# AN EXPOSURE RATING APPROACH TO PRICING PROPERTY EXCESS-OF-LOSS REINSURANCE

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*Abstract*

*Included in the 1963* Proceedings *is the paper, "Rating by Layer of Insurance," by Ruth E. Salzmann. In her paper, Salzmann examines the relationship between homeowners fire losses and the corresponding amount of insurance. Using 1960 accident year data from the Insurance Company of North America (INA), each homeowners fire claim was expressed as a percentage of the amount of insurance on the policy affording the coverage. An accumulated loss cost distribution by percentage of insured value was then developed. These distributions can be (and indeed still are) used to exposure rate property excess-of-loss reinsurance.*

*In order to determine whether the relationship between size of loss and amount of insurance is a stable one over time, Salzmann's methodology has been applied to a more current set of data (Hartford Insurance Group homeowners losses for accident years 1984–1988). Any changes in this relationship over time would have obvious implications for any reinsurer currently using the Salzmann Tables to exposure rate property excess-of-loss reinsurance. Salzmann's methodology has also been applied to The Hartford's small commercial property book of business in order to determine whether the commercial property relationships of loss size to amount of insurance differ from those of homeowners.*

## 1. INTRODUCTION

Included in the 1963 *Proceedings* is the paper, "Rating by Layer of Insurance" by Ruth E. Salzmann [1]. In this paper, Salzmann develops cumulative loss distributions by percentage of insured value, in order to demonstrate that there is a direct relationship between property size-of-loss distributions and the corresponding amounts at risk. As testimony to the thoroughness of her analysis, the "Salzmann Tables" contained in her paper are still used today by many reinsurers as one means of rating property excess-of-loss reinsurance.

However, in reviewing Salzmann's paper, it becomes evident that she never represented her study as the final word on property excess rating but, rather, intended it to be a modest first step into this arena. Furthermore, there are a number of important points not addressed by the study; therefore the continued use of these tables as a reinsurance rating tool is inappropriate. While the methodology employed by Salzmann is theoretically sound, the loss data used in her analysis differs significantly from that which is typically covered by a property excess-of-loss treaty. However, by applying Salzmann's methodology to a more appropriate set of loss data, it is possible to produce a revised set of tables that are directly applicable to the rating of property excess-of-loss reinsurance.

## 2. SALZMANN'S STUDY

In compiling the loss data for her study, Salzmann captured individual claim (and policy) information for each of the following variables:

| | |
|---|---|
| Company: | INA |
| Line of Business: | Homeowners |
| Accident Year: | 1960 |
| Cause of Loss: | Fire |
| Coverage: | Building Losses Only (Coverage A) |
| Construction: | Frame, Brick |
| Protection: | Protected, Unprotected |
| Insured Values (Homeowners Coverage A Limit): | $10,000, $15,000, $20,000, $25,000 |

The stated reasons for selecting the homeowners line of business were that: (1) the insured value, or policy amount, was a fair approximation of the amount at risk; and (2) underinsurance, if any, would be relatively consistent by class, due to the built-in incentive to fully insure in order to satisfy the replacement cost clause, which comes into operation when the insured value equals 80% of the building's replacement cost. Also, only the building loss portion of each claim was considered, since it was felt that these losses would have the most direct relationship with the policy amount and thus provide the best basis for the study.

For each claim, the building loss was expressed as a percentage of the corresponding amount of insurance from the policy affording the coverage. By changing the claim size scale from a pure-dollar basis to a percentage-of-insured-value basis, the Table 1 claim count distribution was produced:

TABLE 1

CUMULATIVE CLAIM COUNT DISTRIBUTION BY PERCENT OF INSURED VALUE*

| Loss as a Percent of Insured Value | Frame-Protected | Frame-Unprotected | Brick-Protected | Brick-Unprotected | Total |
|---|---|---|---|---|---|
| 5% | 92.0% | 91.3% | 93.9% | 92.9% | 92.3% |
| 10 | 95.4 | 94.1 | 96.4 | 95.8 | 95.4 |
| 20 | 97.3 | 95.4 | 97.8 | 96.8 | 97.0 |
| 30 | 98.0 | 96.0 | 98.2 | 97.9 | 97.7 |
| 40 | 98.6 | 96.5 | 98.5 | 98.4 | 98.2 |
| 50 | 98.9 | 97.1 | 98.8 | 98.7 | 98.6 |
| 60 | 99.1 | 97.4 | 99.2 | 98.9 | 98.8 |
| 70 | 99.3 | 97.5 | 99.4 | 98.9 | 99.0 |
| 80 | 99.5 | 97.9 | 99.7 | 98.9 | 99.2 |
| 90 | 99.6 | 98.1 | 99.7 | 99.2 | 99.4 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

* Combined distribution for the $10,000; $15,000; $20,000; and $25,000 amounts of insurance.

In addition to examining the distribution of claim counts by percentage of insured value, Salzmann also produced a cumulative loss distribution by percentage of insured value. To derive the dollar amount of losses contained within the first $X\%$ of insured value, Salzmann combined two values: (1) $X\%$ of insured value, per claim, for those claims which exceeded $X\%$ of insured value, and (2) 100% of each claim's incurred loss, per claim, for those claims which did not exceed $X\%$ of insured value. The results of Salzmann's calculations are shown in Table 2.

## TABLE 2

CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE*

| Loss as a Percent of Insured Value | Frame-Protected | Frame-Unprotected | Brick-Protected | Brick-Unprotected | Total |
|---|---|---|---|---|---|
| 5% | 42.8% | 26.9% | 39.3% | 28.8% | 38.1% |
| 10 | 54.2 | 35.9 | 49.4 | 39.2 | 48.7 |
| 20 | 67.4 | 47.8 | 61.9 | 52.2 | 61.5 |
| 30 | 76.8 | 57.5 | 71.7 | 63.1 | 71.1 |
| 40 | 83.9 | 65.7 | 79.7 | 70.6 | 78.6 |
| 50 | 89.0 | 73.2 | 86.5 | 77.5 | 84.6 |
| 60 | 92.7 | 79.6 | 91.9 | 82.8 | 89.3 |
| 70 | 95.5 | 85.7 | 96.0 | 87.3 | 93.1 |
| 80 | 97.6 | 91.3 | 98.3 | 91.8 | 96.1 |
| 90 | 99.1 | 95.7 | 99.3 | 95.9 | 98.2 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

* Combined distribution for the $10,000; $15,000; $20,000; and $25,000 amounts of insurance.

By comparing the distributions derived for the various amount of insurance groups ($10,000; $15,000; $20,000; and $25,000), Salzmann concluded that the relationship between size-of-loss distributions and insured values was constant across all amounts of insurance. She also pointed out several potential uses for her tables, with one of them being their potential incorporation as a reinsurance rating tool. Some 30 years later, her tables are still considered to be a very useful source of reinsurance rating information.

## 3. USING SALZMANN TABLES TO PRICE REINSURANCE

Using Salzmann Tables to price property excess-of-loss reinsurance represents a so-called "exposure rating" technique. Exposure rating does not rely on the ceding company's actual loss history as a basis for developing a reinsurance rate but, rather, is based on its current (or projected treaty year) distribution of direct premium by policy limit. For each policy limit written by the ceding company, an estimate is made as to the proportion of losses that will fall within the reinsurance layer being priced. In casualty reinsurance, one standard method of estimating these proportions is through the use of increased limits factors, while in property reinsurance, Salzmann Tables serve an equivalent function.

