referred to above, an adjustment is made that reflects economic conditions affecting the losses. Home-price trends tend to have the most substantial impact.

With a default, the severity is derived using property-price changes, costs during foreclosure, accrued interest, and other factors. The a priori loss estimate is the probability of default times its severity. The BF method can be used to calculate the remaining loss rate by using the a priori loss rate, the loss curve, and losses and persistency to date.

In recent months, independent financial institutions and different levels of the government have been introducing innovative programs to assist homeowners who are unable to meet their monthly payments. Adjustments can be incorporated to integrate the impact of these and other programs on overall loss estimates.

Prepayment and credit-loss values chosen from the approaches described above are needed to project future cash flows. Many of these securities have multiple tranches that have different payment triggers for scheduled principal, interest, and losses. A cash-flow model delineates overall collateral performance from original borrowers to the different security holders, based on deal triggers. Future cash flows to the investor are then discounted to get a present value for the security.

Getting to the True Value

All of the above describes a general method for calculating the intrinsic value of a security. Risk quantification begins by understanding the range of outcomes that can evolve from the process. In better economic times, it was difficult to envision the current strained scenario as part of what could really happen. Many believed that a new paradigm was in play, where credit losses would not be a concern and economic growth would continue as the world began to integrate. However, this is exactly the reason for scenario analysis and risk quantification—it provides the company with a better understanding of the potential value of the security beyond financial reporting purposes to strategic risk management purposes. □

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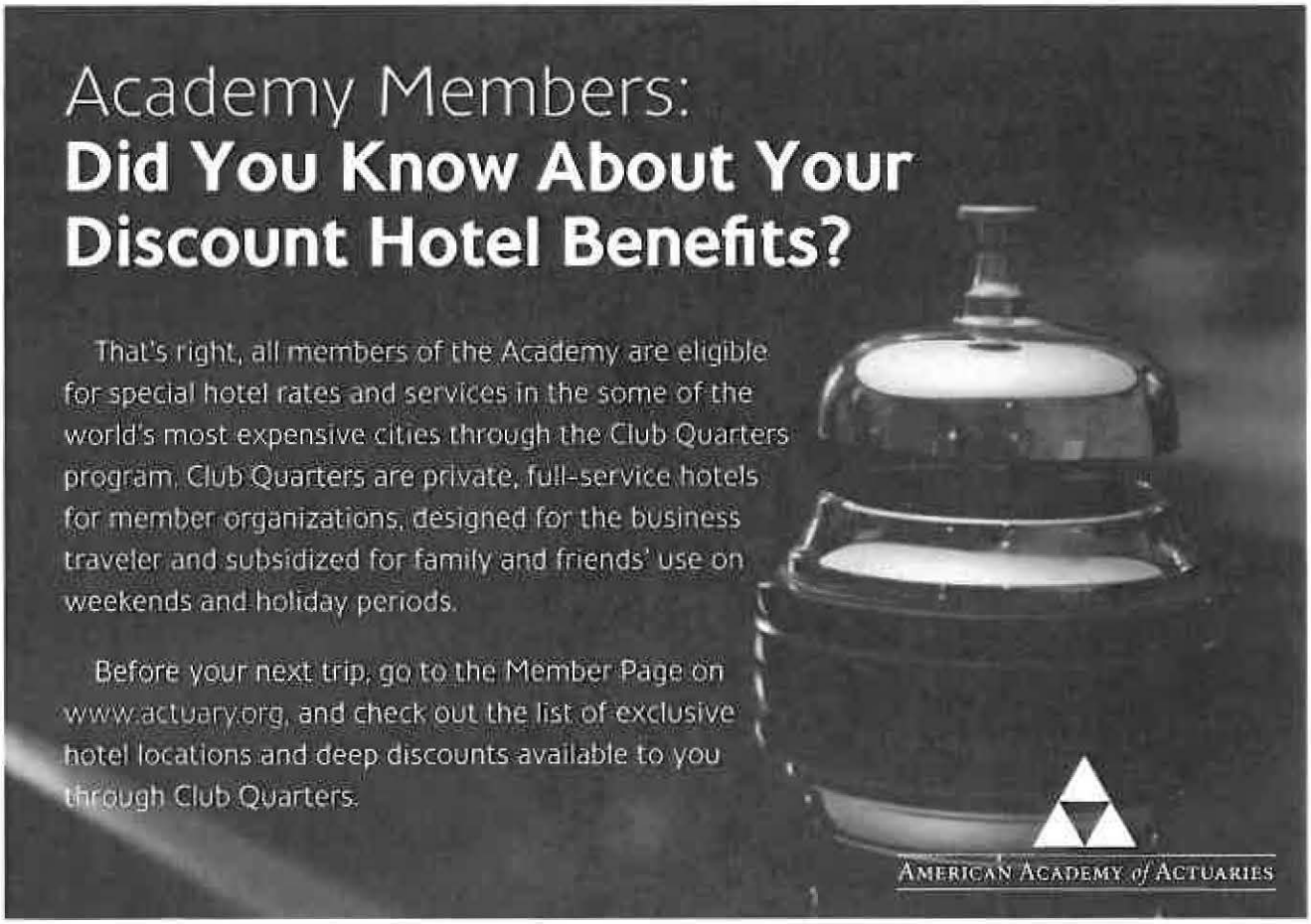

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EXHIBIT 18

ATRIUM INSURANCE CORPORATION

ANALYSIS OF EXCESS-OF-LOSS REINSURANCE PROGRAM - 40% NET PREMIUM FOR UNITED GUARANTY RESIDENTIAL INSURANCE COMPANY

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March 23, 2007

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ATRIUM INSURANCE CORPORATION

ANALYSIS OF EXCESS-OF-LOSS REINSURANCE PROGRAM - 40% NET PREMIUM FOR UNITED GUARANTY RESIDENTIAL INSURANCE COMPANY

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ATRIUM INSURANCE CORPORATION

ANALYSIS OF EXCESS-OF-LOSS REINSURANCE PROGRAM - 40% NET PREMIUM FOR UNITED GUARANTY RESIDENTIAL INSURANCE COMPANY

INTRODUCTION

Mortgage insurance protects an investor holding a mortgage loan against default by the mortgagor. Banks and mortgage lenders such as PHH Corporation (PHH) generally require that borrowers obtain mortgage insurance from third-party mortgage insurers on low down payment loans. These same banks and mortgage lenders reinsure mortgage insurance risk by operating insurance companies and assuming reinsurance business from a primary insurer. Under the proposed structure, Atrium Insurance Corporation (Atrium) will enter into an excess-of-loss reinsurance agreement with United Guaranty Residential Insurance Company (UGRIC). UGRIC issues mortgage insurance on mortgage loans originated or purchased by affiliate lenders of Atrium. Atrium is therefore agreeing to accept from UGRIC a portion of the risk of default in return for a share of the premium paid.

Milliman, Inc. (Milliman) has been retained by PHH to independently assess the likelihood that a particular mortgage reinsurance structure with UGRIC would meet two tests specified in the August 6, 1997 letter of the Department of Housing and Urban Development with respect to compliance of captive mortgage reinsurance arrangements with the Real Estate Settlement Procedures Act. Although Atrium is not a captive insurance company, its relationship to PHH as an insurance company subsidiary lends itself to be held to the same captive requirements set forth by the Department of Housing and Urban Development. It is on the basis of this structural similarity that Milliman develops its opinion.

PERMISSIBILITY OF LENDER CAPTIVE REINSURANCE ARRANGEMENTS

On August 6, 1997, the Department of Housing and Urban Development (the "Department") issued a letter (the "HUD Letter") detailing the facts concerning captive reinsurance programs, relevant law, and how the Department will scrutinize lender captive reinsurance arrangements to determine whether any specific captive reinsurance program is permissible under the Real Estate Settlement Procedures Act ("RESPA"), specifically paragraph 8 (c) (2) of RESPA, 12 U.S.C. & 2607 (c) (2). For reasons set forth in the HUD Letter, the Department concluded that, so long as payments for reinsurance arrangements are solely "payments for goods or services actually performed," these arrangements are permissible under RESPA. We understand that you are familiar with the HUD Letter, and we have attached a copy of the letter to this report (Attachment A).

For reasons set forth in the HUD Letter, the Department's view of captive reinsurance is that the arrangements are permissible under RESPA if the payments to the reinsurer: (1) are for reinsurance services actually furnished or for services performed and (2) are bona fide compensation that does not exceed the value of such services. Where the Department scrutinizes a captive reinsurance arrangement, the letter states that the Department will apply the following two-part test to determine if the arrangement complies with RESPA:

1) Determine whether reinsurance is actually being provided in return for the compensation (Section II (B) (1) of the HUD Letter); and
2) Determine whether the compensation exceeds the value of the reinsurance (Section II (B) (2) of the HUD Letter).

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To facilitate its analysis, the Department may use information obtained from the lender, the primary insurer, the captive reinsurer, or other sources, including data on the rate, magnitude, and timing of the default losses and mortgage insurance payments and any other information to undertake the analysis.

Transfer of Risk

To determine that a real service, or reinsurance is actually being performed by the reinsurer for which it may legally be compensated (the first test, Section II (B) (1)) the Department states that there must be a real transfer of risk. The Department specifically indicates that the requirement for a real transfer of risk would be clearly satisfied by a quota share arrangement, under which the reinsurer is bound to participate pro rata in every claim. The Department also states that the requirement for a real transfer of risk could also be met by excess loss arrangements, if the band of the reinsurer's potential exposure is such that a reasonable business justification would motivate a decision to reinsure that band. Milliman, in the course of providing its opinion addresses this requirement and the results for this test are found in the Transfer of Risk section of the report.

As part of the first test described above, the Department details additional requirements that must be satisfied which are **not** addressed in Milliman's opinion and are as follows:

- There must be a legally binding contract for the reinsurance with terms and conditions conforming to industry standards; and
- The reinsurer must post capital and reserves satisfying the laws of the state in which it is chartered and the reinsurance contract between the primary insurer and the reinsurer must

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provide for the establishment of adequate reserves to ensure that, when a claim against the reinsurer is made, funds will exist to satisfy the claim.

Compensation Commensurate with the Risk

If the requirements in Section II (B) (1) for determining that reinsurance is actually being provided in return for the compensation are met, the Department will then determine whether the compensation paid for the reinsurance does not exceed the value of the reinsurance (Section II (B) (2)). The Department will evaluate whether the compensation is commensurate with the risk and, where warranted, administration costs. The specific points within the Department's evaluation requirements which **are** addressed in the Compensation Commensurate with the Risk section of Milliman's opinion include the following:

- Compare, using relevant mathematical models, the risk borne by the captive reinsurer with payments provided by the primary insurer;
- Analyze the likelihood of losses occurring, the magnitude and volatility of possible losses, the amount of payments received, the timing of the payments and potential losses, current market discount rates, and other relevant factors; and
- Take into account the relative risk exposure of the primary lender (Milliman interprets this as referring to the primary insurer) and the captive reinsurer.

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As part of the second test described above, the Department details additional requirements that may be evaluated which are **not** addressed in Milliman's opinion and are as follows:

- Consider the extent to which the lender of the firm controlling the captive reinsurer is shielded from potential losses by inadequate reserves and a corporate structure that segregates risk;
- Examine other financial transactions between the lender, primary insurer, and captive reinsurer to determine whether they are related to the reinsurance agreement; and
- Examine whether the ceding commission (if applicable) is commensurate with administrative costs assumed by the primary insurer.

Milliman's Analysis

It is our understanding that the tests, requirements and areas of evaluation are the Department's interpretation of various federal laws and regulations. Furthermore, the Department may consider items not specifically addressed in our tests in determining the permissibility of a particular captive reinsurance arrangement. We are not lawyers, and nothing in this report is intended to provide legal assurance that the requirements of these laws are met. We are also not accountants or auditors. We therefore do not offer opinions as to whether there is compliance with any applicable accounting or auditing standards. The tests addressed by Milliman involve financial and actuarial analysis and judgment. Our opinions are from those perspectives.

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Specifically, in analyzing whether the transfer of risk test is satisfied, Milliman reviews whether there is a reasonable probability (at least 10%) of a loss (present value loss ratio in excess of 100%) to the reinsurer under the agreement. Milliman's analysis compares the reinsurers' present value loss ratio at a 10% probability level to a 110% loss ratio in order to assess whether this test is met. The 10% probability level is the outcome at which 10% of the simulated scenarios generate higher loss levels.

In analyzing whether the second pricing test is satisfied, Milliman reviews whether the premium ceded by UGRIC to Atrium is reasonable in relation to the reinsured risk. Milliman formulates its opinion by analyzing whether:

- The cumulative return on capital for the reinsurer is reasonable relative to returns on capital for primary mortgage insurers; and
- The average reinsurance underwriting results as measured by loss ratios are reasonable in relation to those of primary mortgage insurers.

This report presents the results of our analysis.

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DESCRIPTION OF THE REINSURANCE STRUCTURE

Under the excess layer reinsurance agreement for book year 2005 reviewed by Milliman, UGRIC will cede to Atrium 45% of the gross written premium to reinsure 10.0% of the original risk insured for a given book year of business. In return, for underwriting, loss mitigation and other operational services, Atrium will provide UGRIC 11.1% of its premium as a ceding commission. The resulting net written premium percentage for Atrium will be 40.0%.

In return for the premium, Atrium under the defined excess-of-loss structure will reinsure a second loss position of 10.0% of the original book risk for each book year of business. The reinsured second loss position will begin after UGRIC pays the first loss position of 4.0% of the aggregate book risk for each book year of business.

For example, the following table illustrates Atrium's excess-of-loss reinsurance program terms based on assumed loan volume of $1.6 billion and average mortgage insurance coverage of 29.28% for a hypothetical book year:

Atrium Insurance Corporation Excess-of-Loss Reinsurance Program Terms Hypothetical Book Year ($ Thousands)	
A) Loan Volume	$1,574,951
B) Mortgage Insurance Coverage	29.28%
C) Gross Mortgage Insurance Risk (A x B)	$461,146
D) First Loss Position - UGRIC (C x .04)	$18,446
E) Second Loss Position - Atrium (C x .10)	$46,115

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Based on the example above, UGRIC covers approximately the first $18.4 million of losses arising from the book year of loans. If losses exceed $18.4 million, Atrium covers the next $46.1 million of losses. Atrium's policy limit of $46.1 million is exhausted once direct losses exceed approximately $64.6 million (i.e., $18.4 million + $46.1 million, difference due to rounding). All subsequent losses are then the responsibility of UGRIC.

The reinsurance period for each individual loan in each book year of business is 10 years. Atrium supports the reinsurance with capital and the ceded net written premium deposited into a trust. If trust funds are depleted such that Atrium's capital is below the required capital, Atrium can infuse additional funds in order to continue reinsuring business [Atrium must maintain total capital of at least 10% of reinsured risk (i.e., a risk to capital ratio of 10 to 1)]. However, Atrium has no liability beyond the funds available in the trust. The trust associated with this structure also supports previous books of business with UGRIC. The previous books of business will run-off under their existing terms. The capital in the trust may be used for all reinsurance structures, but must meet the 10% capital maintenance requirements referred to above for all book years.

Releases of capital from the trust to Atrium are allowed beginning January 1, 2005, but only if the assets (capital plus loss reserve and unearned premium reserve) in the trust exceed 102% of the sum of the loss reserve and unearned premium reserve plus the greater of:

- 20% of the reinsured risk (i.e., a risk to capital ratio of 5 to 1); or
- The contingency reserve.