An example of how Salzmann Tables are used to exposure rate a property reinsurance program is shown in Exhibit 1. The example is for a company which is considering purchasing a $100,000 excess of $100,000 reinsurance treaty to cover its homeowners property losses. The only input necessary to perform the exposure rating calculation is the ceding company's estimated distribution of premium by its Coverage A (Building) limits for the period to be covered by the treaty. Given this distribution of premium by Coverage A limits, the mechanics of calculating an exposure rate are straightforward. First, the ceding company's retention is expressed as a percentage of each of the Coverage A limits, yielding the percentages shown in Column 3. These percentages can be viewed simply as the portion of the total policy limit that is being retained by the ceding company. For example, for a $200,000 policy the ceding company retains the first 50% of the Coverage A limit, while for the lower limit policies, the ceding company retains anywhere from 100% to 400% of the Coverage A limit.

By using these relationships of percentage retention to Coverage A limit as entry values into the Salzmann Tables, the corresponding premium (loss) allocations can be determined. For example, if the ceding company retains the first 50% of a $200,000 policy, the Salzmann Tables indicate that they will be responsible for 89% of total loss. Thus, for any $200,000 policy, the ceding company should retain 89% of the total premium, while the reinsurer only needs 11% of total policy premium to cover losses in excess of 50% of the Coverage A limit. As detailed in Exhibit 1, since all of the other Coverage A limits are less than or

# EXHIBIT 1

## EXPOSURE RATING EXAMPLE—$100,000 EXCESS OF $100,000 LAYER

| Coverage A Limit | Direct Premium | Ceding Co. Retention as a Percent of Coverage A Limit* | Percentage Allocation of Total Premium-Salzmann Table Frame-Protected | Ceding Co. Retention Plus Reinsurance Limit as a Percent of Coverage A Limit** | Percentage Allocation of Total Premium-Salzmann Table Frame-Protected | Exposure Factor (6) − (4) | Exposure Premium (2) × (7) |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $ 25,000 | $ 200,000 | 400% | 100% | 800% | 100% | 0% | $ 0 |
| 50,000 | 200,000 | 200 | 100 | 400 | 100 | 0 | 0 |
| 75,000 | 200,000 | 133 | 100 | 267 | 100 | 0 | 0 |
| 100,000 | 200,000 | 100 | 100 | 200 | 100 | 0 | 0 |
| 200,000 | 200,000 | 50 | 89 | 100 | 100 | 11 | 22,000 |
| | $1,000,000 | | | | | | $22,000 |

$$\text{Exposure Rate} = \frac{\$22{,}000 \times .60 \times 1.10}{\$1{,}000{,}000} \times 1.0 \times \frac{100}{80} = 1.82\%$$

* Column 3 = $100,000 ÷ Column 1
** Column 5 = $200,000 ÷ Column 1

equal to the ceding company's retention, the Salzmann Tables allocate 100% of the policy premium to the ceding company.

By using the Salzmann Tables, it is estimated that the primary company will collect $22,000 in direct premium to cover losses and expenses in the $100,000 excess of $100,000 layer. To convert this to a reinsurance premium, several additional adjustments are necessary:

1. Ceding company expenses (acquisition costs and other expenses) need to be removed. This can be accomplished by multiplying the gross exposure premium by the expected pure loss component (excluding loss adjustment expenses). For purposes of this example, assume an expected pure loss component of 60%.
2. If the reinsurer is to share the cost of allocated loss adjustment expenses, then an appropriate loading must be added to the reinsurance rate. For purposes of this example, the rate will be loaded by 10%.
3. The ceding company's rate adequacy needs to be assessed. If the ceding company's underlying rates are inadequate, the reinsurer's exposure premium resulting from use of the Salzmann Tables will also be inadequate by the same percentage. In this example, it is assumed that the underlying rates are adequate, so no adjustment is necessary; i.e., the adjustment factor = 1.0.
4. Finally, the reinsurer will include a loading for expenses and profit. For purposes of this example, it is assumed that this element represents 20% of the final reinsurance premium—this loading would be expressed as "100/80ths."

These adjustments result in a final indicated exposure rate of 1.82%:

$$\text{Exposure Rate} = \frac{\$22{,}000 \times .60 \times 1.10}{\$1{,}000{,}000} \times 1.0 \times \frac{100}{80} = 1.82\%$$

Thus, based on the ceding company's estimated distribution of direct premium by policy limit, an exposure rating estimate produced by using the Salzmann Tables indicates that the reinsurer needs only $18,200 to provide for both its expenses and for expected losses within the $100,000 excess of $100,000 layer.

As a second example of exposure rating using the Salzmann Tables, if the ceding company was considering a further reduction in its retention to $25,000, the cost of the additional necessary reinsurance ($75,000 excess of $25,000) would be estimated at 15.05% of its direct premium, or $150,500 (Exhibit 2). The ceding company may view this additional reinsurance purchase as both an effective, and relatively inexpensive, means of removing some unwanted volatility from its books.

The natural alternative to exposure rating is experience rating. In experience rating, the ceding company's actual claim history for the previous three to five accident years provides the basis for developing a reinsurance rate. In the simplest form of experience rating, actual historical losses are adjusted for inflation, on a claim-by-claim basis, from the date of loss up to the average loss date anticipated for the treaty. These trended claim values are then cast against the proposed reinsurance structure, to determine how they would impact both the $75,000 excess of $25,000 and $100,000 excess of $100,000 layers. On a trended basis, then, an estimate of the extent to which each accident year's actual reported claims would have impacted each of the reinsurance layers is produced. Excess loss development factors are then applied to these trended figures in order to produce an estimate of ultimate trended excess losses by layer for each accident year. By then comparing these accident year ultimate excess loss figures to their respective premium bases (with historical premiums adjusted to either present rate levels or proposed treaty year rate levels), a three- to five-year average burning cost can be developed. By loading this "trended and developed" burning cost for reinsurer expenses and profit an "experience rate" results.

A reinsurer will typically produce both an exposure rating estimate and an experience rating estimate for each layer of reinsurance. These two rating methodologies may not always produce similar answers, however. Determining which of the two estimates is more credible is not always a straightforward process. Generally, experience rating is useful only on working layers, while exposure rating theoretically works well on all layers. In our example, experience rating is apparently not well suited for the $100,000 excess of $100,000 layer, given that expected losses are only $13,200 ($22,000 × .60); experience rating may produce a useful pricing estimate for the $75,000 excess of $25,000 layer, where expected losses are $109,440 ($182,400 × .60). One method of com-

# EXHIBIT 2

## EXPOSURE RATING EXAMPLE—$75,000 EXCESS OF $25,000 LAYER

| Coverage A Limit | Direct Premium | Ceding Co. Retention as a Percent of Coverage A Limit* | Percentage Allocation of Total Premium-Salzmann Table Frame-Protected | Ceding Co. Retention Plus Reinsurance Limit as a Percent of Coverage A Limit** | Percentage Allocation of Total Premium-Salzmann Table Frame-Protected | Exposure Factor (6) − (4) | Exposure Premium (2) × (7) |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $ 25,000 | $ 200,000 | 100.0% | 100.0% | 400% | 100% | 0.0% | $ 0 |
| 50,000 | 200,000 | 50.0 | 89.0 | 200 | 100 | 11.0 | 22,000 |
| 75,000 | 200,000 | 33.3 | 79.2 | 133 | 100 | 20.8 | 41,600 |
| 100,000 | 200,000 | 25.0 | 72.1 | 100 | 100 | 27.9 | 55,800 |
| 200,000 | 200,000 | 12.5 | 57.5 | 50 | 89 | 31.5 | 63,000 |
| | $1,000,000 | | | | | | $182,400 |

$$\text{Exposure Rate} = \frac{\$182{,}400 \times .60 \times 1.10}{\$1{,}000{,}000} \times 1.0 \times \frac{100}{80} = 15.05\%$$

* Column 3 = $ 25,000 ÷ Column 1
** Column 5 = $100,000 ÷ Column 1

bining experience and exposure rate estimates into a single estimate of reinsurance rate is described by Gary Patrik and Isaac Mashitz in their 1990 Discussion Paper "Credibility for Treaty Reinsurance Excess Pricing" [2].