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In our analysis, we have assumed that annual administrative expenses paid with trust funds will be limited to $100,000. Additionally, we have assumed a 35% federal income tax will be paid with trust funds and that Atrium does not pay a premium tax with trust funds.

Our review is based on an assumption that Atrium assumes risks of a national lender with average loss experience and a risk profile similar to that provided to Milliman by PHH. Furthermore, we have assumed that annual insured loan volume will be consistent with the level reflected in our analysis which was also provided to Milliman by PHH. To the extent that Atrium's annual insured loan volume, trust account balance, risk profile or claims experience differs from our assumptions, the results of our analysis may not be appropriate.

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SUMMARY AND CONCLUSIONS

Based on representations by PHH as referred to below and our review of UGRIC's reinsurance program for book year 2005 as defined by:

- A net ceded premium equal to 40.0% of the primary mortgage insurance premium (a 45% gross premium with a 11.1% ceding commission);
- A risk layer beginning at 4.0% of original risk insured;
- Annual insured loan volume, a distribution of insurance by loan to value and instrument type, and other risk characteristics, generally similar to that represented to Milliman by PHH;
- A maximum risk layer of 10.0% of the original risk insured; and
- Minimum capital requirements, expense and tax provisions, and restrictions on the release of trust assets as outlined above,

Milliman is of the opinion that, from an actuarial and financial point of view, this reinsurance agreement:

(A) Has a reasonable probability of a loss to the reinsurer, which likely satisfies the transfer of risk test in the HUD letter; and

(B) Has a net ceded premium which is reasonably related to the ceded risk, which likely satisfies the test in the HUD Letter that the compensation paid does not exceed the value of the reinsurance.

Milliman has also concluded that the reinsurance program provides a way of increasing the management of risk by providing the lender with an incentive for better loan originations.

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TRANSFER OF RISK ANALYSIS

To determine that a real service or reinsurance is actually being performed by the reinsurer for which it may legally be compensated, (the first test, Section II (B) (1)), the Department states that there must be a real transfer of risk. The Department specifically indicates that the requirement for a real transfer of risk would be clearly satisfied by a quota share arrangement, under which the reinsurer is bound to participate pro rata in every claim. The Department also states that the requirement for a real transfer of risk could also be met by excess loss arrangements, if the band of the reinsurer's potential exposure is such that a reasonable business justification would motivate a decision to reinsure that band.

Specifically, in analyzing whether the transfer of risk test is satisfied, Milliman reviews whether there is a reasonable probability (at least 10%) of a loss (present value loss ratio in excess of 100%) to the reinsurer under the agreement. Milliman's analysis compares the reinsurers' present value loss ratio at a 10% probability level to a 110% loss ratio in order to assess whether this test is met. The 10% probability level is the outcome at which 10% of the simulated scenarios generate higher loss levels.

Based on our analysis of the projected financial performance under the reinsurance contract, Milliman believes that the proposed reinsurance agreement likely satisfies the transfer of risk in the HUD Letter in that there is a reasonable probability of a loss to the reinsurer.

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In reaching this conclusion, we simulated the pro-forma financial statements for Atrium for all in force book years as well as the 2005 book year under various performance scenarios. We then compared the net present value of Atrium's cash flows for the 2005 book year and calculated a discounted loss ratio. The present value loss ratio is defined for the 2005 book year as the ratio of the present value of paid losses to the present value of premiums received recognizing that both cash flows may be cut-off if Atrium's assets are depleted.

As a note, our transfer of risk test focuses on the premium and losses for the 2005 book year. However, we have also projected the performance for the previous book years due to the trust fund providing cross-collateralized security for both the previous and the prospective book years. The performance of previous book years affects the ability of the trust to meet reinsured obligations for the 2005 book year and thus affects transfer of risk on the 2005 book year. Our projections reflect the loss rate correlation between consecutive book years.

Atrium incurs significant losses in many of the scenarios. Furthermore, approximately 10% of the scenarios generated a loss outcome at or above the stress scenario illustrated on Exhibit 1, which results in a 213% present value loss ratio. As a technical note, this stress scenario assumes an ultimate loss rate (i.e., reflecting frequency and severity) of approximately 13.41% of original risk insured for the 2005 book year and loss rates as displayed on Exhibit 2 for prior book years. The loss rates for recent book years are projected to be consistent with the stressed 2005 book year (due to the correlation referenced above).

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We believe that this 113% loss in excess of premiums demonstrates a loss under a reasonably possible scenario. The net premiums and losses to Atrium are displayed on Exhibit 1. Premiums and losses in Exhibit 1 are adjusted to recognize that the contract is cut-off if Atrium's assets are depleted (i.e., no future premiums are ceded to Atrium subsequent to cut-off). The premiums received through cut-off and reinsured losses satisfied by Atrium for the 2005 book year are discounted to their present value at the beginning of the book year based on a 4.25% assumed yield. The selection of 4.25% is based on the 10-year treasury yields during 2005. Due to the strong cross-collateralization of Atrium's trust fund, our scenario does not result in a cut-off of premium and losses.

As mentioned above, our analysis has conservatively focused on the performance of the 2005 book year and prior book years since the contract may be put into run-off after the 2005 book year (i.e., each individual loan in book year 2005 would continue to be reinsured for its 10-year term), but no subsequent book years would be reinsured). However, in a scenario with more book years and additional capital from contingency reserves, retained earnings, and potential capital contributions for subsequent book years, it is more likely that all (or a greater portion) of the reinsured losses will be satisfied under the stress scenario due to cross-collateralization. Cross-collateralization refers to the ability to utilize capital and retained earnings from profitable book years to satisfy losses of unprofitable book years. Therefore, a multiple book year scenario, with additional book years, increases the likelihood of all or a greater portion of the reinsured losses being satisfied.

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The projected financial statements used to derive the cash flow analysis on Exhibit 1 are displayed on Exhibits 2 through 5. The exhibits contain the following:

- Exhibit 2 – The assumptions underlying the stress scenario;
- Exhibit 3 – The pro-forma statutory balance sheet for the stress scenario;
- Exhibit 4 – The pro-forma statutory statement of income for the stress scenario; and
- Exhibit 5 – The pro-forma change in assets/cash flow statement for the stress scenario.

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COMPENSATION COMMENSURATE WITH THE RISK ANALYSIS

In analyzing whether the second pricing test is satisfied, Milliman reviews whether the premium ceded by UGRIC to Atrium is reasonable in relation to the reinsured risk. Milliman formulates its opinion by analyzing whether:

- The cumulative return on capital for the reinsurer is reasonable relative to returns on capital for primary mortgage insurers; and
- The average reinsurance underwriting results as measured by loss ratios are reasonable in relation to those of primary mortgage insurers.

Our analysis of the reasonableness of the price in relation to the reinsured risk also relies on our simulation of projected financial results for Atrium. However, the analysis focuses exclusively on the 2005 book year. We estimated the expected financial performance under the contract based on the average penetration of losses into the reinsured layer under the projected scenarios. The pro-forma financial statements for the expected performance are displayed on Exhibits 6 through 9 (which are similar in format to Exhibits 2 through 5).

We have concluded that the 40% net ceded premium is reasonable in relation to the ceded risk given the following:

- The internal rate of return (IRR) of the dividend stream of 12% and the cumulative return on capital of 7% over the term of the run-off are reasonable relative to returns on capital for primary mortgage insurers; and

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- The average reinsurance underwriting results as measured by loss ratios (on both a nominal and present value basis) are reasonable in relation to those of the primary company on a gross and net basis (i.e., before and after the reinsurance contract).

As a technical note, our analysis assumes that the gross mortgage insurance rates are reasonable relative to the risk of the primary insurer. However, we have not conducted an independent review of the primary rates.

Rate of Return Comparison

Atrium's returns were measured on two bases to compare the primary company's returns:

- The internal rate of return of dividends was measured; and
- The cumulative average return on capital was measured.

The internal rate of return of the expected dividend stream is 12% as displayed on Exhibit 7. The internal rate of return is the rate of return which equates the present value of the contributed capital to the flow of dividends. A final dividend at the end of the run-off (year 11) is calculated to liquidate the trust. This final dividend is equal to the remaining investable assets less the unearned premium and loss reserve.

The cumulative return on average capital of 7% is also displayed at the bottom of Exhibit 7. The return on capital for a calendar year is calculated by dividing net income by the average capital during the year (including the contingency reserve). A cumulative return on capital is then calculated over the term of the contract for one book year.

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The 12% IRR and 7% return on capital can be compared to the return on capital for the active primary mortgage insurance industry. The returns on average capital for the last twenty-nine years are displayed on Exhibit 10. The returns are calculated in a manner similar to the return on average capital calculation described above and are based on several industry sources.

We believe that the projected returns under the reinsurance structure are reasonable given that they are consistent with those experienced by the industry.

Loss Ratio Comparison

The expected underwriting performance under the reinsurance contract was compared to that of the primary insurer as an additional test of the reasonableness of the ceded premium relative to the risk. The expected loss ratio was projected from our simulation of financial performance separately on a gross basis (i.e., the direct experience of the primary company) and on a ceded basis (i.e., the reinsurer's share of losses) over the term of the reinsurance contract for one book year. Expected net results were then calculated by subtraction. Present value loss ratios were also projected due to the later payout of reinsured losses.

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The following table shows the results of our loss ratio analysis which is also outlined on Exhibit 11:

	Atrium Insurance Corporation Expected Loss Ratio Comparison 45% Gross Premium with 11.1% Ceding Commission – 40% Net Premium	
	Nominal	**Present Value[1]**
Gross (UGRIC)	60%	55%
Ceded (Atrium)	58	50
Net (UGRIC)	62	59

[1] Based on 4.25% yield

We believe that the reinsurance premium is reasonable in relation to the reinsured risk since the projected expected loss ratios for Atrium are reasonable in relation to the loss ratios for the primary insurer. We believe that it is reasonable for the reinsurer's loss ratio to be below that of the primary company since the reinsurer is covering the more volatile excess layer. The reinsurance coverage provides the primary company with significant reinsurance protection attaching at profitable levels for the primary company and reducing volatility in the years with above average losses.

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The table below demonstrates the reinsurer's more volatile performance by showing the loss ratios at various probability levels:

	Atrium Insurance Corporation Loss Ratio Comparison at Probability Levels 40% Net Ceded Premium	
Probability Level	**Net Primary Insurer**	**Ceded[1]**
50%	60%	14%
60	62	40
70	64	74
80	66	123
90	69	213
95	112	241

[1] Net of ceding commission

The interpretation of the probability levels above is that they represent the probability that a single book year has a projected loss ratio at or below the indicated level. For example, the primary insurer's net loss ratio is 112% at the 95% probability level while the reinsurer's loss ratio is 241%. There is a 95% chance that the reinsurer will have a loss ratio at or below 241%. Therefore, there is a 5% chance (i.e., 1.0 – 95%) that the reinsurer's loss ratio will be higher than 241%. As demonstrated above, the reinsurance provides significant protection above the 70% probability level, which significantly reduces the volatility of the primary insurer's loss ratio. As a technical note, the table above assumes that all reinsured losses are satisfied through sufficient capital and cross-collateralization.

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QUALIFICATIONS AND LIMITATIONS

It is our understanding that the tests, requirements and areas of evaluation outlined in the HUD Letter are the Department's interpretation of various federal laws and regulations. Furthermore, the Department may consider items not specifically addressed in our tests in determining the permissibility of a particular captive reinsurance arrangement. We are not lawyers, and nothing in this report is intended to provide legal assurance that the requirements of these laws are met. We are also not accountants or auditors. We therefore do not offer opinions as to whether there is compliance with any applicable accounting or auditing standards. The tests addressed by Milliman involve financial and actuarial analysis and judgment. Our opinions are from those perspectives. Also, we are not opining on the capital adequacy or financial condition of Atrium.

In performing this analysis, we have relied on data and other information provided and represented to us by or on behalf of PHH. We have not audited, verified, or reviewed this data and other information for reasonableness and consistency. Such a review is beyond the scope of our assignment. If the underlying data or information is inaccurate or incomplete, our analysis may likewise be inaccurate or incomplete.

Any study of future operating results involves estimates of future contingencies. While our analysis represents our best professional judgment, arrived at after careful analysis of the available information, it is important to note that a significant degree of variation from our projections is not only possible, but is in fact probable. The sources of this variation are numerous: future national or regional economic conditions, mortgage prepayment speeds, and legislative changes affecting the program are examples. Furthermore, we have assumed average

nationwide claim experience provided by PHH is appropriate. This experience has substantial geographical and lender diversification. To the extent that Atrium's insured loan volume, trust account balance, risk profile or claims experience differs significantly from our assumptions, the results of our analysis may not be appropriate. Also, we have assumed that UGRIC's current primary mortgage insurance rates are reasonable relative to their risk, although we have not conducted an independent review of primary rates.

Our analysis assumes Atrium's books of business terminate at their natural expiration (i.e., either at cut-off or at the end of run-off) and does not take into account any possible commutation of insured books. It is possible that a commutation could materially impact Milliman's opinions with regard to the transfer of risk and the compensation commensurate with the risk. Furthermore, it is likely that any commutation would affect the cross-collateralization between book years referenced in the Transfer of Risk Analysis section of this report.

In evaluating whether the ceded premium is reasonable relative to the ceded risk, Milliman determines whether the ceded premium is within a range of reasonable prices based on a simulation of projected financial results for the reinsurer. Milliman estimates the expected financial performance under the contract based on the average penetration of losses into the reinsured layer under the projected scenarios and compares the underwriting performance and returns to those of the primary insurers. As a neutral party providing our opinion, Milliman does not determine whether a particular deal is more advantageous for the ceding company or the reinsurer. Many factors affect a company's decision to enter into particular reinsurance contracts (e.g., risk appetite, capital, earnings volatility, and risk management considerations are several

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examples). It is Atrium's and UGRIC's ultimate decision as to whether or not they enter into any particular reinsurance agreement.

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LIMITED DISTRIBUTION OF RESULTS

This report has been prepared for the use of and is only to be relied upon by the management of PHH. No portion of this report may be provided to any other party without Milliman's prior written consent. In the event such consent is provided, the report must be provided in its entirety. This report may not be filed with the SEC or other securities regulatory bodies. In the event Milliman's work is distributed to other parties due to statute or regulations, or by agreement of Milliman and PHH, Milliman requires that its work be distributed in its entirety, and that any recipient be advised to have their own actuary review the work. Milliman does not intend to benefit any third party recipient of its work product or create any legal duty from Milliman to a third party even if Milliman consents to the release of its work product to such third party.

Milliman understands that PHH intends to distribute this report to its auditors in connection with the preparation of the financial statements of PHH. We will consent to such distribution as long as each work product is distributed in its entirety. The auditor may want to have its own actuary review the work. Milliman does not intend to benefit any third party recipient of its work product including the auditor, and does not intend to create any legal duty from Milliman to the auditor even if Milliman consents to the release of its work product. In the event that any audit reveals any error or inaccuracy in the data underlying this report, Milliman requests that the auditor notify Milliman as soon as possible.

Any reader of this report must possess a certain level of expertise in areas relevant to this analysis to appreciate the significance of the assumptions and the impact of these assumptions on the illustrated results. The reader should be advised by, among other experts, actuaries or other professionals competent in the area of actuarial projections of the type in this report, so as to properly interpret the projection results.

If you should have any questions with regard to this analysis or would like to have us consider additional information, please do not hesitate to contact us. We appreciate the opportunity to work with PHH Corporation on this assignment.

Respectfully submitted,

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KAB/MCS/sbs

March 23, 2007

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Exhibit 1

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)
Premium and Loss Analysis - For All Book Years

	Present Value Loss Ratio	Present Value Prems / Losses [1]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total Prems / Losses
Net Premiums		143,919	0	0	0	0	7,486	17,846	27,185	33,469	32,061	24,035	19,656	20,681	17,424	13,218	9,801	7,048	5,017	3,490	2,262	1,352	598	116	0	242,744
Net Premiums Received		143,919	0	0	0	0	7,486	17,846	27,185	33,469	32,061	24,035	19,656	20,681	17,424	13,218	9,801	7,048	5,017	3,490	2,262	1,352	598	116	0	242,744
Paid Losses		34,661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	20,335	18,249	14,430	11,461	7,810	4,730	2,290	567	81,233
Paid Losses Satisfied	24%	34,661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	20,335	18,249	14,430	11,461	7,810	4,730	2,290	567	81,233

[1] Based on 10 year treasury yield for previous calendar years and a 4.25% assumed yield for prospective calendar years. Present valued to the beginning of the contract.

Premium and Loss Analysis - For Prospective Year

	Present Value Loss Ratio	Present Value Prems / Losses [1]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total Prems / Losses
Net Premiums		15,689	0	0	0	0	0	0	0	0	0	0	0	2,281	4,095	3,342	2,520	1,850	1,331	943	662	464	327	116	0	17,931
Net Premiums Received		15,689	0	0	0	0	0	0	0	0	0	0	0	2,281	4,095	3,342	2,520	1,850	1,331	943	662	464	327	116	0	17,931
Paid Losses		33,341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	10,282	9,741	7,691	5,695	3,878	2,534	1,663	567	43,412
Paid Losses Satisfied	213%	33,341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	10,282	9,741	7,691	5,695	3,878	2,534	1,663	567	43,412

[1] Based on a 4.25% assumed yield

Note: Amounts discounted to beginning of prospective calendar year.

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Exhibit 2

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)

		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
		Book Year 1	Book Year 2	Book Year 3	Book Year 4	Book Year 5	Book Year 6	Book Year 7	Book Year 8	Book Year 9	Book Year 10	Book Year 11	Book Year 12
Assumed Reinsurance Structure													
Premium	Gross Premium	25.0%	25.0%	25.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%
	Ceding Commission 1st Year	0.0%	0.0%	0.0%	19.0%	19.0%	19.0%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%
	Renewal	0.0%	0.0%	0.0%	19.0%	19.0%	19.0%	11.1%	11.1%	11.1%	11.1%	11.1%	11.1%
	Net Premium 1st Year	25.0%	25.0%	25.0%	36.5%	36.5%	36.5%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
	Net Premium Renewal	25.0%	25.0%	25.0%	36.5%	36.5%	36.5%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
1st Reinsured Risk Layer	Start (% of Original Risk)	6.5%	6.5%	6.5%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
	End (% of Original Risk)	12.5%	12.5%	12.5%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%	14.0%
	Percentage of Layer Assumed	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Term of Contract (Years of run-off for each Reinsured Loan)	10	10	10	10	10	10	10	10	10	10	10	10

Business Mix

		Percentage of Business												Coverage	Premium
Fixed Rate	97 LTV	0.0%	1.2%	0.6%	0.5%	2.4%	3.7%	5.1%	10.4%	18.9%	26.5%	39.4%	38.9%	35.0%	0.960%
	95 LTV	23.9%	37.5%	36.2%	41.0%	41.5%	46.6%	47.2%	40.8%	35.8%	27.9%	22.4%	22.8%	30.0%	0.780%
	90 LTV	53.3%	47.7%	46.3%	45.6%	45.7%	39.9%	39.3%	36.5%	30.5%	28.7%	24.7%	27.3%	25.0%	0.520%
	85 LTV	7.5%	5.8%	7.7%	7.6%	9.7%	8.3%	7.7%	11.1%	8.4%	9.6%	5.1%	6.3%	12.0%	0.320%
Total or Wtd Avg		84.7%	92.5%	90.9%	94.7%	99.2%	98.6%	99.2%	98.8%	93.6%	92.6%	91.7%	95.3%		

														Coverage	Premium
Adj. Rate	97 LTV	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.000%
	95 LTV	1.1%	2.5%	3.3%	2.4%	0.3%	0.6%	0.2%	0.5%	3.6%	3.0%	4.3%	2.2%	30.0%	0.920%
	90 LTV	13.1%	3.8%	5.0%	2.6%	0.4%	0.7%	0.4%	0.5%	2.4%	3.0%	3.7%	2.2%	25.0%	0.650%
	85 LTV	1.1%	0.4%	0.8%	0.4%	0.1%	0.1%	0.1%	0.1%	0.4%	0.5%	0.4%	0.3%	12.0%	0.370%
Total or Wtd Avg		15.3%	7.1%	9.1%	5.3%	0.8%	1.4%	0.8%	1.2%	6.4%	7.4%	8.3%	4.7%		
Total Fixed & Adj. Rate		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%		

Assumptions

Claim Severity incl. loss adjustment (% of coverage)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Approximate Average Rate	0.587%	0.630%	0.620%	0.626%	0.521%	0.644%	0.651%	0.652%	0.696%	0.708%	0.763%	0.749%	
Approximate Average Coverage	25.14%	26.38%	25.93%	26.18%	26.05%	26.64%	26.87%	26.64%	27.72%	27.91%	29.56%	29.28%	
PSA	375%	375%	375%	375%	375%	375%	375%	375%	375%	375%	375%	375%	
Loan Volume ($000's)	1,265,497	1,180,530	1,838,244	1,859,079	4,690,248	5,911,645	5,622,493	4,444,007	3,352,552	1,849,507	2,875,968	1,574,951	
Average Loan ($000's)	124	127	134	141	137	136	138	138	139	143	144	155	
Loan Counts	10,225	9,271	13,702	13,146	34,239	43,581	40,850	32,259	24,156	12,931	19,935	10,132	
Ultimate Loss Rate	0.85%	0.67%	0.45%	0.75%	0.75%	0.90%	0.80%	1.10%	1.80%	4.66%	8.05%	13.41%	

	Calendar Year-End																					
	Initial Value	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Other Expenses	0	0	0	0	0	0	0	0	0	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Capital Contributions/ (Dividends)	0	0	0	0	460,000	0	17,000,000	11,510,000	0	15,500,000	0	0	(16,800,000)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Investment Yield	5.33%	5.75%	7.78%	5.65%	6.58%	5.54%	4.72%	6.66%	5.16%	5.04%	4.05%	4.15%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%

Statutory Capital Contribution (Also Minimum Statutory Surplus)	0
Dividend Year	11
Tax Rate	35%
Premium Tax Rate	0.000%
Statutory/Partner Risk To Capital Ratio - Cash	10 to 1
Statutory/Partner Risk To Capital Ratio - Cash for Dividend	5 to 1

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CFPB-PHH-00112641

Exhibit 3

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company – Ceding Company)
Pro Forma Statutory Balance Sheet
Multiple Book
(Dollars in 000's)

	Year-End 0	Year-End 1	Year-End 2	Year-End 3	Year-End 4	Year-End 5	Year-End 6	Year-End 7	Year-End 8	Year-End 9	Year-End 10	Year-End 11	Year-End 12	Year-End 13	Year-End 14	Year-End 15	Year-End 16	Year-End 17	Year-End 18	Year-End 19	Year-End 20	Year-End 21	Year-End 22
Assets																							
Investable Assets	0	0	0	0	460	8,228	44,163	86,859	123,930	140,958	156,091	171,391	168,251	178,990	170,270	164,257	125,742	108,660	94,761	76,435	62,675	51,224	35,297
Tax and Loss Bonds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Assets	0	0	0	0	460	8,228	44,163	86,859	123,930	140,958	156,091	171,391	168,251	178,990	170,270	164,257	125,742	108,660	94,761	76,435	62,675	51,224	35,297
Liabilities																							
Unearned Premium Reserve	0	0	0	0	0	539	1,462	2,885	4,607	6,235	7,441	8,419	935	712	536	389	275	196	133	82	47	13	0
Loss Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	20,335	18,249	14,430	11,461	7,810	4,730	2,290	567
Contingency Reserve	0	0	0	0	0	6,193	16,818	33,176	52,977	71,702	85,572	96,819	112,277	121,764	127,798	112,869	101,470	91,903	81,309	67,045	56,669	47,916	34,039
Total Liabilities	0	0	0	0	0	6,731	18,280	36,061	57,584	77,937	93,013	105,239	113,212	122,475	129,696	133,593	119,994	106,530	92,903	74,937	61,446	50,219	34,605
Surplus (Before Capital Contribution)	0	0	0	0	0	1,497	8,883	39,288	66,346	47,521	63,078	66,153	74,480	61,861	63,374	53,516	39,152	10,941	9,100	14,354	11,540	10,798	16,473
Capital (Surplus + Cont. Rsv.)		0	0	0	0	7,689	25,701	72,464	119,323	119,223	148,650	162,972	186,757	183,625	191,172	166,385	140,622	102,844	90,410	81,399	68,210	58,714	50,512
Reinsured Risk		19,085	37,773	66,370	115,042	237,293	394,753	545,844	664,252	757,449	809,066	875,008	902,439	873,842	825,170	701,558	523,763	354,423	221,584	116,927	60,544	4,936	0
Risk-to-Capital Ratio		NA	NA	NA	NA	30.9	15.4	7.5	5.6	6.4	5.4	5.4	4.8	4.8	4.3	4.2	3.7	3.4	2.5	1.4	0.9	0.1	0.0
Capital Constraints																							
Required Risk-to-Capital Ratio		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Required Risk Capital		1,909	3,777	6,637	11,504	23,729	39,475	54,584	66,425	75,745	80,907	87,501	90,244	87,384	82,517	70,156	52,376	35,442	22,158	11,693	6,054	494	0
Statutory Capital Requirement (including Contingency Reserve)		0	0	0	0	6,193	16,818	33,176	52,977	71,702	85,572	96,819	112,277	121,764	127,798	112,869	101,470	91,903	81,309	67,045	56,669	47,916	34,039
Capital "Deficiency (Excess)"		1,909	3,777	6,637	11,504	16,040	13,774	(17,880)	(52,898)	(43,478)	(63,078)	(66,153)	(74,480)	(61,861)	(63,374)	(53,516)	(39,152)	(10,941)	(9,101)	(14,354)	(11,541)	(10,798)	(16,473)
Dividend Required Risk-to-Capital		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
102% of the Dividend Required Risk Capital Requirement		3,893	7,706	13,539	23,469	48,957	82,021	114,295	140,206	160,879	172,639	187,089	185,051	178,990	170,270	164,256	125,742	87,221	57,029	31,903	17,224	3,356	578
102% of the Contingency Reserve Capital Requirement		0	0	0	0	6,856	18,646	36,782	58,735	79,495	94,873	107,343	115,476	124,925	132,290	136,265	122,393	108,660	94,761	76,435	62,675	51,224	35,297
Cash Capital Support / (Dividend)		0	0	0	460	0	17,000	11,510	0	15,500	0	0	(19,441)	(5,347)	(22,799)	(22,853)	(33,404)	(8,810)	(7,243)	(12,855)	(10,312)	(9,793)	(15,781)
Surplus After Capital Contribution / Dividen	0	0	0	0	460	1,497	25,883	50,798	66,346	63,021	63,078	66,153	55,040	56,514	40,574	30,664	5,748	2,131	1,858	1,499	1,229	1,005	692
Cumulative 22 Year Capital Contributions		(124,169)																					

Note: Actual numbers used for certain items to reflect trust account transactions

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CFPB-PHH-00112642

Exhibit 4

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company – Ceding Company)
Pro Forma Statutory Income Statement
Multiple Book
(Dollars in 000's)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Total
Gross Written Premiums (Gross of Ceding Com.)	0	0	0	0	8,818	22,174	34,138	41,324	39,078	28,946	23,477	23,466	19,744	14,968	11,082	7,944	5,643	3,926	2,544	1,521	673	130	289,597
Ceded Written Premium (Gross of Ceding Com.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Written Premium (Gross of Ceding Com.)	0	0	0	0	8,818	22,174	34,138	41,324	39,078	28,946	23,477	23,466	19,744	14,968	11,082	7,944	5,643	3,926	2,544	1,521	673	130	289,597
Earned Premiums (Gross of Ceding Com.)	0	0	0	0	8,279	21,250	32,715	39,603	37,450	27,739	22,499	30,951	19,967	15,143	11,229	8,058	5,722	3,989	2,595	1,556	708	143	289,597
Incurred Losses [1]	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	20,335	18,249	14,430	11,461	7,810	4,730	2,290	567	81,233
Ceding Commission	0	0	0	0	1,331	4,328	6,953	7,856	7,017	4,910	3,822	2,786	2,320	1,750	1,282	896	626	436	282	169	75	14	46,853
Premium Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1,400
Total Underwriting Expenses	0	0	0	0	1,331	4,328	6,953	7,856	7,117	5,010	3,922	2,886	2,420	1,850	1,382	996	726	536	382	269	175	114	48,253
Underwriting Income	0	0	0	0	6,948	16,922	25,762	31,747	30,333	22,729	18,577	28,065	17,547	11,932	(10,487)	(11,187)	(9,435)	(8,008)	(5,597)	(3,443)	(1,757)	(538)	160,111
Investment Income	0	0	0	0	282	1,090	4,001	3,602	2,366	1,698	2,717	7,721	7,519	7,886	7,414	6,696	5,061	4,383	3,830	3,109	2,574	2,129	74,077
Other Income (Expenses)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pre-Tax Net Income	0	0	0	0	7,229	18,012	29,763	35,349	32,699	24,427	21,294	35,786	25,066	19,818	(3,073)	(4,490)	(4,374)	(3,624)	(1,768)	(334)	816	1,591	234,189
Pre-Tax NI After Net Contingency Reserve Contribution	0	0	0	0	1,037	7,386	13,405	15,548	13,975	10,558	10,046	20,329	15,579	13,784	11,856	6,909	5,193	6,970	12,497	10,042	9,569	15,468	200,150
Calculated Federal Income Tax [2]	0	0	0	0	0	0	0	0	32,800	10,500	6,972	12,001	8,757	6,924	(1,086)	(1,580)	(1,536)	(1,273)	(622)	(119)	283	556	72,578
Cumulative Tax Credit Carry-back Available	0	0	0	0	0	0	0	0	0	32,800	43,300	17,472	18,973	20,759	15,682	6,924	0	0	0	0	0	0	
Cumulative Tax Credit Carry-forward Available	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,536	2,809	3,432	3,551	3,268	
Calendar Year Tax Credit Utilized	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,086	1,580	0	0	0	0	283	556	
Federal Tax Incurred	0	0	0	0	0	0	0	0	32,800	10,500	6,972	12,001	8,757	6,924	(1,086)	(1,580)	0	0	0	0	0	0	75,289
Net Income	0	0	0	0	7,229	18,012	29,763	35,349	(101)	13,927	14,322	23,785	16,309	12,894	(1,987)	(2,911)	(4,374)	(3,624)	(1,768)	(334)	816	1,591	158,899
Cumulative Net Income [3]	0	0	0	0	7,229	25,241	55,004	90,353	90,253	104,180	118,502	142,287	158,596	171,490	169,503	166,592	162,218	158,594	156,826	156,492	157,309	158,899	
Increase in Contingency Reserve	0	0	0	0	6,193	10,625	16,358	19,801	18,725	13,870	11,248	15,458	9,487	6,034	(14,929)	(11,399)	(9,567)	(10,594)	(14,264)	(10,376)	(8,753)	(13,878)	
Increase In Surplus (Excluding Capital Contribution)	0	0	0	0	1,037	7,386	13,405	15,548	(18,825)	58	3,074	8,327	6,822	6,860	12,942	8,488	5,193	6,970	12,497	10,042	9,569	15,468	124,861