## 4. COMMENTS ON SALZMANN'S ANALYSIS

Salzmann achieved her goal of demonstrating that there was a direct relationship between homeowners building size-of-loss distributions and their corresponding insured values. When viewed as a pricing tool for property excess-of-loss reinsurance, however, the Salzmann Tables are far from ideal, due to the following considerations:

1. Building Losses Only—By restricting her analysis to only the building loss portion of each homeowners claim, Salzmann was satisfied that losses would thereby have the most direct relationship with the policy amount. In a homeowners policy, however, all of the following property coverages are provided, and would typically be covered by a property excess-of-loss treaty:

   Coverage A: Building;

   Coverage B: Other Structures—Limit provided is 10% of the Coverage A limit;

   Coverage C: Contents—Limit provided is 50% of the Coverage A limit, unless Replacement Cost coverage is purchased, in which case the limit is increased to 70% of the Coverage A limit;

   Coverage D: Loss of Use—Limit provided is 20% of the Coverage A limit.

   Clearly, when considering a "total" homeowners property loss, we are not dealing with just a complete payment of the Coverage A limit, but rather we are looking at a loss which could go as high as two times the Coverage A limit. By considering building losses only, Salzmann did not cover this possibility.

2. Cause of Loss—In demonstrating that a direct relationship existed between building size-of-loss distributions and amounts at risk, Salzmann considered only one cause of loss—fire. Therefore, if Salzmann Tables are used to price a property excess-of-loss reinsurance treaty, an implicit assumption in that price is that all other causes of property losses will exhibit the same relationship between size of loss and amount at risk.

3. Line of Business—Salzmann makes the point in her article that a size-of-loss distribution developed from one population of risks may not be appropriate for another population of risks. Clearly, if Salzmann Tables are used to rate commercial property excess-of-loss treaties, an implicit assumption is that commercial risks possess the same size of loss to insured value relationships as do homeowners risks.

None of these three points should in any way be construed as a criticism of Salzmann, as she clearly stated the goal of her study. However, it seems clear that, due to the three points mentioned above, the way the Salzmann Tables are currently used to rate property excess-of-loss reinsurance is inappropriate.

## 5. AN UPDATED ANALYSIS OF PROPERTY LOSSES

In order to address the problems associated with using the Salzmann Tables as a reinsurance pricing tool, a number of steps were taken. First, an updated review of homeowners fire loss experience was performed, using Hartford Insurance Group data for the 1984–1988 accident years. Second, a similar review of homeowners loss experience was performed for (1) all wind losses, (2) all other property causes of loss, and (3) the 1989 Hurricane Hugo losses, in order to determine whether these distributions of loss as a percentage of insured value differed from those of the fire losses. Finally, a review of commercial property loss experience was also performed, again looking at fire, wind, all other property, and Hurricane Hugo losses.

## 6. HOMEOWNERS FIRE LOSS DISTRIBUTIONS

For all homeowners fire losses, individual claim information was obtained, with losses emanating from all of the property coverages (A, B, C, and D) being included. Losses were then restated as a percentage of the Coverage A limit, with the upper bound on an individual claim's ratio thereby being 200% of the Coverage A limit. As shown in Exhibit 5, by including all of the property coverages within the definition of loss, a much different cumulative claim count distribution emerges. For example, the percentage of claims that exceed the Coverage A limit (100%) varies from 1.3% for Brick-Protected to 8.0% for Frame-Unprotected, a possibility not considered by the Salzmann Tables. Also shown in Exhibits 5 and 6 (and all subsequent similar exhibits) are the claim counts/dollar values that make up the various distributions, so that an assessment of the credibility of each pattern can be made.

When the cumulative distribution of losses by percentage of insured value is examined, the difference becomes even more pronounced, with only 84.5% of total losses being contained within the Coverage A limit (Exhibit 6).

What are the implications of these revised homeowners fire loss tables? By returning to the example of the $100,000 excess of $100,000 layer, several significant changes become apparent. (See Exhibit 3.) As shown, the exposure rate of 7.41%, produced by using the revised homeowners property loss distributions, compares to a Salzmann Table exposure rate of 1.82%. This tremendous increase in the ceding company's exposure rate has two main sources. First, both the $75,000 and $100,000 policy limits represent an exposure to the layer, a fact which was not reflected in the Salzmann Tables. Second, the estimated exposure to the layer produced by the $200,000 policy limits more than doubled.

As an additional consideration, these revised tables also indicate that a homeowners policy carrying a $200,000 Coverage A limit represents a potential property loss which could reach as high as $400,000. The property reinsurance program, as currently structured, would leave the ceding company vulnerable to homeowners property losses within the

# EXHIBIT 3

## EXPOSURE RATING EXAMPLE—$100,000 EXCESS OF $100,000 LAYER

| Coverage A Limit | Direct Premium | Ceding Co. Retention as a Percent of Coverage A Limit* | Percentage Allocation of Total Premium-Hartford Table Frame-Protected | Ceding Co. Retention Plus Reinsurance Limit as a Percent of Coverage A Limit** | Percentage Allocation of Total Premium-Hartford Table Frame-Protected | Exposure Factor (6) − (4) | Exposure Premium (2) × (7) |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $ 25,000 | $ 200,000 | 400% | 100.0% | 800% | 100.0% | 0% | $ 0 |
| 50,000 | 200,000 | 200 | 100.0 | 400 | 100.0 | 0 | 0 |
| 75,000 | 200,000 | 133 | 93.4 | 267 | 100.0 | 6.6 | 13,200 |
| 100,000 | 200,000 | 100 | 84.2 | 200 | 100.0 | 15.8 | 31,600 |
| 200,000 | 200,000 | 50 | 61.7 | 100 | 84.2 | 22.5 | 45,000 |
| | $1,000,000 | | | | | | $89,800 |

$$\text{Exposure Rate} = \frac{\$89{,}800 \times .60 \times 1.10}{\$1{,}000{,}000} \times 1.0 \times \frac{100}{80} = 7.41\%$$

* Column 3 = $100,000 ÷ Column 1
** Column 5 = $200,000 ÷ Column 1

# EXHIBIT 4

## EXPOSURE RATING EXAMPLE—$75,000 EXCESS OF $25,000 LAYER

| Coverage A Limit | Direct Premium | Ceding Co. Retention as a Percent of Coverage A Limit* | Percentage Allocation of Total Premium-Hartford Table Frame-Protected | Ceding Co. Retention Plus Reinsurance Limit as a Percent of Coverage A Limit** | Percentage Allocation of Total Premium-Hartford Table Frame-Protected | Exposure Factor (6) − (4) | Exposure Premium (2) × (7) |
|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| $ 25,000 | $ 200,000 | 100.0% | 84.2% | 400% | 100.0% | 15.8% | $ 31,600 |
| 50,000 | 200,000 | 50.0 | 61.7 | 200 | 100.0 | 38.3 | 76,600 |
| 75,000 | 200,000 | 33.3 | 51.1 | 133 | 93.4 | 42.3 | 84,600 |
| 100,000 | 200,000 | 25.0 | 45.0 | 100 | 84.2 | 39.2 | 78,400 |
| 200,000 | 200,000 | 12.5 | 33.5 | 50 | 61.7 | 28.2 | 56,400 |
| | $1,000,000 | | | | | | $327,600 |

$$\text{Exposure Rate} = \frac{\$327{,}600 \times .60 \times 1.10}{\$1{,}000{,}000} \times 1.0 \times \frac{100}{80} = 27.03\%$$