[1] Based on the assumed ultimate loss rates displayed on the assumptions sheet
[2] Without recognizing the tax deductibility of contingency reserve contributions. Recognizing the taxation of 20% of the increase in the unearned premium reserve
[3] This does not reflect a deduction for contributions to the contingency reserve.
Note: Actual numbers used for certain items to reflect trust account transactions

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CFPB-PHH-00112643

Exhibit 5

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)
Pro Forma Projections (Statutory)
Cash Flows, Changes In Assets and Investment Income
Multiple Book
(Dollars in 000's)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22
A	Beginning Assets	0	0	0	0	460	8,228	44,163	86,859	123,930	140,958	156,091	171,391	168,251	178,990	170,270	164,257	125,742	108,660	94,761	76,435	62,675	51,224
B	Net Written Premium	0	0	0	0	8,818	22,174	34,138	41,324	39,078	28,946	23,477	23,466	19,744	14,968	11,082	7,944	5,643	3,926	2,544	1,521	673	130
C	Paid Losses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,361	20,335	18,249	14,430	11,461	7,810	4,730	2,290
D	Underwriting Expenses	0	0	0	0	1,331	4,328	6,953	7,856	7,117	5,010	3,922	2,886	2,420	1,850	1,382	996	726	536	382	269	175	114
E	Net Underwriting Cash Flow (B - C - D)	0	0	0	0	7,486	17,846	27,185	33,469	31,961	23,935	19,556	20,581	17,324	13,118	8,339	(13,387)	(13,332)	(11,040)	(9,299)	(6,558)	(4,231)	(2,274)
Non-Investable Assets																							
F	Initial Tax and Loss Bond Asset (Beg. Contingency Rsv x Tax Rate)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	Tax and Loss Bonds Purchased in Year (Annual Contrib. to Cont. Rsv x Tax Rate)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H	Other Income (Expenses)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
I	Weighted Average Investable Assets = A + 0.5 x (E + H) - F - (0.5 x G)	0	0	0	0	4,203	17,151	57,756	103,593	139,911	152,925	165,869	181,682	176,913	185,549	174,440	157,563	119,076	103,140	90,111	73,156	60,559	50,087
J	Assumed Yield	5.75%	7.78%	5.65%	6.58%	5.54%	4.72%	6.66%	5.16%	5.04%	4.05%	4.15%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
K	Investment Income (I x J)	0	0	0	0	282	1,090	4,001	3,602	2,366	1,698	2,717	7,721	7,519	7,886	7,414	6,696	5,061	4,383	3,830	3,109	2,574	2,129
L	Federal Income Tax Incurred	0	0	0	0	0	0	0	0	32,800	10,500	6,972	12,001	8,757	6,924	(1,086)	(1,580)	0	0	0	0	0	0
M	Cash Capital Contribution	0	0	0	460	0	17,000	11,510	0	15,500	0	0	(19,441)	(5,347)	(22,799)	(22,853)	(33,404)	(8,810)	(7,243)	(12,855)	(10,312)	(9,793)	(15,781)
N	Ending Assets (A + E + H − K - L + M)	0	0	0	460	8,228	44,163	86,859	123,930	140,958	156,091	171,391	168,251	178,990	170,270	164,257	125,742	108,660	94,761	76,435	62,675	51,224	35,297

Note: Actual numbers used for certain items to reflect trust account transactions

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Exhibit 6

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company – Ceding Company)

Assumed Reinsurance Structure

			Net Premium
Premium	Gross Premium	45.0%	
	Ceding Commission 1st Year	11.1%	40.0%
	Renewal	11.1%	40.0%
Losses			
	Start (% of Original Risk)	4.0%	
	End (% of Original Risk)	14.0%	
	Percentage of Layer Assumed	100.0%	

Assumptions

Claim Severity incl. loss adjustment (% of coverage)	100%
Approximate Average Rate	0.749%
Approximate Average Coverage	29.28%
PSA	375%
Loan Volume ($000's)	1,574,951
Average Loan ($000's)	155
Loan Counts	10,132
Ultimate Loss Rate	6.67%
Other Expenses 1st Year	100,000
Other Expenses Subsequent Years	100,000
Initial Capital Contribution	4,611,867
Capital Contribution - Year 1	0
Capital Contribution - Year 2	0
Investment Yield	4.25%
Statutory Capital Contribution (Also Minimum Statutory Surplus)	0
Dividend Year	0
Tax Rate	35%
Premium Tax Rate	0.000%
Statutory/Partner Risk To Capital Ratio - Cash	10 to 1
Statutory/Partner Risk To Capital Ratio - Cash for Dividend	5 to 1
Term of Contract	10 (Years of run-off for each Reinsured Loan)

Business Mix

		Percentage of Business	Coverage	Premium
Fixed Rate	97 LTV	38.9%	35.0%	0.960%
	95 LTV	22.8%	30.0%	0.780%
	90 LTV	27.3%	25.0%	0.520%
	85 LTV	6.3%	12.0%	0.320%
Total or Wtd Avg		95.3%	28.0%	0.714%

		Percentage of Business	Coverage	Premium
Adj. Rate	97 LTV	0.0%	0.0%	0.000%
	95 LTV	2.2%	30.0%	0.920%
	90 LTV	2.2%	25.0%	0.650%
	85 LTV	0.3%	12.0%	0.370%
Total or Wtd Avg		4.7%	1.2%	0.035%

	Percentage of Business	Coverage	Premium
Total Fixed & Adj. Rate	100.0%	29.28%	0.749%

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CFPB-PHH-00112645

Exhibit 7

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)
Pro Forma Statutory Balance Sheet
Single Book
(Dollars in 000's)

	Year-End 0	Year-End 1	Year-End 2	Year-End 3	Year-End 4	Year-End 5	Year-End 6	Year-End 7	Year-End 8	Year-End 9	Year-End 10	Year-End 11
Assets												
Investable Assets	4,612	6,245	9,061	9,549	9,515	9,488	11,727	10,721	8,607	7,211	5,942	594
Tax and Loss Bonds	0	0	0	0	0	0	0	0	0	0	0	0
Total Assets	4,612	6,245	9,061	9,549	9,515	9,488	11,727	10,721	8,607	7,211	5,942	594
Liabilities												
Unearned Premium Reserve	0	206	178	138	105	79	59	44	32	24	18	0
Loss Reserve	0	0	0	0	0	0	3,073	3,228	2,227	1,888	1,443	455
Contingency Reserve	0	1,180	3,497	5,410	6,881	7,993	6,339	4,169	2,728	1,422	410	128
Total Liabilities	0	1,386	3,675	5,547	6,986	8,072	9,470	7,440	4,988	3,335	1,871	582
Surplus (Before Capital Contribution)	4,612	4,859	5,386	5,920	4,468	2,930	2,257	3,280	3,620	3,877	4,071	4,204
Capital (Surplus + Cont. Rsv.)		6,038	8,884	11,330	11,349	10,923	8,595	7,449	6,348	5,299	4,481	4,331
Reinsured Risk		46,119	46,119	46,119	46,119	46,119	46,119	43,046	39,818	37,591	35,703	0
Risk-to-Capital Ratio		7.6	5.2	4.1	4.1	4.2	5.4	5.8	6.3	7.1	8.0	0.0
Capital Constraints												
Required Risk-to-Capital Ratio		10	10	10	10	10	10	10	10	10	10	10
Required Risk Capital		4,612	4,612	4,612	4,612	4,612	4,612	4,305	3,982	3,759	3,570	0
Statutory Capital Requirement (including Contingency Reserve)		1,180	3,497	5,410	6,881	7,993	6,339	4,169	2,728	1,422	410	128
Capital "Deficiency (Excess)"		(1,426)	(4,272)	(5,920)	(4,468)	(2,930)	(2,257)	(3,144)	(2,366)	(1,540)	(911)	(4,204)
Dividend Required Risk-to-Capital		5	5	5	5	5	5	5	5	5	5	5
102% of the Dividend Required Risk Capital Requirement		9,619	9,589	9,549	9,515	9,488	12,602	12,119	10,428	9,619	8,773	464
102% of the Contingency Reserve Capital Requirement		1,414	3,748	5,658	7,125	8,233	9,659	7,589	5,087	3,401	1,909	594
Cash Capital Support / (Dividend)		0	0	(1,919)	(1,939)	(1,513)	0	0	0	0	0	(4,192)
Surplus After Capital Contribution / Dividend	4,612	4,859	5,386	4,001	2,529	1,417	2,257	3,280	3,620	3,877	4,071	12
Cumulative 11 Year Capital Contributions		(4,951)										
	0	1	2	3	4	5	6	7	8	9	10	11
IRR Equity Flows	(4,612)	0	0	1,919	1,939	1,513	0	0	0	0	0	4,331
IRR	12%											
Average Capital		5,325	7,461	9,147	9,411	9,410	9,003	8,022	6,898	5,823	4,890	2,310
Cumulative Average Capital		5,325	12,786	21,933	31,344	40,754	49,757	57,779	64,677	70,500	75,390	77,700
Net Income Before Contingency Reserve Contribution		1,426	2,845	2,446	1,938	1,512	(814)	(1,146)	(1,101)	(1,049)	(818)	(150)
Cumulative Net Income (before cont. reserve contrib.)		1,426	4,272	6,718	8,656	10,169	9,354	8,208	7,107	6,058	5,240	5,090
Cumulative Return on Capital		27%	33%	31%	28%	25%	19%	14%	11%	9%	7%	7%

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Exhibit 8

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)
Pro Forma Statutory Income Statement
Single Book
(Dollars in 000's)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Total
Gross Written Premiums (Gross of Ceding Com.)	2,566	4,607	3,785	2,909	2,198	1,648	1,230	914	677	501	185	21,220
Ceded Written Premium (Gross of Ceding Com.)	0	0	0	0	0	0	0	0	0	0	0	
Net Written Premium (Gross of Ceding Com.)	2,566	4,607	3,785	2,909	2,198	1,648	1,230	914	677	501	185	21,220
Earned Premiums (Gross of Ceding Com.)	2,359	4,635	3,825	2,943	2,224	1,668	1,245	925	685	507	202	21,220
Incurred Losses [1]	0	0	0	0	0	3,073	3,228	2,227	1,888	1,443	455	12,314
Ceding Commission	285	511	420	323	244	183	137	101	75	56	20	2,355
Premium Tax	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	100	100	100	100	100	100	100	100	100	100	100	1,100
Total Underwriting Expenses	385	611	520	423	344	283	237	201	175	156	120	3,455
Underwriting Income	1,974	4,024	3,304	2,520	1,880	(1,687)	(2,220)	(1,503)	(1,378)	(1,092)	(373)	5,450
Investment Income	242	350	454	459	444	432	454	402	329	274	223	4,064
Other Income (Expenses)	0	0	0	0	0	0	0	0	0	0	0	0
Pre-Tax Net Income	2,217	4,374	3,759	2,979	2,324	(1,255)	(1,765)	(1,101)	(1,049)	(818)	(150)	9,515
Pre-Tax NI After Contingency Reserve Contribution	1,037	2,057	1,847	1,507	1,212	400	404	340	257	194	133	9,387
Calculated Federal Income Tax [2]	790	1,529	1,313	1,040	812	(441)	(619)	(386)	(368)	(287)	(54)	3,330
Cumulative Tax Credit Carry-back Available	0	790	2,319	2,842	2,353	1,852	812	0	0	0	0	
Cumulative Tax Credit Carry-forward Available	0	0	0	0	0	0	0	0	386	754	1,041	
Calendar Year Tax Credit Utilized	0	0	0	0	0	441	619	0	0	0	0	
Federal Tax Incurred	790	1,529	1,313	1,040	812	(441)	(619)	0	0	0	0	4,424
Net Income	1,426	2,845	2,446	1,938	1,512	(814)	(1,146)	(1,101)	(1,049)	(818)	(150)	5,090
Cumulative Net Income [3]	1,426	4,272	6,718	8,656	10,169	9,354	8,208	7,107	6,058	5,240	5,090	
Increase in Contingency Reserve	1,180	2,318	1,912	1,471	1,112	(1,655)	(2,170)	(1,441)	(1,306)	(1,012)	(283)	
Increase In Surplus (Excluding Capital Contribution)	247	528	534	467	400	840	1,023	340	257	194	133	4,963

[1] Based on the assumed ultimate loss rates displayed on the assumptions sheet.
[2] Without recognizing the tax deductibility of contingency reserve contributions. Recognizing the taxation of 20% of the increase in the unearned premium reserve.
[3] This does not reflect a deduction for contributions to the contingency reserve.

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Exhibit 9

ATRIUM INSURANCE CORPORATION
(United Guaranty Residential Insurance Company -- Ceding Company)
Pro Forma Projections (Statutory)
Cash Flows, Changes In Assets and Investment Income
Single Book
(Dollars in 000's)

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11
A	Beginning Assets	4,612	6,245	9,061	9,549	9,515	9,488	11,727	10,721	8,607	7,211	5,942
B	Net Written Premium	2,566	4,607	3,785	2,909	2,198	1,648	1,230	914	677	501	185
C	Paid Losses	0	0	0	0	0	0	3,073	3,228	2,227	1,888	1,443
D	Underwriting Expenses	385	611	520	423	344	283	237	201	175	156	120
E	Net Underwriting Cash Flow (B - C - D)	2,181	3,995	3,265	2,487	1,854	1,365	(2,079)	(2,515)	(1,725)	(1,543)	(1,379)
Non-Investable Assets												
F	Initial Tax and Loss Bond Asset (Beg. Contingency Rsv x Tax Rate)	0	0	0	0	0	0	0	0	0	0	0
G	Tax and Loss Bonds Purchased in Year (Annual Contrib. to Cont. Rsv x Tax Rate)	0	0	0	0	0	0	0	0	0	0	0
H	Other Income (Expenses)	0	0	0	0	0	0	0	0	0	0	0
I	Weighted Average Investable Assets = A + 0.5 x (E + H) - F - (0.5 x G)	5,702	8,242	10,694	10,792	10,442	10,171	10,687	9,463	7,745	6,440	5,252
J	Assumed Yield	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%
K	Investment Income (I x J)	242	350	454	459	444	432	454	402	329	274	223
L	Federal Income Tax Incurred	790	1,529	1,313	1,040	812	(441)	(619)	0	0	0	0
M	Cash Capital Contribution	0	0	(1,919)	(1,939)	(1,513)	0	0	0	0	0	(4,192)
N	Ending Assets (A + E + H + K - L - M)	6,245	9,061	9,549	9,515	9,488	11,727	10,721	8,607	7,211	5,942	594

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Exhibit 10

Active Mortgage Insurance Industry Net Income as Percent of Average Capital

	Net Income % Average Capital	Source
1977	26.4%	UGRIC filing
1978	21.6%	UGRIC filing
1979	29.0%	UGRIC filing
1980	27.4%	UGRIC filing
1981	25.5%	UGRIC filing
1982	13.1%	UGRIC filing
1983	13.7%	UGRIC filing
1984	2.6%	S&P
1985	0.7%	S&P
1986	9.2%	S&P
1987	3.0%	S&P
1988	1.9%	Moody's
1989	13.8%	Moody's
1990	16.4%	Moody's
1991	17.5%	Moody's
1992	22.5%	Moody's
1993	16.9%	Moody's
1994	17.6%	Moody's
1995	21.3%	Moody's
1996	21.1%	Moody's
1997	22.2%	Moody's
1998	17.1%	Milliman [1]
1999	14.7%	Milliman [1]
2000	17.5%	Milliman [1]
2001	15.4%	Milliman [1]
2002	10.2%	Milliman [1]
2003	8.4%	Milliman [1]
2004	8.4%	Milliman [1]
2005	7.9%	Milliman [1]
29 year average:	15.3%	

[1] Based on annual statements filed by the carriers within the industry.

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Exhibit 11

ATRIUM INSURANCE CORPORATION

(United Guaranty Residential Insurance Company -- Ceding Company)
Expected Loss Ratio Comparison
45% Gross Premium with 11.1% Ceding Commission - 40% Net Premium

	Gross	Ceded [1]	Net
Premium - Nominal	$47,155	$21,220	$25,935
Premium - Present Value [2]	$40,977	$18,439	$22,537
Expected Losses - Nominal	28,434	12,314	16,120
Expected Losses - Present Value [2]	22,470	9,251	13,219
Expected Loss Ratio - Nominal	60%	58%	62%
Expected Loss Ratio - Present Value [2]	55%	50%	59%

[1] Ceded premium is gross of ceding commission
[2] Based on a 4.25% assumed yield

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U. S. Department of Housing and Urban Development
Washington, D. C. 20410-8000

August 6, 1997

Attachment A

OFFICE OF THE ASSISTANT SECRETARY
FOR HOUSING-FEDERAL HOUSING COMMISSIONER

Mr. Sandor Samuels
General Counsel
Countrywide Funding Corporation
155 N. Lake Avenue
Pasadena, California 91109

Dear Mr. Samuels:

Last year the Department of Housing and Urban Development (the Department) sought from you information on the captive reinsurance program of Amerin Guaranty Corporation (Amerin) with Countrywide Home Loans (Countrywide) and its affiliated reinsurer, Charter Reinsurance (Charter). You then requested that the Department clarify the applicability of Section 8 of the Real Estate Settlement Procedures Act (RESPA) to captive reinsurance programs. For the reasons set forth below, we have concluded that, so long as payments for reinsurance under captive reinsurance arrangements are solely "payment for goods or facilities actually furnished or for services actually performed," these arrangements are permissible under RESPA. See paragraph 8(c)(2) of RESPA, 12 U.S.C. § 2607(c)(2). The following details the facts concerning captive reinsurance programs as we understand them, relevant law, and how the Department will scrutinize these arrangements to determine whether any specific captive reinsurance program is permissible under RESPA.

I. BACKGROUND

A typical captive reinsurance arrangement involves a mortgage lender acting in concert with a fully licensed reinsurance affiliate of the mortgage lender and an unaffiliated primary mortgage insurer. The sole purpose of the reinsurance affiliate is to reinsure loans which the affiliated mortgage lender originates and which the unaffiliated, primary mortgage insurance company insures. The primary mortgage insurer and the reinsurer enter into a contract under which the primary insurer agrees to pay the reinsurer an agreed upon portion of the mortgage insurance premiums for loans originated by the lender and insured by the primary insurer. The lender, therefore, has a financial interest in having the primary insurer in the captive reinsurance program selected to provide the mortgage insurance.

Premiums paid for the reinsurance may be net of an agreed upon "ceding commission," which represents the reinsurer's share of the costs of administering the book of insured business.

Under the contract between the primary insurer and the reinsurer, the reinsurer posts capital and reserves satisfying the laws of the state in which it is chartered and may also establish an additional security fund to ensure that, when a claim against the reinsurer is made, funds will exist to satisfy the claim. In exchange for a portion of mortgage insurance premiums (minus a ceding commission, if applicable) to be paid by the primary insurer, the reinsurer obligates itself to reimburse the primary insurer for an agreed portion of claims that may require payment under the contract. Under different reinsurance arrangements, the reinsurance obligations generally take one of two forms. The first is an "excess loss" arrangement, under which the primary insurer pays, and is solely responsible for, claims arising out of a given book of business up to a predetermined amount, after which the reinsurer is obligated to reimburse the primary insurer's claims up to another predetermined amount. Thereafter, the primary insurer is solely responsible for claims in excess of the reinsurer's tier of losses on a given book. A second type of contract is the "quota share" contract, under which the reinsurer would bear a portion of all insured losses.

Under captive arrangements of which the Department is aware, some degree of disclosure is provided to the consumer about the arrangement and some opportunity is accorded to the consumer to choose whether or not to have the loan insured through a captive reinsurance program.

II. LEGAL ANALYSIS

Subsection 8(a) of RESPA provides that "[n]o person shall give and no person shall accept any fee, kickback, or thing of value pursuant to any agreement or understanding, oral or otherwise, that business incident to or a part of a real estate settlement service involving a federally related mortgage loan shall be referred to any person." 12 U.S.C. § 2607(a). "Thing of value" is further described in the Department's regulations as including "without limitation, monies, things, discounts, salaries, commissions, fees, duplicate payments of a charge, stock, dividends, distributions of partnership profits, franchise royalties, credits representing monies that may be paid at a

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future date, the opportunity to participate in a money-making program...." 24 C.F.R. § 3500.14(d). In addition, subsection 8(b) prohibits the giving or receipt of any portion, split or percentage of any charge made or received for the rendering of a real estate settlement service "other than for services actually performed." 12 U.S.C. § 2607(b). These prohibitions against paying for referrals and against splitting fees are very broad and cover a variety of activities.

Subsection 8(c) of RESPA sets forth various exemptions from these prohibitions. It provides, in relevant part, that nothing in section 8 shall be construed as prohibiting "(2) the payment to any person of a bona fide salary or compensation or other payment for goods or facilities actually furnished or for services actually performed." 12 U.S.C. § 2607(c)(2).

The Department's view of captive reinsurance is that the arrangements are permissible under RESPA if the payments to the reinsurer: (1) are for reinsurance services "actually furnished or for services performed" and (2) are bona fide compensation that does not exceed the value of such services.

The rationale behind this two-step analysis is that in instances in which a lender selects the mortgage insurer, including under a captive reinsurance arrangement, the lender's actions would constitute a referral of loans to a mortgage insurer, by influencing the borrower's selection of his or her mortgage insurer. See 24 C.F.R. § 3500.14(f) (definition of "referral"). If the lender or its reinsurance affiliate is merely given a thing of value by the primary insurer in return for this referral, in monies or the opportunity to participate in a money-making program, then section 8 would be violated; the payment would be regarded as payment for the referral of business or a split of fees for settlement services. If, however, the lender's reinsurance affiliate actually performs reinsurance services and compensation from the primary insurer is bona fide and does not exceed the value of the reinsurance, then such payments would be permissible under subsection 8(c). Conversely, any captive reinsurance arrangement in which reinsurance services are not actually performed or in which the payments to the reinsurer are not bona fide and exceed the value of the reinsurance would violate section 8 as an impermissible referral fee.

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A. Analysis of Specific Captive Reinsurance Arrangements

The Department will analyze captive reinsurance arrangements to determine if the arrangements comply with RESPA. Factors which may cause the Department to give particular scrutiny to an arrangement and cause it to apply the test set forth in Part II(B) of this analysis include, but are not limited to, the following:

1. The amount charged directly or indirectly to the consumer for mortgage insurance in a captive program is greater than the amount charged to the consumer for mortgage insurance not involving reinsurance for a similar risk.

2. The costs (premiums minus a ceding commission, if applicable) paid to the captive reinsurer are greater than the cost for comparable non-captive reinsurance available in the market.

3. The lender restricts its mortgage insurance business in whole or to a large extent to a primary mortgage insurer that has a reinsurance agreement with the lender's captive reinsurer.

4. Any major secondary market institution refuses to purchase mortgages insured under a particular captive reinsurance agreement or places special conditions on such purchases.

5. Any credit rating agency reduces the rating of the primary mortgage insurer in whole or in part because of agreements with captive reinsurers.

6. Any State regulatory body questions the adequacy of the reserves maintained by the primary mortgage insurer or the captive reinsurer.

7. The primary insurer's agreement to reinsure is conditioned on the affiliated lender's agreement to refer all of or a predetermined volume of its mortgage insurance business to the primary insurer, or the terms of the agreement (such as the percentage of the premium per loan reinsured that is paid to the reinsurer by the primary insurer) fluctuate depending on the volume of the primary insurance business referred by the lender to the primary insurer. The presence of either of these conditions makes it more likely that at least a portion of the compensation paid to the reinsurer is for the referral of mortgage insurance business.

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8. Adequate consumer disclosure is not provided. The Department believes that consumers would be well served by a meaningful disclosure[1] and a meaningful choice[2] for consumers about having their loans included in a captive reinsurance program. A demonstrated willingness to provide such a disclosure may indicate that the arrangement is designed to provide real reinsurance.

The Department does not consider any of these eight factors to be determinative of whether an arrangement merits scrutiny by the Department, nor does it regard the absence of any of these factors to be determinative that further scrutiny is not merited. In addition, as noted in Part II(B), the Department may consider these eight factors in applying the test in Part II(B), to the extent applicable.

B. Test for Whether a Captive Reinsurance Arrangement Violates RESPA

Where the Department scrutinizes a captive reinsurance arrangement, it will apply a two-part test for determining whether the arrangement violates RESPA. The Department will first determine whether the reinsurance arrangement meets three requirements that establish that reinsurance is actually being provided in return for the compensation. If one or more of the requirements is not met, the inquiry will end, and the arrangement will be regarded as an impermissible captive reinsurance arrangement under RESPA. If all of the requirements are met, the Department will determine whether the compensation exceeds the value of the reinsurance. To facilitate its analysis, the Department may use information obtained from the lender, the primary insurer, the captive reinsurer, or other sources, including data on the rate, magnitude, and timing of default losses and mortgage insurance payments and any other

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[1] A meaningful disclosure would reveal that the captive reinsurance arrangement exists, that the lender stands to gain financially under the arrangement, and that the consumer may choose not to have his or her insurance provided by an insurer in such an arrangement.

[2] A meaningful choice whether to participate would provide the consumer an easy, non-burdensome opportunity to opt out by, for example, indicating a preference one way or the other on a form.

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information necessary to undertake the analysis and may exercise its subpoena authority pursuant to 24 C.F.R. part 3800 to obtain such information.

1. Determining that Reinsurance is Actually Being Provided in Return for the Compensation

To determine that a real service--reinsurance--is performed by the reinsurer for which it may legally be compensated, the following requirements must be satisfied:

a. There must be a legally binding contract for reinsurance with terms and conditions conforming to industry standards.

b. The reinsurer must post capital and reserves satisfying the laws of the state in which it is chartered and the reinsurance contract between the primary insurer and the reinsurer must provide for the establishment of adequate reserves to ensure that, when a claim against the reinsurer is made, funds will exist to satisfy the claim. Unless the reinsurer is adequately capitalized and adequate reserves (which may include letters of credit or guarantee arrangements) and funds are available to pay claims, real services are not being provided.

c. There must be a real transfer of risk. The reinsurance transaction cannot be a sham under which premium payments (minus a ceding commission, if applicable) are given to the reinsurer even though there is no reasonable expectation that the reinsurer will ever have to pay claims. This requirement for a real transfer of risk would clearly be satisfied by a quota share arrangement, under which the reinsurer is bound to participate pro rata in every claim. The requirement could also be met by excess loss arrangements, if the band of the reinsurer's potential exposure is such that a reasonable business justification would motivate a decision to reinsure that band. Unless there is a real transfer of risk, no real reinsurance services are actually being provided. In either case, the premiums paid (minus a ceding commission, if applicable) must be commensurate to the risk, as discussed in Part II(B)(2).

In evaluating these requirements, the Department may also consider the factors in Part II(A), to the extent relevant. If any of the requirements in this Part II(B)(1) is not met, the arrangement will be regarded as an impermissible reinsurance arrangement under RESPA. If any of the requirements is not met, the "service" being compensated would appear to be the lender's referral of business to the mortgage insurer, which RESPA prohibits.

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2. Determining that the Compensation Paid for Reinsurance Does Not Exceed the Value of the Reinsurance

If the requirements in Part II(B)(1) for determining that reinsurance is actually being provided in return for the compensation are met, the Department will then determine whether the compensation paid for reinsurance does not exceed the value of the reinsurance. The Department will evaluate whether the compensation is commensurate with the risk and, where warranted, administrative costs. The Department's evaluation of this requirement may:

-- Compare, using relevant mathematical models, the risk borne by the captive reinsurer with the payments provided by the primary insurer.

-- Analyze the likelihood of losses occurring, the magnitude and volatility of possible losses, the amount of payments received, the timing of the payments and potential losses, current market discount rates, and other relevant factors.

-- Take into account the relative risk exposure of the primary lender and the captive reinsurer.

-- Consider the extent to which the lender or the firm controlling the captive reinsurer is shielded from potential losses by inadequate reserves and a corporate structure that segregates risks.

-- Examine other financial transactions between the lender, primary insurer, and captive reinsurer to determine whether they are related to the reinsurance agreement.

-- Examine whether the ceding commission is commensurate with the administrative costs assumed by the primary insurer.

In making this evaluation, the Department may also consider the factors in Part II(A), to the extent relevant. If the Department concludes that the compensation paid for the reinsurance exceeds the value of the reinsurance pursuant to the analysis in this Part II(B)(2), the arrangement will be regarded as an impermissible reinsurance arrangement under RESPA and the payments exceeding the value of the reinsurance will be considered a referral fee or unearned fee.

III. CONCLUSION

In setting forth this analysis, the Department notes the trend in the mortgage market toward increased diversification of risk. The Department welcomes such trends to the extent that

such arrangements increase the availability of mortgage credit. Where RESPA would not preclude such arrangements, the Department would generally support them.

The Department believes the system of mortgage insurance and reinsurance is not necessarily comparable to other types of settlement services. Thus, the Department could analyze other settlement service programs differently, depending on the facts of the particular program.

I trust that this guidance will assist you to conduct your business in accordance with RESPA.

Sincerely,

Nicolas P. Retsinas
Assistant Secretary for
Housing-Federal Housing
Commissioner

cc: Mr. Randolph C. Sailer II
Senior Vice President and General Counsel
Amerin Guaranty Corporation
200 East Randolph Drive, 49th Floor
Chicago, IL 60601-7125

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EXHIBIT 20

AMERICAN ACADEMY *of* ACTUARIES

REINSURANCE ATTESTATION SUPPLEMENT 20-1:

RISK TRANSFER TESTING PRACTICE NOTE

American Academy of Actuaries Committee on Property and Liability Financial Reporting

November 2005

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

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Reinsurance Attestation Supplement 20-1: Risk Transfer Testing Practice Note

Background and Purpose of Document

The Property and Casualty Annual Statement Instructions for 2005 issued by the National Association of Insurance Commissioners (NAIC) contain a new supplement, Supplement 20-1, titled the "Reinsurance Attestation Supplement: Attestation of Chief Executive Officer and Chief Financial Officer Regarding Reinsurance Agreements" (Reinsurance Attestation Supplement). The 2005 Annual Statement Instructions do not change the scope of the Statement of Actuarial Opinion to include an evaluation of risk transfer. Further, the Reinsurance Attestation Supplement places requirements on the company's chief executive officer (CEO) and chief financial officer (CFO) and not on the Appointed Actuary. However, it is very possible that the CEO or CFO will seek actuarial support related to the risk transfer analysis and documentation requirements outlined in the Reinsurance Attestation Supplement.