* Column 3 = $ 25,000 ÷ Column 1
** Column 5 = $100,000 ÷ Column 1

## EXHIBIT 5

### CUMULATIVE CLAIM COUNT DISTRIBUTION BY PERCENT OF INSURED VALUE

### HOMEOWNERS: FIRE LOSSES ONLY

| Loss as a Percent of Insured Value | Frame-Protected | | Frame-Unprotected | | Brick-Protected | | Brick-Unprotected | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 |
| 5% | 85.5% | 92.0% | 82.1% | 91.3% | 91.4% | 93.9% | 89.6% | 92.9% | 88.0% | 92.3% |
| 10 | 90.3 | 95.4 | 85.7 | 94.1 | 94.9 | 96.4 | 92.6 | 95.8 | 92.2 | 95.4 |
| 20 | 93.4 | 97.3 | 87.9 | 95.4 | 96.8 | 97.8 | 94.0 | 96.8 | 94.7 | 97.0 |
| 30 | 94.4 | 98.0 | 89.0 | 96.0 | 97.2 | 98.2 | 94.2 | 97.9 | 95.4 | 97.7 |
| 40 | 95.0 | 98.6 | 89.4 | 96.5 | 97.5 | 98.5 | 94.6 | 98.4 | 95.8 | 98.2 |
| 50 | 95.5 | 98.9 | 89.8 | 97.1 | 97.8 | 98.8 | 95.0 | 98.7 | 96.3 | 98.6 |
| 60 | 95.9 | 99.1 | 90.4 | 97.4 | 98.0 | 99.2 | 95.2 | 98.9 | 96.6 | 98.8 |
| 70 | 96.3 | 99.3 | 90.9 | 97.5 | 98.2 | 99.4 | 95.6 | 98.9 | 96.9 | 99.0 |
| 80 | 96.7 | 99.5 | 91.1 | 97.9 | 98.4 | 99.7 | 95.6 | 98.9 | 97.1 | 99.2 |
| 90 | 97.0 | 99.6 | 91.7 | 98.1 | 98.5 | 99.7 | 95.8 | 99.2 | 97.4 | 99.4 |
| 100 | 97.2 | 100.0 | 92.0 | 100.0 | 98.7 | 100.0 | 96.1 | 100.0 | 97.6 | 100.0 |
| 110 | 97.6 | 100.0 | 92.2 | 100.0 | 98.9 | 100.0 | 96.6 | 100.0 | 97.9 | 100.0 |
| 120 | 97.9 | 100.0 | 92.5 | 100.0 | 99.1 | 100.0 | 96.8 | 100.0 | 98.2 | 100.0 |
| 130 | 98.2 | 100.0 | 93.4 | 100.0 | 99.2 | 100.0 | 96.9 | 100.0 | 98.4 | 100.0 |
| 140 | 98.5 | 100.0 | 94.7 | 100.0 | 99.3 | 100.0 | 97.3 | 100.0 | 98.7 | 100.0 |
| 150 | 98.9 | 100.0 | 95.8 | 100.0 | 99.5 | 100.0 | 97.7 | 100.0 | 99.0 | 100.0 |
| 160 | 99.3 | 100.0 | 98.0 | 100.0 | 99.7 | 100.0 | 98.1 | 100.0 | 99.4 | 100.0 |
| 170 | 99.5 | 100.0 | 98.8 | 100.0 | 99.8 | 100.0 | 99.0 | 100.0 | 99.6 | 100.0 |
| 180 | 99.7 | 100.0 | 99.7 | 100.0 | 100.0 | 100.0 | 99.4 | 100.0 | 99.8 | 100.0 |
| 190 | 99.9 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 99.9 | 100.0 |
| 200 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Claim Counts | 16,289 | 4,862 | 1,367 | 1,333 | 14,381 | 1,432 | 968 | 378 | 33,005 | 8,005 |

## EXHIBIT 6

### CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE

### HOMEOWNERS: FIRE LOSSES ONLY

| Loss as a Percent of Insured Value | Frame-Protected | | Frame-Unprotected | | Brick-Protected | | Brick-Unprotected | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 | Hartford 1984–88 | INA 1960 |
| 5% | 23.2% | 42.8% | 13.6% | 26.9% | 32.3% | 39.3% | 18.4% | 28.8% | 25.1% | 38.1% |
| 10 | 30.9 | 54.2 | 19.0 | 35.9 | 39.9 | 49.4 | 23.6 | 39.2 | 32.5 | 48.7 |
| 20 | 41.1 | 67.4 | 27.6 | 47.8 | 49.2 | 61.9 | 31.6 | 52.2 | 42.2 | 61.5 |
| 30 | 48.8 | 76.8 | 35.2 | 57.5 | 56.4 | 71.7 | 38.3 | 63.1 | 49.7 | 71.1 |
| 40 | 55.6 | 83.9 | 42.3 | 65.7 | 62.9 | 79.7 | 44.7 | 70.6 | 56.4 | 78.6 |
| 50 | 61.7 | 89.0 | 49.1 | 73.2 | 68.3 | 86.5 | 50.6 | 77.5 | 62.3 | 84.6 |
| 60 | 67.1 | 92.7 | 55.3 | 79.6 | 73.1 | 91.9 | 56.1 | 82.8 | 67.6 | 89.3 |
| 70 | 72.1 | 95.5 | 61.2 | 85.7 | 77.3 | 96.0 | 61.3 | 87.3 | 72.4 | 93.1 |
| 80 | 76.5 | 97.6 | 66.7 | 91.3 | 81.3 | 98.3 | 66.3 | 91.8 | 76.8 | 96.1 |
| 90 | 80.6 | 99.1 | 71.9 | 95.7 | 84.9 | 99.3 | 71.2 | 95.9 | 80.9 | 98.2 |
| 100 | 84.2 | 100.0 | 76.7 | 100.0 | 88.0 | 100.0 | 75.9 | 100.0 | 84.5 | 100.0 |
| 110 | 87.5 | 100.0 | 81.3 | 100.0 | 90.8 | 100.0 | 80.1 | 100.0 | 87.7 | 100.0 |
| 120 | 90.3 | 100.0 | 85.8 | 100.0 | 93.1 | 100.0 | 84.0 | 100.0 | 90.6 | 100.0 |
| 130 | 92.7 | 100.0 | 89.9 | 100.0 | 94.9 | 100.0 | 87.7 | 100.0 | 93.0 | 100.0 |
| 140 | 94.8 | 100.0 | 93.4 | 100.0 | 96.5 | 100.0 | 91.1 | 100.0 | 95.1 | 100.0 |
| 150 | 96.5 | 100.0 | 96.2 | 100.0 | 97.9 | 100.0 | 94.2 | 100.0 | 96.8 | 100.0 |
| 160 | 97.7 | 100.0 | 98.2 | 100.0 | 98.8 | 100.0 | 96.8 | 100.0 | 98.1 | 100.0 |
| 170 | 98.6 | 100.0 | 99.3 | 100.0 | 99.4 | 100.0 | 98.5 | 100.0 | 98.9 | 100.0 |
| 180 | 99.2 | 100.0 | 99.8 | 100.0 | 99.7 | 100.0 | 99.7 | 100.0 | 99.4 | 100.0 |
| 190 | 99.6 | 100.0 | 100.0 | 100.0 | 99.9 | 100.0 | 100.0 | 100.0 | 99.7 | 100.0 |
| 200 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Loss Dollars | $94,022,331 | $1,981,703 | $12,798,859 | $726,819 | $49,739,143 | $695,122 | $5,873,890 | $221,391 | $162,434,223 | $3,625,035 |

$200,000 excess of $200,000 layer. An obvious solution to this problem would be for the ceding company to purchase an additional layer of reinsurance protection.

If we look at the revised exposure rate for the $75,000 excess of $25,000 layer (Exhibit 4), the increase over the Salzmann Table estimate is less substantial, with a revised rate of 27.03%, compared to a Salzmann Table estimate of 15.05%.