This communication by the American Academy of Actuaries Committee on Property and Liability Financial Reporting (COPLFR) is intended to provide advisory, non-binding guidance to property/casualty actuaries regarding testing for risk transfer. It has been written by actuaries, for actuaries, and is not intended to be professional accounting guidance. Further, the guidance is not intended for use in life and health insurance.

This communication is not an Actuarial Standard of Practice. It has not been adopted by the Actuarial Standards Board (ASB) and is not binding on any actuary. It should not be deemed to describe or codify generally accepted actuarial practice. From the perspective of the actuarial profession, meeting the requirements of the Reinsurance Attestation Supplement is an evolving area and a generally accepted practice which may apply does not yet exist.

Reinsurance Attestation Supplement

The Reinsurance Attestation Supplement will be part of the Annual Statement for property/casualty insurance companies and will be public information. This new supplement is required to be filed by March 1 each year. The requirements of the Reinsurance Attestation Supplement apply to a company's ceded reinsurance program, and not to any assumed reinsurance.

A complete copy of the Reinsurance Attestation Supplement is included as an attachment to this document. In summary, the supplement requires the CEO and CFO of the company to attest, with respect to active ceded reinsurance contracts, to the following four items:

- There are no separate written or oral agreements between the reporting entity and the assuming reinsurer that would reduce, limit, mitigate, or otherwise affect any actual or potential loss to the parties under the reinsurance contract;

- For each such reinsurance contract entered into, renewed, or amended on or after January 1, 1994, for which risk transfer is not reasonably considered to be self-evident, documentation concerning the economic intent of the transaction and the risk transfer analysis evidencing the proper accounting treatment is available for review;

- The reporting entity complies with the requirements set forth in SSAP 62; and

- The reporting entity has appropriate controls in place to monitor the use of reinsurance and adhere to the provisions of SSAP 62.

Actuarial Involvement in Reinsurance Attestation Supplement

The CEO and CFO are required to attest that a process is in place to fulfill the company's obligations under SSAP 62 and that the appropriate responsible parties have met their obligations regarding the accounting for reinsurance. We anticipate that the most likely areas of actuarial involvement in support of the Reinsurance Attestation Supplement will be in the selection, quantification, and documentation of ceded reinsurance contracts.

The wording of the Reinsurance Attestation Supplement provides for a "safe harbor" such that cash flow testing is unnecessary for contracts where risk transfer is considered to be reasonably self-evident. However, it does not define or describe the contracts or situations that might qualify for this safe harbor. "Selection" refers to the evaluation of ceded reinsurance contracts to determine those where risk transfer is not reasonably self-evident, so that such contracts will require a cash flow analysis to evaluate risk transfer.

"Quantification" refers to the development of a cash flow analysis to evaluate the economics of the transaction, including the premiums, losses and other cash flows between the ceding company and the reinsurer under the reinsurance agreement. Two essential items considered by the decision-maker in deciding whether a reinsurance agreement meets the risk transfer requirements of SSAP 62 are as follows:

- the "reasonable possibility of", where the estimate measures the likelihood or probability of a given loss amount.

- "a significant loss", where the estimate measures the potential magnitude of an economic loss to the reinsurer, for example using different scenarios or a model.

In this document, we may refer to the quantification of economic losses as "cash flow testing" or "measuring risk transfer." However, it is typically not the responsibility of the actuary to decide whether a reinsurance contract meets the standards of SSAP 62; for many companies this decision is made by accounting professionals after considering the actuarial evaluation of the economics of the transaction.

"Documentation" refers to written materials, including risk transfer analyses, which are maintained on each reinsurance contract where risk transfer is not considered to be reasonably self-evident, such that an auditor or regulatory examiner may follow the process used by the company to assess the proper reinsurance accounting treatment as required by SSAP 62.

Contents of Practice Note

The remainder of this document contains the following sections:

- Key excerpts from statutory and GAAP reinsurance accounting standards;
- Documentation files for ceded reinsurance transactions;
- Safe harbors for which risk transfer may be self-evident without the requirement of cash flow testing;
- A summary of issues to be considered when performing cash flow testing;
- Frequently asked questions and answers that may be helpful to the practicing actuary; and
- A copy of the Reinsurance Attestation Supplement (see attachment).

In several places within the Practice Note, we refer to a report issued by the American Academy of Actuaries (Academy) in August 2005 titled "*Risk Transfer in P&C Reinsurance: Report to the Casualty Actuarial Task Force of the National Association of Insurance Commissioners*" (the Academy risk transfer report).

The report can be downloaded from the Academy website at the following addresses:

Casualty Web Page: http://www.actuary.org/casual.asp
Full Report: http://www.actuary.org/pdf/casualty/risk_transfer.pdf
Report minus appendices: http://www.actuary.org/pdf/casualty/risk_transfer_abbrev.pdf

Committee on Property and Liability Financial Reporting (COPLFR) 2004-05

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COPLFR prepared this Practice Note with a great deal of assistance from Sheldon Rosenberg and Marvin Pestcoe.

Excerpts from Reinsurance Accounting Standards

SSAP 62

Guidance for the accounting underlying the completion of an insurer Annual Statement is provided in the Statement of Statutory Accounting Principles (SSAPs) issued by the NAIC and published in the NAIC's *Accounting Practices and Procedures Manual*. Guidance regarding the recording of reinsurance transactions is provided in *SSAP 62: Property and Casualty Reinsurance.* The actuary may find the following excerpts from SSAP 62 helpful when considering the issue of risk transfer.

Paragraphs 9 through 16 of SSAP 62 are subtitled "Reinsurance Contracts Must Include Transfer of Risk."

In paragraph 9 of SSAP 62 it is stated that "The essential ingredient of a reinsurance contract is the transfer of risk….Unless the agreement contains this essential element of risk transfer, no credit shall be recorded."

Paragraph 10 of SSAP 62 includes the statement that "Actual or imputed investment returns are not an element of insurance risk."

Paragraph 12 of SSAP 62 reads as follows:
"12. Indemnification of the ceding entity against loss or liability relating to insurance risk in reinsurance requires both of the following:

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

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

In paragraph 13 of SSAP 62 it is stated that "A reinsurer shall not have assumed significant insurance risk under the reinsured contracts if the probability of a significant variation in either the amount or timing of payments by the reinsurer is remote."

Paragraph 14 of SSAP 62 states that "The ceding entity's evaluation of whether it is reasonably possible for a reinsurer to realize a significant loss from the transaction shall be based on the present value of all cash flows between the ceding and assuming companies under reasonably possible outcomes, without regard to how the individual cash flows are described or characterized. An outcome is reasonably possible if its probability is more than remote. The same interest rate shall be used to compute the present value of cash flows for each reasonably possible outcome tested. A constant interest rate shall be used in determining those present values because the possibility of investment income varying from expectations is not an element of insurance risk. Judgment is required to identify a reasonable and appropriate interest rate."

Paragraph 15 of SSAP 62 contains a description of one instance where cash flow testing is not required to demonstrate risk transfer, previously referred to as a "safe harbor." Paragraph 15 contains the comment that "In this narrow circumstance, the reinsurer's economic position is virtually equivalent to having written the insurance contract directly."

FAS 113

Statement of Financial Accounting Standards, No. 113: Accounting and Reporting for Reinsurance of Short-Duration and Long-Duration Contracts… (FAS 113) was published in December 1992 and provides guidance regarding the accounting and reporting for reinsurance contracts under U.S. Generally Accepted Accounting Principles (GAAP). The actuary will likely also find this document helpful when considering the issue of risk transfer. There are many parallels between SSAP 62 and FAS 113. Of particular interest are paragraphs 9 and 11. Paragraph 9, similar to paragraph 12 of SSAP 62, reads as follows:

"9. 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 insurance contracts.

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

Paragraph 11 of FAS 113, similar to paragraph 15 of SSAP 62, reads as follows:

"11. Significance of loss shall be evaluated by comparing the present value of all cash flows, determined as described in paragraph 10, with the present value of the amounts paid or deemed to have been paid to the reinsurer. If, based on this comparison, the reinsurer is not exposed to the reasonable possibility of significant loss, the ceding enterprise shall be considered indemnified against loss or liability relating to insurance risk only if substantially all of the insurance risk relating to the reinsured portions of the underlying insurance contracts has been assumed by the reinsurer."

In describing the type of testing required to demonstrate significance of loss, paragraph 11 also describes a case where such testing is not required. When discussing this type of safe harbor, we will use the term "paragraph 11 exception," which is a commonly used term that refers back to FAS 113.

The above excerpts from FAS 113 and SSAP 62 are not intended to be a complete treatment of risk transfer as discussed in these documents. For example, in evaluating risk transfer the decision-maker normally considers such issues as the definitions of "significant," "reasonably possible" and "remote." Such issues involve interpretation of accounting guidance and are outside the scope of this Practice Note. The actuary may

wish to read the remaining portions of SSAP 62 and FAS 113, including the questions and answers to these statements. The actuary should also consider consulting with accounting and/or legal professionals as he or she deems appropriate to assist in understanding the issue of risk transfer in reinsurance contracts.

Documentation Files for Ceded Reinsurance Transactions

Among other requirements, the Reinsurance Attestation Supplement contains the attestation that there is documentation concerning the economic intent of the transaction and the risk transfer analysis for certain contracts. According to a recent survey of insurers described in the Academy's risk transfer report, the following items were considered to be of value for the contract file of the ceding entity:

a. Relevant correspondence between the ceding and assuming entities. This usually includes any related agreements, including but not limited to interlinked reinsurance contracts or trust agreements.

b. A copy of each draft of the reinsurance slip and contract.

c. A memorandum from management describing the business purpose and the economic intent for the reinsurance cession.

d. A statement regarding risk transfer, either that the risk transfer is considered to be reasonably self-evident or a copy of the analysis that displays the possible outcomes, their likelihood, and their economic impact.

e. Signoff from management that risk transfer has been demonstrated or is believed to be reasonably self-evident.

f. Copy of signoff from an external auditor or other party as to risk transfer, if available.

To the extent the actuary is asked to quantify the risk transfer described in d. above, it might be helpful to have available documentation supporting the analysis and calculations sufficient for another actuary practicing in the area to follow. The risk transfer documentation will be available to state regulators and auditors. In developing such documentation, the actuary might wish to refer to Actuarial Standard of Practice (ASOP) 9, *Documentation and Disclosure in Property and Casualty Insurance Ratemaking, Loss Reserving and Valuations*.

Safe Harbors – Where Risk Transfer Is Reasonably Self-Evident

The Reinsurance Attestation Supplement, and in particular its second paragraph, identifies several circumstances whereby contracts are excluded from all or a portion of the scope of the attestation:

- Contracts with No Amounts Recoverable: The introduction statement to the attestation statement identifies its scope as "all reinsurance contracts for which the reporting entity is taking credit on its current financial statement". As such, contracts that are not active, or where there are no unearned premiums, losses or other amounts recognized as recoverable as of the Annual Statement date, are excluded from the scope of the attestation.

- Certain Older Contracts: With regard to maintaining documentation evidencing risk transfer, the attestation statement requires that management only consider "each such reinsurance contract entered into, renewed, or amended on or after January 1, 1994," since this is the date when the current accounting rules surrounding risk transfer in reinsurance contracts were adopted by the NAIC. Prior to that date, no risk transfer analysis was required under statutory accounting rules. Note that this exception only relates to the second paragraph of the attestation statement.

- Risk Transfer Is Reasonably Self-Evident: Also with regard to evidencing risk transfer under the second paragraph, the attestation statement requires that management maintain documentation with respect to contracts "for which risk transfer is not reasonably considered to be self-evident." It is our understanding that the purpose of this clarification is to eliminate and/or avoid the time and expense associated with unnecessary analyses.

While the first two bullet-point exclusions are self-explanatory, the last bullet point concerning possible safe harbors is not. Accordingly, the discussion below provides guidance to actuaries when assisting management in making the determination as to whether or not risk transfer is reasonably self-evident.

Risk Transfer Reasonably Self-Evident

Since the adoption of the current accounting rules surrounding risk transfer, it has been common practice that risk transfer analyses and related documentation be completed only for contracts considered to be "finite" or "structured," as opposed to "traditional." In most cases, these analyses and documentation have not been completed for many traditional reinsurance contracts presumably because risk transfer was deemed to be self-evident. Furthermore, risk transfer cash flow tests generally have not been required for traditional contracts by auditors or financial examiners performing regulatory functions. However, since there are no universally accepted definitions of the terms "finite" and

"traditional," and the same contract features and/or structures may be present in either finite or traditional contracts, there is no simple way to divide the two groups.

With regard to the attestation statement, company management may consider this matter anew and may review all of its ceded reinsurance contracts that are still active. For those contracts that are not exempted by the first two exclusions above, management would need to decide if risk transfer is self-evident and might look to its internal or consulting actuaries for assistance in making this determination.

When evaluating reinsurance contracts as to whether risk transfer is reasonably self-evident, it should be understood that this is a principles-based standard. Therefore, there is no bright line that can be used for its application. As a matter of practice, it would be more conservative to evaluate contracts for risk transfer when there is any doubt as to whether or not risk transfer is reasonably self-evident.

Common Safe Harbors

This section of the Practice Note summarizes common safe harbors observed by practitioners, but these ideas are not intended to be exhaustive, nor are they exclusive. In practice, there will be contracts in addition to those identified in this section where it can be deemed that risk transfer is reasonably self-evident. In making this determination, important considerations include an evaluation of the substance of the arrangement, the existence, impact, and role of risk-limiting features, and the use of professional judgment.

Also, as described in the Academy's risk transfer report, the Academy asked casualty actuaries to contribute ideas with respect to appropriate safe harbors for risk transfer cash flow testing. A wide variety of answers were received. Many of these ideas fall in the category of research ideas as yet untested in the marketplace, and include suggestions intended for future consideration. These ideas are contained in their entirety in the Academy risk transfer report. We believe that the regulators of individual states may have their own ideas regarding safe harbors. Actuaries may find it beneficial to discuss this issue with their domiciliary regulators as questions arise.

Risk transfer is reasonably self-evident in most traditional per-risk or per-occurrence excess of loss reinsurance contracts. For these contracts, a predetermined amount of premium is paid and the reinsurer assumes nearly all or all of the potential variability in the underlying losses, and it is evident from reading the basic terms of the contract that the reinsurer can incur a significant loss. In many cases, there is no aggregate limit on the reinsurer's loss. The existence of certain experience-based contract terms, such as experience accounts, profit commissions, and additional premiums, generally reduce the amount of risk transfer and make it less likely that risk transfer is reasonably self-evident. Typically, the more risk retained by the ceding company through these terms, the less likely that risk transfer is self-evident.

Also, the "rate on line" is an important consideration with excess of loss reinsurance contracts. (Rate on line is defined here as the premium paid to reinsure 100 percent of a layer divided by the size of the layer.) Excess of loss contracts with no or minimal risk-

limiting features and with relatively low rates on line are typically deemed to transfer risk. However, even if a contract has no risk-limiting features, as the rate on line approaches the present value of the limit of coverage, risk transfer is usually no longer deemed to be reasonably self-evident.

Straight quota-share contracts are typically exempted from risk transfer requirements under the paragraph 11 exception of FAS 113. However, the introduction of risk limiting features to a quota share contract, such as a loss ratio cap (other than one that is so high its effect is de minimus), a loss retention corridor, or a sliding scale commission, often prevents the contract from qualifying for the exception.

In summary, the following contracts would typically be considered safe harbors, either through the paragraph 11 exception or because risk transfer is reasonably self-evident:

- A straight quota share with no risk-limiting features other than a loss ratio cap with negligible effect on the economics of the transaction;

- Single year property catastrophe and casualty clash contracts with little or no risk limiting features apart from a reinstatement premium common to these types of contracts;

- Most facultative and treaty per risk excess of loss arrangements with rates on line well below the present value of the limit of coverage, or without aggregate limits, sub-limits, or contingent features.

Of course, as noted above, this list is not intended to be an exclusive or exhaustive list.

While there are always exceptions, contracts that would not typically qualify for risk transfer being reasonably self-evident include:

- Aggregate excess of loss contracts--most of these contracts either contain significant risk-limiting features, and/or attach in an expected layer of loss so that the premium approaches the present value of the coverage provided;

- Contracts with experience accounts, experience rating refunds, or similar provisions, if such provisions have a significant impact on the contract's economics;

- Multiple year contracts--many of these have provisions that protect the reinsurer from changes in exposure over the contract period and make the analysis complicated, and/or have features that adjust the terms of later years explicitly or implicitly based on results in earlier years;

- Quota share contracts with risk limiting features such as loss retention corridors, sliding scale commissions, loss ratio caps and/or sub-limits that significantly impact the amount of risk being transferred.

For a given reinsurance contract, once the determination is made that risk transfer is not reasonably self-evident, management will need to evaluate the amount of risk transferred and prepare documentation supporting the business rationale for the contract. In most cases, it would be expected that the rigor of the analysis and documentation would increase to the extent that the contract transfers less risk. The following section provides guidance for actuaries to consider when performing cash flow testing for reinsurance contracts.

A final observation is that failure to satisfy the "reasonably self-evident" standard does not necessarily mean that a contract has insufficient risk to qualify as reinsurance, nor that it is a finite risk contract. It simply means that more analysis is required in order to make a determination of risk transfer. In the context of the attestation by the CEO and CFO, it also means that there is a requirement for management to maintain documentation of that analysis, as described in the next section.

Risk Transfer Cash Flow Testing

For contracts where risk transfer is not deemed to be reasonably self-evident, management will need to have documentation supporting risk transfer available for regulatory review. This section will focus on the cash flow testing as part of the risk transfer analysis and the issues to consider, current industry practice as it relates to incorporating parameter risk and handling various exposures, and the value of judgment to the process. It should be noted that the risk transfer measurement process is intended to be a prospective analysis, to be completed at the time of entering the reinsurance contract.

When documenting risk transfer, there will likely be many instances in which management looks to its internal or external actuaries for assistance as regards the measurement of risk. While SSAP 62 is an accounting statement, and thus the need for risk transfer cash flow testing arises from the application of accounting rules, actuaries may provide significant input in, or even take the lead in, the evaluation and quantification of insurance risk. Nevertheless, despite the actuaries' role in quantifying a contract's risk, the final determination of whether that risk is sufficient is typically an accounting decision.

Risk transfer analyses may range from very simple premium to loss limit approaches for certain contracts, to highly sophisticated stochastic models with many inputs and variables for other contracts. Typically, the required rigor of such analyses increases as the contractual terms become more complex, and/or to the extent that risk transfer becomes more limited through risk-limiting contract features. In cases where the actuary is asked to perform cash flow tests as part of the risk transfer analysis, the actuary may wish to review the steps outlined in the remainder of this document before undertaking such an evaluation.

In reading this section, it is important to note that there are currently no actuarial standards of practice on risk transfer analysis, and practice is evolving rapidly. Though the goal of evaluation of risk transfer differs to some extent from the goals in pricing reinsurance contracts or setting loss reserves, parts of the approach and development of estimates require some of the same considerations that are outlined in existing statements of principles and standards of practice regarding property/casualty ratemaking and loss reserving. Though not directly applicable, these statements might be used as a resource by actuaries when performing cash flow tests for risk transfer.

Understand the Substance of the Agreement

In order to understand the substance of the agreement before evaluating and quantifying the amount of the economic losses being transferred, the actuary may wish to do the following:

- Obtain and review as much background to the transaction as practicable, including the business purpose and the substance of the transaction. In this regard, the actuary may wish to have discussions with management or other key personnel as applicable. Furthermore, the actuary may wish to obtain and review internal accounting memoranda or other relevant internal documentation.

- Obtain and read the entire agreement, as well as any related agreements, including but not limited to interlinked reinsurance contracts or trust agreements.

If it is not clear how certain contractual terms operate, the actuary might choose to seek assistance from accounting and legal professionals, as applicable. Should the actuary rely on the interpretation of contractual language from another person or party, the actuary usually discloses such reliance in his/her documentation.

In reviewing the contract, the actuary may encounter contract provisions which may create contingent rights or obligations that appear to reduce risk if applied. These include special termination clauses, warranties, and adjustable limits or deductibles. In some cases, these provisions are worded in indefinite or ambiguous ways that make modeling difficult and, perhaps, impossible unless one were to make assumptions about the behavior of one or both parties to the contract. In those cases, if it is not possible to clarify the intent of the parties, the actuary might not be able to complete a quantification of the economic losses transferred under the agreement. Further, if the actuary does make assumptions about the behavior of parties to the contract, it may be appropriate to incorporate documentation of these assumptions in the analysis documentation.

Develop Cash Flow/Scenario Testing of Subject Losses

Once the actuary understands the substance of the contract, the next step is usually to determine what losses or loss events subject to the contract are reasonably possible. As with any actuarial analysis, the use of informed judgment is critical when developing cash flow analyses under reinsurance agreements.

In some cases, in particular for those contracts in which a single event, such as a large catastrophe, is required to produce a significant loss to the reinsurer, an analysis of what is reasonably possible is sometimes limited to the identification of one scenario or several alternative scenarios, and discussion as to whether or not those are reasonably possible.

In other cases, the actuary may develop a stochastic model that projects estimates of subject losses using thousands of scenarios. In these models, there are several key assumptions that the actuary normally selects, such as:

- A mean and coefficient of variation of losses;
- An assumed distribution of such losses;
- Selected payout patterns, as well as variation in such patterns;
- Adjustments for parameter risk.

The modeled distributions may be based on aggregate losses, individual frequency and severity distributions, or some combination of these.

In many cases, the mean is selected by reviewing historical data where available, supplemented by industry or competitor company data when appropriate. There is often less data available to estimate the coefficient of variation of losses; while historical data is often used as a starting point, in many cases it is appropriate to supplement such data with other information and judgment.

Similar to a pricing application, it might be appropriate to adjust historical data to make it an unbiased estimator of results for the prospective analysis period. Possible adjustments might include: trending losses, on-leveling premiums, adjusting for changes in exposure, and adjusting for the presence or absence of large losses or catastrophic events.

When determining a loss distribution, a positively skewed distribution such as the lognormal distribution is often used. Again, this is largely a matter of judgment and will depend on the individual situation.

Payout patterns are usually determined from historical payout patterns, if available, or from industry patterns. While variation in such patterns is a feature that is modeled by actuaries, there is little, if any, practical guidance on how to vary a payout pattern, or how much variation could be reasonably expected. It is normally a matter of actuarial judgment to determine whether the resultant approach and amount of variation in the payout pattern is reasonable.

Finally, the inclusion of parameter risk is usually an important element to cash flow testing. Parameter risk in this context refers to the potential inaccuracy in the form and parameters of the loss distribution. The sources of parameter risk are typically numerous in a reinsurance risk transfer analysis; there is a very good discussion of this in the Casualty Actuarial Society (CAS) white paper contained in Appendix 2 of the Academy's risk transfer report.

By definition, parameter risk is very difficult to model and measure. In many cases, the actuary will account for parameter risk by increasing the coefficient of variation (CV) in the modeled analysis. In other cases, the actuary might adjust the mean or weigh together multiple models, each having its own mean and CV, to encompass parameter risk. More elaborately, parameter risk can be incorporated by explicitly treating the parameters of the loss distribution as stochastic variables themselves. In any case, the selection and application of parameter risk is complex and usually involves the significant application of professional judgment on the part of the actuary.[1]

[1] A possible resource for understanding and modeling parameter uncertainty is *Parameter Uncertainty in (Log) Normal Distributions*, by Rodney E. Kreps.

Overlay the Contractual Terms

Whether determined through the selection of a single scenario or through thousands of scenarios via stochastic simulation, the actuary normally considers the amount and timing of cash flows that would be ceded under the contract for each loss scenario that is being modeled. Cash flow items may include loss payments, loss adjustment expense payments, initial premiums, additional premium payments, payment of profit or experience-based commissions, and other related cash flows. An appropriate quantification of the economics under an agreement includes contractual terms to the extent they affect cash flows between ceding company and reinsurer.

For certain contracts, modeling of contractual terms can become very difficult. This is often the case when there are notional experience accounts, funds-held accounts, and other accounts where there are interest credits and charges. Further, the impact of commutation, cancellation, or similar clauses may also significantly complicate the analysis.

For some contracts, there might be more than one applicable term for a given scenario. For example, the reinsurance company might have the option to cancel a contract, or not cancel and receive more premium. Usually, for purposes of evaluating risk transfer, it is appropriate to presume that the company with the option (in this case the reinsurer) will act in its financial best interest. Often the reinsurer will be required by the contract to exercise its option before it is clear how losses will ultimately develop. In those cases it is common practice to attribute "perfect knowledge" to the reinsurer. While computationally easier, this assumption might inappropriately understate the reinsurer's risk. If it is not clear how such contractual terms interact with each other, the actuary may find it prudent to seek clarification or other assistance from accounting and legal professionals.

There are other circumstances in which the actuary may choose to seek assistance from accounting and legal professionals. These include contracts with the following provisions:

- Multiple year arrangements--some multiple year contracts, particularly those covering more than two years, contain contractual features that reduce the risk to the reinsurer through clauses that are very difficult to reflect when modeling the contractual cash flows.

- For crediting funds-held and/or experience accounts, interest rates that are significantly below or above risk-free rates, and/or different from the rate that is used to present value the cash flows.

- Ceding commissions paid in the future or at the expiration of the contract.

- Consideration of maintenance fees--while such fees are usually considered to be additional consideration to the reinsurer in an evaluation of risk transfer, it might depend on the contract language.

- Existence of commutation clauses, cancellation rights, or similar clauses--the existence of such clauses in some contracts provides either or both parties with rights that might appropriately be considered in the quantification of the economics under an agreement.

Sometimes, the existence of the above features can significantly complicate the actuary's ability to appropriately quantify cash flows.

Once the loss scenarios are determined and the contractual terms are applied, the actuary may present-value the cash flows and quantify the economics of the reinsurance agreement under various scenarios.

Interest Rate Used to Present-Value Cash Flows

SSAP 62 does not specify a method for choosing the interest rate to be used for discounting; it specifically refers to this as an area to which judgment should be applied. SSAP 62 does, however, require that a single interest rate be used to present value the cash flows, and that the interest rate reflect the time value of money.

While not specified in the regulations, a commonly used approach is to use a risk-free interest rate, with duration approximately equal to that of the net cash flows. Based on current industry practice, an interest rate is often selected based on U.S. Treasury securities with similar durations. Typically, this is either performed based on a weighted average of the cash flows with U.S. Treasury yield curve analysis using zero-coupon securities, or through the selection of a single rate based on a simple review of U.S. Treasury rates and judgment.

Summary of Ceded Cash Flows

According to SSAP 62, significance of loss shall be evaluated by comparing the present value of all cash flows with the present value of the amounts paid or deemed to have been paid to the reinsurer. This comparison is frequently developed through a ratio comparison whose numerator and denominator are developed as follows:

- The numerator reflects the present value of the cash flows between the parties. This would include premiums less losses, ceding commissions if applicable, and other contractually determined cash flows, if any.

- The denominator reflects the present value of the total consideration to the reinsurer regardless of how it is characterized. This may include the initial premium, plus additional premiums, reinstatement premiums, maintenance fees, etc., less experience-based profit commissions or similar cash flows. Such premiums are typically not reduced for ceding commissions, brokerage payments, or other fees.

- There are several items that are specifically not considered--brokerage paid to an intermediary, investment risk, and general and other expenses of the reinsurance company that are not cash flows between the parties.

Where the actuary performed stochastic testing, estimated cash flow would typically be presented by percentile in a manner similar to the following:

Percentile or Scenario	*Nominal Total Ceded Premium*	*NPV Total Ceded Premium*	*Nominal Ultimate Ceded Loss*	*NPV Ultimate Ceded Loss*	*NPV Reinsurer's Profit / (Loss)*	*NPV Profit/ (Loss) to NPV Premium*
5.0%	44,586	46,718	43,386	41,718	5,000	10.7%
10.0%	50,062	51,983	48,862	46,983	5,000	9.6%
15.0%	54,305	56,062	53,105	51,062	5,000	8.9%
20.0%	57,960	59,577	56,760	54,577	5,000	8.4%
25.0%	61,179	62,672	59,979	57,672	5,000	8.0%
30.0%	64,027	65,411	62,827	60,411	5,000	7.6%
35.0%	67,224	68,485	66,024	63,485	5,000	7.3%
40.0%	70,223	71,368	69,023	66,368	5,000	7.0%
45.0%	73,392	74,415	72,192	69,415	5,000	6.7%
50.0%	76,845	77,735	75,645	72,735	5,000	6.4%
55.0%	79,781	80,559	78,581	75,559	5,000	6.2%
60.0%	83,308	83,950	82,108	78,950	5,000	6.0%
65.0%	86,874	87,379	85,674	82,379	5,000	5.7%
70.0%	90,774	91,100	89,544	86,100	5,000	5.5%
75.0%	95,970	96,125	94,770	91,125	5,000	5.2%
80.0%	100,000	100,000	99,613	95,781	4,219	4.2%
85.0%	100,000	100,000	106,301	102,213	(2,213)	-2.2%
87.5%	100,000	100,000	112,109	107,797	(7,797)	-7.8%
90.0%	100,000	100,000	117,391	112,876	(12,876)	-12.9%
92.5%	100,000	100,000	120,000	115,385	(15,385)	-15.4%
95.0%	100,000	100,000	120,000	115,385	(15,385)	-15.4%
97.5%	100,000	100,000	120,000	115,385	(15,385)	-15.4%
Mean	76,180	77,096	77,939	74,941	2,155	2.8%

Following is a brief summary of the columns in the table:

- "Percentile or Scenario" represents a common way to present results of stochastic simulation. For this particular table, outcomes from stochastic simulation are ordered in terms of losses ceded to the reinsurer.

- "Nominal Total Ceded Premium" reflects the total premium under the contract. These amounts are stated gross of ceding commissions, and are increased for additional premiums and reduced for experience-based profit commissions, as applicable, for each of the respective scenarios presented in the table. "NPV Total

Ceded Premium" reflects these amounts discounted to present value. The fact that the NPV Total Ceded Premium is sometimes greater than the Nominal Total Ceded Premium, while unexpected, is a function of the particular terms of the contract represented by this table.

- "Nominal Ultimate Ceded Loss" reflects the total losses and expenses, as applicable, for which the reinsurer would be obligated to pay under the contract. "NPV Ultimate Ceded Loss" reflects these amounts discounted to present value.