## 7. HOMEOWNERS—ADDITIONAL PROPERTY LOSS DISTRIBUTIONS

In order to address the second problem associated with using the Salzmann Tables as a reinsurance pricing tool, an evaluation of homeowners wind losses was made. This was identical in every respect to the fire loss study, except for the removal of the protected/unprotected data split. Cumulative claim count and loss dollar distributions are shown in Exhibit 7. Clearly, the distribution of wind losses is dramatically different from that of the fire losses. However, it should be noted that the 1984–1988 period did not contain any significant catastrophes, so that the distributions shown in Exhibit 7 should be considered as essentially "non-catastrophe" wind distributions. By performing a review of the wind losses resulting from Hurricane Hugo (1989), one indication of the loss distribution resulting from a major windstorm catastrophe can be developed (Exhibit 8). Finally, all other property causes of loss were considered on a combined basis, with the resulting loss distribution being shown in Exhibit 9.

By comparing the loss cost distributions derived for the various causes of loss, it is clear that the Salzmann Tables, which consider fire losses only, are inappropriate for use as a reinsurance pricing tool.

## TABLE 3

CUMULATIVE LOSS COST DISTRIBUTIONS BY PERCENT OF INSURED VALUE

| Loss Size as a Percent of Insured Value | Fire | Wind | Hurricane Hugo | All Other |
|---|---|---|---|---|
| 5% | 25.1% | 87.1% | 54.0% | 73.5% |
| 10 | 32.5 | 93.4 | 70.0 | 81.0 |
| 20 | 42.2 | 95.9 | 81.5 | 86.0 |
| 30 | 49.7 | 96.9 | 86.8 | 88.6 |
| 40 | 56.4 | 97.6 | 90.1 | 90.4 |
| 50 | 62.3 | 98.0 | 92.5 | 92.0 |
| 60 | 67.6 | 98.4 | 94.1 | 93.2 |
| 70 | 72.4 | 98.7 | 95.5 | 94.3 |
| 80 | 76.8 | 98.9 | 96.5 | 95.3 |
| 90 | 80.9 | 99.1 | 97.4 | 96.1 |
| 100 | 84.5 | 99.2 | 98.2 | 96.9 |

## 8. HOMEOWNERS EXPOSURE RATING—AN EXAMPLE

Given the large differences that exist between the fire, wind, and all other loss distributions, the question becomes one of how this information can be combined into an effective rating plan for homeowners property excess-of-loss reinsurance. One possible method is outlined in the following example:

1. Obtain the ceding company's historical distribution of homeowners losses by cause of loss. For example, fire losses may represent 35% of total incurred losses historically, while wind losses (non-catastrophes) equal 15%, other property losses (theft, freeze, water, etc.) equal 35%, and liability losses equal 15%.

2. Calculate exposure rates for the reinsurance layer, using each of the fire, wind, and other property loss tables separately. It should be noted that, in this example, the exposure rates have been calculated using the "total" (all construction types/all protection

## EXHIBIT 7

### CUMULATIVE CLAIM COUNT AND LOSS COST DISTRIBUTIONS BY PERCENT OF INSURED VALUE

### HOMEOWNERS: WIND LOSSES ONLY

| Loss Size as a Percent of Insured Value | Frame | | Brick | | Total | |
|---|---|---|---|---|---|---|
| | Claim Counts | Losses | Claim Counts | Losses | Claim Counts | Losses |
| 5% | 95.0% | 86.7% | 94.8% | 87.8% | 94.9% | 87.1% |
| 10 | 98.9 | 93.1 | 99.1 | 93.8 | 99.0 | 93.4 |
| 20 | 99.7 | 95.6 | 99.7 | 96.3 | 99.7 | 95.9 |
| 30 | 99.8 | 96.6 | 99.8 | 97.3 | 99.8 | 96.9 |
| 40 | 99.9 | 97.3 | 99.9 | 97.9 | 99.9 | 97.6 |
| 50 | 99.9 | 97.8 | 99.9 | 98.3 | 99.9 | 98.0 |
| 60 | 99.9 | 98.2 | 99.9 | 98.6 | 99.9 | 98.4 |
| 70 | 99.9 | 98.5 | 99.9 | 98.8 | 99.9 | 98.7 |
| 80 | 99.9 | 98.8 | 100.0 | 99.1 | 100.0 | 98.9 |
| 90 | 100.0 | 99.0 | 100.0 | 99.2 | 100.0 | 99.1 |
| 100 | 100.0* | 99.2 | 100.0** | 99.3 | 100.0 | 99.2 |
| 110 | 100.0 | 99.4 | 100.0 | 99.4 | 100.0 | 99.4 |
| 120 | 100.0 | 99.5 | 100.0 | 99.6 | 100.0 | 99.5 |
| 130 | 100.0 | 99.6 | 100.0 | 99.7 | 100.0 | 99.6 |
| 140 | 100.0 | 99.7 | 100.0 | 99.8 | 100.0 | 99.7 |
| 150 | 100.0 | 99.8 | 100.0 | 99.8 | 100.0 | 99.8 |
| 160 | 100.0 | 99.9 | 100.0 | 99.9 | 100.0 | 99.9 |
| 170 | 100.0 | 99.9 | 100.0 | 99.9 | 100.0 | 99.9 |
| 180 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 190 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 200 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Claim Counts/ Loss Dollars | 57,844 | $70,170,726 | 27,698 | $41,283,311 | 85,542 | $111,454,037 |

* .04% of claims exceed 100% of insured value

** .03% of claims exceed 100% of insured value

## EXHIBIT 8

### CUMULATIVE CLAIM COUNT AND LOSS COST DISTRIBUTIONS BY PERCENT OF INSURED VALUE

### HOMEOWNERS: HURRICANE HUGO LOSSES ONLY

| Loss Size as a Percent of Insured Value | Frame | | Brick | | Total | |
|---|---|---|---|---|---|---|
| | Claim Counts | Losses | Claim Counts | Losses | Claim Counts | Losses |
| 5% | 69.2% | 47.0% | 74.4% | 59.9% | 72.3% | 54.0% |
| 10 | 86.5 | 62.3 | 90.2 | 76.6 | 88.7 | 70.0 |
| 20 | 94.7 | 75.1 | 97.3 | 87.0 | 96.2 | 81.5 |
| 30 | 96.9 | 81.5 | 98.5 | 91.2 | 97.8 | 86.8 |
| 40 | 97.8 | 85.8 | 99.0 | 93.8 | 98.5 | 90.1 |
| 50 | 98.6 | 89.0 | 99.4 | 95.5 | 99.1 | 92.5 |
| 60 | 98.7 | 91.3 | 99.6 | 96.4 | 99.2 | 94.1 |
| 70 | 98.9 | 93.5 | 99.7 | 97.2 | 99.3 | 95.5 |
| 80 | 99.2 | 95.0 | 99.7 | 97.8 | 99.5 | 96.5 |
| 90 | 99.3 | 96.2 | 99.7 | 98.4 | 99.5 | 97.4 |
| 100 | 99.4 | 97.3 | 99.7 | 99.0 | 99.6 | 98.2 |
| 110 | 99.6 | 98.2 | 99.9 | 99.5 | 99.7 | 98.9 |
| 120 | 99.7 | 98.7 | 100.0 | 99.8 | 99.8 | 99.3 |
| 130 | 99.7 | 99.1 | 100.0 | 99.8 | 99.9 | 99.5 |
| 140 | 99.8 | 99.5 | 100.0 | 99.9 | 99.9 | 99.7 |
| 150 | 99.8 | 99.7 | 100.0 | 99.9 | 99.9 | 99.8 |
| 160 | 99.9 | 99.9 | 100.0 | 100.0 | 100.0 | 99.9 |
| 170 | 99.9 | 99.9 | 100.0 | 100.0 | 100.0 | 100.0 |
| 180 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 190 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 200 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Claim Counts/ Loss Dollars | 1,869 | $8,429,553 | 2,713 | $9,943,900 | 4,582 | $18,373,453 |