- The "NPV Reinsurer's Profit or Loss" column is the difference between the NPV Total Ceded Premium and the NPV Ultimate Ceded Loss columns. This amount is then divided by the "NPV Total Ceded Premium" column to generate the percentages in the final column.

Quantification of Cash Flows

The information in the above table could be used as input to the method used to quantify the economics under an agreement, the results of which could provide meaningful input to decision-makers when deciding whether the reinsurance agreement meets the risk transfer requirements of SSAP 62. No one method for evaluating risk transfer may be appropriate for use in all cases. Company management must decide which method or methods on which to rely, and in this decision they may be aided by the advice of an actuary. It is typically not the responsibility of the actuary to decide whether the risk transfer so measured is sufficient to meet the standards of SSAP 62; for many companies this decision is made by accounting professionals after considering the actuarial input.

Methods that have been proposed or used by actuarial practitioners include relative risk approaches, Value at Risk (VaR) methods, and Tail Value at Risk (TVaR) methods, including an Expected Reinsurer Deficit method. For a description and discussion of various methods, please see the Academy's risk transfer report, in particular Appendix 2. It is important to note that such proposed or used methods may or may not be suitable for evaluating risk transfer under any given agreement. Therefore, the decision-maker may want to consult with actuaries and accounting professionals when considering which method or methods are suitable for evaluating risk transfer under a specific agreement.

Questions and Answers on Risk Transfer

Question 1: Which contracts should be subject to a risk transfer cash flow analysis?

Answer: Beginning with the 2005 Annual Statement, insurance companies are required to attest that they maintain risk transfer analysis documentation. This requirement applies to all ceded reinsurance contracts which satisfy the following criteria:

1. The contract is effective or amended after Jan. 1, 1994;

2. The ceding company is "taking credit for" the contract in its current financial statement (i.e. has either established an asset or reduced a liability);

3. Risk transfer is not "reasonably self-evident."

Question 2: What is the "reasonably self-evident" standard and how is it applied?

Answer: The CEO and CFO of the ceding company are required to attest that they maintain documentation of the risk transfer analysis for certain contracts. Contracts for which risk transfer is "reasonably self-evident" are exempt from this requirement. This exemption reduces the burden of requiring risk transfer analysis for all contracts.

"Reasonably self-evident" is a principles-based standard. Thus, judgment needs to be applied. In addition, this particular standard has not been tested. The safe harbor section of this Practice Note contains more ideas with respect to this area. In the event of uncertainty, it may be wise to err on the side of performing a risk transfer analysis. Nevertheless, it is possible to make a number of observations about the application of the standard.

The first observation is that risk transfer would normally be reasonably self-evident for most traditional reinsurance contracts which are written using standard contract features and for which the motivation was simple risk transfer. For these contracts, it may be easy to conclude that it is reasonably possible (i.e. more than remote) that the reinsurer can incur a significant loss.

A second observation is that even for traditional reinsurance contracts, it is normally prudent to pay particular attention to contracts with aggregate limits that cap the reinsurer's total loss. For these contracts it is often useful to compare the reinsurer's premium to the present value of its aggregate limit.

A final observation is that failure to satisfy the "reasonably self-evident" standard does not necessarily mean that a contract has insufficient risk to meet the requirements of SSAP 62, nor that it is a finite risk contract. It simply means that a risk transfer analysis is required in order to evaluate whether the reinsurance agreement meets those

accounting requirements. In the context of the attestation by the CEO and CFO, it also means that there is a requirement to maintain documentation of that analysis.

Question 3: Who determines the meaning of "reasonably self-evident"?

Answer: The "reasonably self-evident" standard is a principles-based standard, and as such, judgment is required in its application. As with any statutory rule, company management is responsible for making this judgment, although the judgment may be made after consultation with internal and/or external advisors.

Question 4: What is the actuary's responsibility in the risk transfer analysis process?

Answer: Actuaries can be expected to play several roles, depending on the circumstances.

In-house actuaries are likely to be asked to help company management develop guidelines for the risk transfer analysis process, including operational procedures for determining which contracts are reviewed, the methods used for the analysis, and the format of the documentation. It is also likely that actuaries will provide significant input in, or even take the lead in, the evaluation and quantification of insurance risk.

Actuaries will also likely be involved in supporting the review work performed by external auditors and regulators.

Nevertheless, while actuaries may take the lead role in quantifying a contract's risk, it is important to remember that the determination of whether that risk is sufficient for a given accounting treatment is typically an accounting rather than an actuarial decision.

Question 5: Will the Appointed Actuary need to certify certain elements of risk transfer?

Answer: No, this is not a responsibility of the Appointed Actuary. The guidance on the Statement of Actuarial Opinion Instructions from the NAIC Casualty Actuarial Task Force (CATF) specifically notes that the scope of the opinion does not include an evaluation of risk transfer.

The selection of the individual who is to perform the risk transfer analysis is the responsibility of management. It need not be the Appointed Actuary, nor need it be an actuary at all. Although an actuary may be asked to play a role in cash flow testing for risk transfer, there is no requirement to this effect.

Question 6: What is the 10/10 rule and how does it relate to the quantification of sufficient risk transfer in a reinsurance contract?

Answer: SSAP 62 includes a risk transfer standard that states that a contract has sufficient risk for reinsurance accounting treatment if the reinsurer has a "reasonable probability" of a "significant loss." SSAP 62 goes on to define reasonably probable as "not remote." No further guidance is provided and the SSAP 62 risk transfer test remains a principles-based rather than a bright-line test.

The 10/10 rule is a frequently cited test for determining if there is enough risk in a contract to satisfy the risk transfer standard laid out in SSAP 62. Specifically, the 10/10 rule equates "reasonable possibility" with "at least a 10 percent chance" and "significant loss" with "a net present value loss at least equal to 10 percent of the reinsurer's net present value premium." The 10/10 rule may be thought of as a specific case of a more general Value at Risk method for measuring economic losses under a reinsurance agreement.

The Academy's risk transfer report notes that many actuaries believe the 10/10 rule is inadequate for purposes of testing across the spectrum of all reinsurance agreements, particularly for agreements that reinsure low frequency/high severity risks. Further, COPLFR does not believe a bright-line approach, without allowance for judgment, is an optimal approach. These conclusions were supported by the NAIC's CATF in its comment letter on the Academy's risk transfer report.

Question 7: What interest rate should be used in each evaluated scenario to make the present value calculation?

Answer: Paragraph 14 of SSAP 62 states that "The same interest rate shall be used to compute the present value of cash flows for each reasonably possible outcome tested. … Judgment is required to identify a reasonable and appropriate interest rate." Similarly, paragraph 66 of FAS 113 states that "A constant interest rate is used in determining these present values because the possibility of investment income varying from expectations is not an element of insurance risk. The Board concluded that it was not necessary to specify in detail the interest rate used in the calculation; judgment is required to identify a reasonable and appropriate rate."

While not specified in the regulations, a common approach is to use a risk-free interest rate, with duration approximately equal to that of the net cash flows. Based on current industry practice, an interest rate is selected based on U.S. Treasury securities with similar durations. Typically, this is either performed based on a weighted average of the cash flows with U.S. Treasury yield curve analysis using zero-coupon securities, or through the selection of a single rate based on a simple review of U.S. Treasury rates and judgment.

Some contracts may specify interest rates for crediting funds-held and/or experience accounts that are significantly below or above risk-free rates, and/or different from the rate that is used to present value the cash flows. In these situations, the actuary may choose to seek assistance from accounting and legal professionals in determining how to model the contract terms.

Question 8: Let us assume our company plans to improve the content and documentation in the underwriting file prospectively, and we discover that some currently in-force contracts meet the risk transfer standard but are not sufficiently documented in the file. What could we do?

Answer: According to regulators who drafted the Reinsurance Attestation Supplement, it is permissible to add explanatory memoranda to the underwriting file as long as it is clear that this material is dated after entering into the contract and is being provided for ease of explanation purposes.

Question 9: If a company did not complete a risk transfer analysis at the time the reinsurance contract was written and then retrospectively constructs a risk transfer analysis for inclusion in the documentation file, would it base the analysis on the most current information and loss experience?

Answer: No. The analysis would be completed as though it were prospective, using the information available to the company at the time at which it entered into the contract. As noted in the answer to Question 8, the analysis would be dated when completed, noting that it has been added to the documentation file for ease of explanation purposes.

As a separate matter, such retrospective analyses should only be completed when necessary. It is the view of regulators that compliance with SSAP 62 requires that documentation supporting risk transfer be prepared at the time the contract is agreed upon between the parties.

Question 10: May a ceding company use a risk transfer analysis performed by a third party, such as a reinsurance intermediary, as support in satisfying the requirements of the Reinsurance Attestation Supplement?

Answer: Yes. Management may obtain expert advice from third parties. However, company management must select the appropriate parties to advise them, must take ownership of the results of the analysis, and must be responsible for maintaining the documentation. These responsibilities cannot be delegated to an outside entity.

Question 11: May a ceding company and a reinsurer reach different conclusions regarding risk transfer on a reinsurance contract?

Answer: Yes, it is possible that this may happen. A reinsurer and a ceding company may reach agreement on the terms of a reinsurance contract without agreement upon the expected loss ratio or the potential distribution of results on the subject business. Each company is responsible for its own assessment of risk transfer. Typically, the ceding company and the reinsurer do not share their analyses of risk transfer. Given the potential for a difference in knowledge of the subject business and in factors that may affect ceded experience between the ceding company and the reinsurer, and given the

amount of subjective judgment that may be involved in the analysis, there is a reasonable possibility that two entities might reach different conclusions regarding risk transfer on the same reinsurance contract.

Question 12: Does a risk transfer analysis always need to include probability distributions of cash flow estimates?

Answer: No. Sometimes it may be sufficient to generate one or several scenarios to support the risk transfer analysis. The amount of work that is appropriate is a matter of judgment. It typically depends on factors such as the level of complexity of the reinsurance contract, the materiality of the contract, and the nature of any risk-limiting features.

Question 13: If a prospective risk transfer analysis indicates that there is significant risk under a treaty, but subsequent loss experience is different than estimated, does that mean the risk transfer analysis is faulty and that the company may need to revise its accounting treatment?

Answer: No. The fact that loss experience is different than originally estimated, even if no losses are sustained under the contract, does not imply that there was not risk transfer at inception.

Question 14: Where may I find additional information from the CAS or Academy regarding risk transfer standards and testing?

Answer: In August 2005, the Academy issued its risk transfer report. The report contains the results of a survey on current industry practices in the evaluation of risk transfer. It includes a variety of alternatives to evaluating risk transfer suggested by actuarial professionals practicing in the area as well as the thoughts of professionals on the subject of which types of contracts should qualify for a "safe harbor" from a risk transfer cash flow analysis. It also includes thoughts on how risk transfer could be measured. Among the attachments to the report is a paper produced by a Research Working Party on Risk Transfer formed by the CAS, as well as insights from 18 individuals who responded to a June 2005 letter asking respondents to address the following four questions: What is an effective test for risk transfer? What criteria should be used to determine whether a reinsurance contract transfers significant risk to the reinsurer? What safe harbors, if any, should be established so that a full risk transfer analysis does not have to be completed for each and every reinsurance contract? What are the advantages and disadvantages of the suggested approach versus other approaches commonly used?

The actuary may also find it helpful to review a paper produced by the CAS Valuation, Finance and Investments Committee (VFIC), "*Accounting Rule Guidance Statement of Financial Accounting Standards No. 113 – Considerations in Risk Transfer Testing*". The paper may be found in the 2002 fall edition of the CAS Forum. The paper was written to provide some considerations to CAS members on risk transfer testing.

As the questions of risk transfer and reasonable self-evidence are principles-based conclusions, the actuary may find this material useful when measuring risk and giving advice on issues surrounding the Reinsurance Attestation Supplement. However, it is important to note that the material in these publications falls in the category of research ideas and does not constitute official guidance.

Question 15: I understand that the NAIC is exploring possible changes to statutory accounting for ceded reinsurance. What changes have been made for 2005, and what is the NAIC considering for 2006 and beyond? Is the FASB considering similar changes for US GAAP accounting?

Answer: During 2005, the NAIC adopted certain changes to SSAP 62 effective beginning with the 2005 Annual Statement. In addition to the Reinsurance Attestation Supplement described herein, the NAIC also increased disclosure requirements for property/casualty insurance companies. Companies will be required to report the contract terms and management objectives of reinsurance agreements with certain features that have the effect of altering policyholders' surplus by more than 3 percent. The Reinsurance Attestation Supplement and the new disclosures will be part of the Annual Statement for property/casualty insurance companies and will be public information. These changes can be found at the NAIC's website, www.naic.org.

In addition, during 2005 the NAIC's Property and Casualty Reinsurance Study Group considered a proposal to change SSAP 62 to require bifurcation of reinsurance agreements that meet certain criteria. As described in the proposal, bifurcation of a reinsurance agreement entails accounting for a reinsurance transaction in two parts, such that the part of the transaction transferring insurance risk is accounted for as reinsurance and the part of the transaction financing losses and not transferring insurance risk is accounted for as a deposit. While this change was not adopted for 2005, the NAIC is expected to continue evaluating the requirements in SSAP 62 in 2006.

During 2005, the FASB also engaged in a project to clarify what constitutes transfer of significant insurance risk in insurance and reinsurance contracts, and to improve accounting by more clearly defining which contracts, or portions thereof, should be accounted for as insurance versus deposits. FASB is also exploring simple approaches to bifurcation of insurance contracts that include both insurance and financing elements. The FASB expects to have a draft issued during the first quarter of 2006, with a final document issued during the third quarter of 2006.

Supp 20-1

REINSURANCE ATTESTATION SUPPLEMENT

ATTESTATION OF CHIEF EXECUTIVE OFFICER AND CHIEF FINANCIAL OFFICER REGARDING REINSURANCE AGREEMENTS

Insurers are required to file a supplement to the annual statement titled "Reinsurance Attestation Supplement" by March 1 each year. The following provides a list of what is required within this filing.

The Chief Executive Officer and Chief Financial Officer shall attest, under penalties of perjury, with respect to all reinsurance contracts for which the reporting entity is taking credit on its current financial statement, that to the best of their knowledge and belief after diligent inquiry:

(I) Consistent with *SSAP No. 62—Property and Casualty Reinsurance*, there are no separate written or oral agreements between the reporting entity (or its affiliates or companies it controls) and the assuming reinsurer that would under any circumstances, reduce, limit, mitigate or otherwise affect any actual or potential loss to the parties under the reinsurance contract, other than inuring contracts that are explicitly defined in the reinsurance contract except as disclosed herein;

(II) For each such reinsurance contract entered into, renewed, or amended on or after January 1, 1994, for which risk transfer is not reasonably considered to be self-evident, documentation concerning the economic intent of the transaction and the risk transfer analysis evidencing the proper accounting treatment, as required by *SSAP No. 62—Property and Casualty Reinsurance*, is available for review;

(III) The reporting entity complies with all the requirements set forth in *SSAP No. 62—Property and Casualty Reinsurance; and*

(IV) The reporting entity has appropriate controls in place to monitor the use of reinsurance and adhere to the provisions of *SSAP No. 62—Property and Casualty Reinsurance.*

Any exceptions to the aforementioned shall be disclosed in the attestation and an explanation of the exceptions shall be attached to the attestation.

Exceptions:

Signed:

Chief Executive Officer Chief Financial Officer

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