## EXHIBIT 9

### CUMULATIVE CLAIM COUNT AND LOSS COST DISTRIBUTIONS BY PERCENT OF INSURED VALUE

### HOMEOWNERS: OTHER PROPERTY LOSSES ONLY

| Loss Size as a Percent of Insured Value | Frame | | Brick | | Total | |
|---|---|---|---|---|---|---|
| | Claim Counts | Losses | Claim Counts | Losses | Claim Counts | Losses |
| 5% | 94.8% | 72.5% | 94.1% | 75.6% | 94.6% | 73.5% |
| 10 | 98.3 | 79.8 | 98.1 | 83.3 | 98.2 | 81.0 |
| 20 | 99.3 | 84.9 | 99.4 | 88.2 | 99.3 | 86.0 |
| 30 | 99.5 | 87.6 | 99.6 | 90.5 | 99.6 | 88.6 |
| 40 | 99.6 | 89.6 | 99.7 | 92.0 | 99.7 | 90.4 |
| 50 | 99.7 | 91.3 | 99.8 | 93.3 | 99.7 | 92.0 |
| 60 | 99.7 | 92.7 | 99.8 | 94.3 | 99.8 | 93.2 |
| 70 | 99.8 | 93.9 | 99.8 | 95.1 | 99.8 | 94.3 |
| 80 | 99.8 | 95.0 | 99.9 | 95.9 | 99.8 | 95.3 |
| 90 | 99.8 | 95.9 | 99.9 | 96.6 | 99.8 | 96.1 |
| 100 | 99.8 | 96.7 | 99.9 | 97.2 | 99.9 | 96.9 |
| 110 | 99.9 | 97.4 | 99.9 | 97.7 | 99.9 | 97.5 |
| 120 | 99.9 | 98.0 | 99.9 | 98.2 | 99.9 | 98.1 |
| 130 | 99.9 | 98.5 | 99.9 | 98.6 | 99.9 | 98.6 |
| 140 | 99.9 | 99.0 | 99.9 | 99.0 | 99.9 | 99.0 |
| 150 | 99.9 | 99.3 | 100.0 | 99.3 | 99.9 | 99.3 |
| 160 | 100.0 | 99.6 | 100.0 | 99.6 | 100.0 | 99.6 |
| 170 | 100.0 | 99.8 | 100.0 | 99.7 | 100.0 | 99.7 |
| 180 | 100.0 | 99.9 | 100.0 | 99.8 | 100.0 | 99.8 |
| 190 | 100.0 | 99.9 | 100.0 | 99.9 | 100.0 | 99.9 |
| 200 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Claim Counts/ Loss Dollars | 122,737 | $191,655,726 | 66,250 | $98,628,340 | 188,987 | $290,284,066 |

classes) loss cost distributions for each cause of loss. This reflects the fact that reinsurers often have difficulty obtaining information regarding a ceding company's distribution of homeowners business by construction type or protection class. If this information is available for a particular ceding company, an additional step would be added to this exposure rating process, with the various construction/protection loss cost distributions being used to calculate an exposure rate for each cause of loss.

3. Produce a final exposure rate by weighting the exposure rates produced in Step 2 by the percentage weights obtained in Step 1. In the example:

| Cause of Loss | Loss Weights | Exposure Rates* | |
|---|---|---|---|
| | | $75,000 Excess of $25,000 | $100,000 Excess of $100,000 |
| Fire | 35% | 26.55% | 7.26% |
| Wind | 15 | 1.99 | 0.40 |
| Other Property | 35 | 6.59 | 1.53 |
| Liability | 15 | N/A | N/A |
| Final Exposure Rate: | | 11.90% | 3.14% |

* Derived from total loss distributions in Exhibit 6 (Fire), Exhibit 7 (Wind), and Exhibit 9 (All Others).

This proposed rating methodology has several advantages over simply using the Salzmann Tables. First, it explicitly recognizes the fact that all causes of loss need to be considered, not just fire. If fire losses are only 35% of total losses historically, the exposure rate derived by application of the fire tables should only receive a 35% weight. Second, it recognizes that each cause of loss has its own unique loss distribution. Finally, by considering all of the homeowners property coverages (A–D), the revised tables are directly applicable to the rating of property excess-of-loss reinsurance, whereas the Salzmann Tables, based on building losses only, are not.

## 9. COMMERCIAL PROPERTY

In order to address the third problem associated with using the Salzmann Tables as a reinsurance pricing tool, an evaluation of commercial property loss experience was also made. In order to keep things on a manageable level, this analysis was performed on only the small commercial package segment, the so-called "Main Street" book that virtually every primary company professes to write, and virtually every reinsurer has targeted as its "niche." This analysis was further limited to only those policies covering a single location, so that losses and insured values (policy limits) would be directly comparable.

In addition to the multiple location problem, several other complicating factors exist in any analysis of commercial property loss experience. First, the coverages provided are not standard across all commercial property policies. Due to the fact that many commercial buildings are leased to tenants, some commercial policies (the owner's) may cover the structure itself, while other policies (the tenant's) may only include contents coverage. Second, even for those policies that provide both building and contents coverages, there isn't the same direct relationship between the building limit and the contents limit as there is with homeowners risks.

This lack of a direct percentage relationship with the building limit also extends to the time element (business interruption) coverages, which would typically be included in the definition of loss under a property excess-of-loss reinsurance agreement. A further complicating factor to consider is that while the population of homeowners risks represents a very homogeneous set of exposures (notwithstanding any protection class and/or construction type considerations), under a commercial property policy the class of business (e.g., retail, office, restaurant, etc.) being covered introduces an additional variable into the rating equation, resulting in a less homogeneous set of exposures. Finally, the range of insured values being covered by commercial property policies is much greater than that of homeowners, making it necessary to re-examine the question of whether the relationship between size of loss and insured value is constant across the entire range of insured values.

One possible approach to address the absence of a uniform relationship among the limits purchased by coverage within a single policy would be to segregate the historical loss experience into a number of building/contents/time element limits combinations, with cumulative loss cost distributions then being derived for each limits combination:

| Building Limit | Contents Limit | Time Element Limit |
|---|---|---|
| $ 0 | $10,000; 20,000; . . . 500,000 | $10,000; 20,000; . . . 500,000 |
| 25,000 | 0; 20,000; . . . 500,000 | 0; 10,000; . . . 500,000 |
| 50,000 | 0; 10,000; . . . 1,000,000 | 0; 10,000; . . . 1,000,000 |
| . | . . . | . . . |
| . | . . . | . . . |
| . | . . . | . . . |
| 1,000,000 | 0; 10,000; . . . 10,000,000 | 0; 10,000; . . . 10,000,000 |

The result of this exercise would be a separate "Salzmann Table" for each possible building/contents/time element limits combination. To then perform an exposure rating calculation, the only input required would be the ceding company's distribution of premium across the various limits combinations. Clearly, while this approach might produce the most accurate commercial property rating tool possible, a massive amount of loss data would be required to create such a system.

One possible means of condensing the analysis described above would be to produce a single combined building/contents/time element loss distribution for each class of commercial business; e.g., retail/wholesale; service/office; apartment/condominium; and restaurant. The assumption being made here is that since the underlying loss exposures are similar for each risk within a given class of business, there is likely to be a consistent relationship between the relative magnitudes of the building, contents, and time element limits required. By comparing the total loss generated from these three coverages to the total limits purchased, a cumulative loss cost distribution can be developed for each class of business.

Exhibits 10, 11, 12, and 13 detail the cumulative loss cost distributions derived for fire, wind, all other property, and Hurricane Hugo losses, with individual distributions having been developed for the four major classes of business. Several points should be noted regarding these distributions. First, the historical data indicates that class of business is a variable that should be considered in the reinsurance rating mechanism, as significant differences in the cumulative loss cost distributions have been developed. Second, as with the homeowners data, the cumulative loss cost distributions vary significantly by cause of loss. Finally, by comparing the commercial property loss cost distributions to both the Salzmann Table and the homeowners table, the need for separate, commercial property-only reinsurance rating tables becomes obvious.

## TABLE 4

CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE
FIRE LOSSES ONLY

| Loss Cost as a % of Insured Value | Hartford Commercial Property Total | Hartford Homeowners Total | Salzmann Table Total |
|---|---|---|---|
| 5% | 51.2% | 25.1% | 38.1% |
| 10 | 65.1 | 32.5 | 48.7 |
| 20 | 79.9 | 42.2 | 61.5 |
| 30 | 87.9 | 49.7 | 71.1 |
| 40 | 92.8 | 56.4 | 78.6 |
| 50 | 95.9 | 62.3 | 84.6 |
| 60 | 97.3 | 67.6 | 89.3 |
| 70 | 98.3 | 72.4 | 93.1 |
| 80 | 99.1 | 76.8 | 96.1 |
| 90 | 99.7 | 80.9 | 98.2 |
| 100 | 100.0 | 84.5 | 100.0 |

## EXHIBIT 10

### CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE COMMERCIAL PROPERTY: FIRE LOSSES ONLY

| Loss as a Percent of Insured Value | Retail/ Wholesale | Service/ Office | Apartment/ Condominium | Restaurant | Total |
|---|---|---|---|---|---|
| 5% | 44.2% | 52.6% | 60.0% | 58.9% | 51.2% |
| 10 | 58.4 | 66.7 | 72.1 | 73.1 | 65.1 |
| 20 | 75.3 | 80.5 | 83.5 | 87.5 | 79.9 |
| 30 | 85.2 | 88.4 | 89.7 | 93.3 | 87.9 |
| 40 | 91.3 | 93.4 | 93.8 | 96.1 | 92.8 |
| 50 | 95.2 | 96.6 | 96.4 | 97.3 | 95.9 |
| 60 | 97.1 | 97.9 | 97.6 | 98.3 | 97.3 |
| 70 | 98.2 | 98.6 | 98.7 | 99.0 | 98.3 |
| 80 | 99.0 | 99.2 | 99.6 | 99.5 | 99.1 |
| 90 | 99.6 | 99.7 | 99.8 | 99.7 | 99.7 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Loss Dollars | $43,970,963 | $47,812,881 | $11,548,944 | $18,657,002 | $121,989,790 |
| Total Claim Counts | 6,367 | 8,280 | 1,895 | 3,475 | 20,017 |

## EXHIBIT 11

### CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE COMMERCIAL PROPERTY: WIND LOSSES ONLY

| Loss as a Percent of Insured Value | Retail/ Wholesale | Service/ Office | Apartment/ Condominium | Restaurant | Total |
|---|---|---|---|---|---|
| 5% | 81.4% | 79.4% | 82.5% | 90.6% | 81.9% |
| 10 | 87.3 | 87.2 | 85.8 | 93.6 | 87.9 |
| 20 | 91.7 | 94.5 | 90.1 | 96.2 | 93.2 |
| 30 | 94.3 | 97.9 | 93.2 | 97.3 | 96.0 |
| 40 | 96.0 | 98.8 | 96.2 | 98.1 | 97.5 |
| 50 | 97.6 | 99.3 | 99.2 | 98.4 | 98.6 |
| 60 | 98.5 | 99.6 | 100.0 | 98.8 | 99.2 |
| 70 | 98.9 | 99.9 | 100.0 | 99.1 | 99.5 |
| 80 | 99.3 | 99.9 | 100.0 | 99.5 | 99.7 |
| 90 | 99.6 | 100.0 | 100.0 | 99.8 | 99.9 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Loss Dollars | $4,782,299 | $5,583,213 | $1,719,718 | $1,848,131 | $13,933,361 |
| Total Claim Counts | 1,547 | 1,832 | 625 | 764 | 4,768 |

## EXHIBIT 12

### CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE COMMERCIAL PROPERTY: ALL OTHER PROPERTY LOSSES

| Loss as a Percent of Insured Value | Retail/ Wholesale | Service/ Office | Apartment/ Condominium | Restaurant | Total |
|---|---|---|---|---|---|
| 5% | 74.7% | 76.4% | 96.7% | 95.3% | 79.0% |
| 10 | 85.4 | 86.2 | 99.1 | 97.7 | 87.9 |
| 20 | 93.0 | 93.1 | 99.5 | 98.7 | 94.1 |
| 30 | 96.2 | 95.9 | 99.6 | 99.1 | 96.6 |
| 40 | 98.0 | 97.8 | 99.7 | 99.4 | 98.1 |
| 50 | 98.9 | 98.6 | 99.8 | 99.7 | 98.9 |
| 60 | 99.3 | 99.1 | 99.8 | 99.8 | 99.3 |
| 70 | 99.6 | 99.4 | 99.9 | 99.9 | 99.6 |
| 80 | 99.8 | 99.6 | 100.0 | 100.0 | 99.8 |
| 90 | 99.9 | 99.8 | 100.0 | 100.0 | 99.9 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Loss Dollars | $23,299,486 | $18,959,591 | $1,226,169 | $8,020,334 | $51,505,580 |
| Total Claim Counts | 11,964 | 10,842 | 823 | 5,525 | 29,154 |

## EXHIBIT 13

### CUMULATIVE LOSS COST DISTRIBUTION BY PERCENT OF INSURED VALUE COMMERCIAL PROPERTY: HURRICANE HUGO LOSSES ONLY

| Loss as a Percent of Insured Value | Retail/ Wholesale | Service/ Office | Apartment/ Condominium | Restaurant | Total |
|---|---|---|---|---|---|
| 5% | | | | | 66.3% |
| 10 | | | | | 80.6 |
| 20 | | | | | 90.8 |
| 30 | | Individual Class of Business loss | | | 96.3 |
| 40 | | cost distributions were not available. | | | 97.9 |
| 50 | | | | | 98.8 |
| 60 | | | | | 99.2 |
| 70 | | | | | 99.6 |
| 80 | | | | | 99.8 |
| 90 | | | | | 99.9 |
| 100 | | | | | 100.0 |
| Total Loss Dollars | | | | | $6,941,155 |
| Total Claim Counts | | | | | 946 |

## 10. COMMERCIAL PROPERTY EXPOSURE RATING—AN EXAMPLE

The commercial property exposure rating example is very similar to that set forth for homeowners. The steps involved in the exposure rating calculation are as follows:

1. For each commercial class of business written by the ceding company, obtain its distribution of premium by policy limit, with the policy limit being a combined building/contents/time element limit. For this example, assume the following premium distribution:

| Policy Limit | Retail/ Wholesale | Service/ Office | Apartment/ Condominiums | Restaurant | Total |
|---|---|---|---|---|---|
| $ 25,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 200,000 |
| 50,000 | 50,000 | 50,000 | 50,000 | 50,000 | 200,000 |
| 75,000 | 50,000 | 50,000 | 50,000 | 50,000 | 200,000 |
| 100,000 | 50,000 | 50,000 | 50,000 | 50,000 | 200,000 |
| 200,000 | 50,000 | 50,000 | 50,000 | 50,000 | 200,000 |
| Total | $250,000 | $250,000 | $250,000 | $250,000 | $1,000,000 |

2. Obtain the ceding company's historical distribution of commercial property losses by cause of loss. While the distribution by cause of loss may vary by class of business, for simplicity it will be assumed that for each class of business, fire losses represent 40% of total incurred losses, while wind losses (non-catastrophes) equal 10%, other property losses equal 15%, and liability losses equal 35%.

3. For each class of business, calculate exposure rates for the reinsurance layer, using each of the fire, wind, and other property loss tables separately.

4. For each class of business, produce a weighted-average exposure rate by weighting the exposure rates produced in Step 3 by the percentage weights obtained in Step 2. For example, for the retail/wholesale class of business:

| Cause of Loss | Loss Weights | Exposure Rates: $75,000 Excess of $25,000 | Exposure Rates: $100,000 Excess of $100,000 |
|---|---|---|---|
| Fire | 40% | 11.53% | 0.79% |
| Wind | 10 | 3.91 | 0.40 |
| Other Property | 15 | 3.51 | 0.18 |
| Liability | 35 | N/A | N/A |
| Weighted-Average Exposure Rate: | | 5.53% | 0.38% |

5. At this point, each class of business has had a weighted-average (by cause of loss) exposure rate developed. These individual class of business exposure rates can now be combined into a total commercial property exposure rate:

| | Class of Business Premium Weights | Exposure Rates $75,000 Excess of $25,000 | Exposure Rates $100,000 Excess of $100,000 |
|---|---|---|---|
| Retail/Wholesale | 25% | 5.53% | 0.38% |
| Service/Office | 25 | 4.44 | 0.27 |
| Apartment/ Condominium | 25 | 3.61 | 0.25 |
| Restaurant | 25 | 2.84 | 0.21 |
| Total Commercial Property Exposure Rate: | | 4.11% | 0.28% |

As can be seen, the differences in exposure rates by class of business can be substantial.

This proposed rating methodology for commercial property explicitly accounts for differing size-of-loss distributions by cause of loss, while also recognizing the fact that these size-of-loss distributions have historically differed by class of business as well. While this represents a significant improvement over simply using the Salzmann Tables, there are still a number of unresolved issues that deserve further research.

The first issue is that of whether the size-of-loss distribution for contents-only policies differs significantly from that for policies containing building coverage. Based on the historical data, there does not appear to be a significant difference in these size-of-loss distributions. Exhibit 14 displays size-of-loss distributions for the retail/wholesale class of business for fire losses only. By comparing the size-of-loss distributions within a comparable amount of insurance range, it can be seen that the distributions are similar for the two types of coverages.

A second issue is that of whether the relationship between size of loss and insured value is constant across the entire range of insured values. Exhibit 14 indicates that the relationship is not constant for retail/wholesale fire losses, while Exhibit 15 indicates that on a total book of business basis, the relationship between size of loss and insured value is not constant for any cause of loss. These findings suggest that not only should class of business be considered in the rating methodology, but also that amount of insurance must be considered, through the implementation of separate exposure rating tables by amount of insurance for a given class of business. Exhibits 16, 17, and 18 provide information on these distributions by class of business and cause of loss.

A final issue is that not all commercial property classes of business have been considered in this study. Examples of classes that warrant additional study include manufacturing/contracting risks, and institutional risks (hospitals, schools, churches). By expanding the number of classes of commercial property risks, a more comprehensive and effective property exposure rating tool could be developed.

## 11. CONCLUSION

In the ongoing debate of art versus science, reinsurance rating remains as much of an art as ever. However, the continued use of Salzmann Tables, under the guise of introducing "science" into the rating equation, is ill-advised. Salzmann Tables are being used inappropriately in many property excess pricing applications today. While this may not pose a serious problem for the working layers of a treaty, due to the existence of a credible experience rate, their continued use on nonworking layers is inappropriate. Through the introduction of the revised homeowners loss tables, and the introduction of the commercial property tables, it is hoped that reinsurance actuaries and underwriters can move one step closer to the "science" end of the rating spectrum.

## REFERENCES

[1] Ruth E. Salzmann, "Rating by Layer of Insurance," *PCAS*, Vol. L, 1963, p. 14.

[2] Gary S. Patrik and Isaac Mashitz, "Credibility for Treaty Reinsurance Excess Pricing," *Pricing*, CAS Discussion Paper Program, Vol. I, 1990, p. 317.

## EXHIBIT 14

### Loss Cost Distribution as a Percent of Insured Value
### Retail/Wholesale Risks: Fire Losses Only

| Loss as a Percent of Insured Value | $1,000 to $25,000 Policy Limits Range | | $25,000 to $100,000 Policy Limits Range | | $100,000 to $300,000 Policy Limits Range | | $300,000 to $1,000,000 Policy Limits Range | | Greater than $1,000,000 Policy Limits Range | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Contents Only Policies | All Other Policies | Contents Only Policies | All Other Policies | Contents Only Policies | All Other Policies | Contents Only Policies | All Other Policies | Contents Only Policies | All Other Policies |
| 5% | 22.7% | 19.7% | 38.3% | 24.1% | 41.9% | 41.9% | 49.4% | 45.4% | 93.9% | 59.8% |
| 10 | 36.2 | 35.9 | 52.2 | 34.4 | 56.1 | 55.9 | 63.3 | 60.1 | 100.0 | 74.9 |
| 20 | 52.7 | 60.4 | 68.3 | 50.5 | 74.1 | 72.9 | 78.5 | 77.6 | 100.0 | 91.7 |
| 30 | 64.6 | 76.8 | 78.8 | 62.5 | 84.8 | 83.1 | 86.8 | 88.3 | 100.0 | 97.9 |
| 40 | 73.9 | 83.8 | 86.1 | 71.2 | 91.3 | 88.9 | 94.3 | 94.5 | 100.0 | 100.0 |
| 50 | 81.5 | 86.5 | 92.0 | 78.9 | 95.7 | 93.1 | 98.3 | 98.1 | 100.0 | 100.0 |
| 60 | 86.5 | 89.2 | 94.6 | 84.5 | 97.6 | 95.8 | 99.4 | 99.5 | 100.0 | 100.0 |
| 70 | 90.5 | 91.9 | 96.4 | 89.1 | 98.5 | 97.3 | 100.0 | 99.9 | 100.0 | 100.0 |
| 80 | 94.2 | 94.6 | 98.0 | 93.3 | 99.2 | 98.6 | 100.0 | 100.0 | 100.0 | 100.0 |
| 90 | 97.4 | 97.3 | 99.1 | 96.9 | 99.7 | 99.6 | 100.0 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Total Loss Dollars | $1,238,692 | $25,598 | $6,002,156 | $2,246,277 | $9,698,540 | $5,201,484 | $3,892,854 | $10,049,175 | $157,517 | $5,458,670 |
| Total Claim Counts | 364 | 6 | 1,451 | 270 | 1,396 | 884 | 470 | 1,060 | 31 | 435 |

## EXHIBIT 15

### LOSS COST DISTRIBUTION AS A PERCENT OF INSURED VALUE
### ALL COMMERCIAL PROPERTY CLASSES OF BUSINESS

Fire Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 24.2% | 37.5% | 45.0% | 52.5% | 75.3% |
| 10 | 37.9 | 50.8 | 58.9 | 67.1 | 88.0 |
| 20 | 54.8 | 66.8 | 75.6 | 82.4 | 96.6 |
| 30 | 66.2 | 77.2 | 85.3 | 90.4 | 99.3 |
| 40 | 75.3 | 84.3 | 91.2 | 95.3 | 99.9 |
| 50 | 82.7 | 89.8 | 95.0 | 98.0 | 99.9 |
| 60 | 87.5 | 92.9 | 96.8 | 99.0 | 99.9 |
| 70 | 91.2 | 95.2 | 97.9 | 99.4 | 99.9 |
| 80 | 94.5 | 97.1 | 98.7 | 99.6 | 99.9 |
| 90 | 97.5 | 98.6 | 99.3 | 99.7 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Wind Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 29.0% | 63.3% | 84.3% | 82.5% | 99.1% |
| 10 | 45.2 | 74.5 | 91.9 | 87.0 | 100.0 |
| 20 | 65.0 | 82.8 | 97.3 | 92.5 | 100.0 |
| 30 | 76.8 | 87.4 | 99.5 | 95.8 | 100.0 |
| 40 | 84.7 | 90.4 | 100.0 | 97.6 | 100.0 |
| 50 | 89.7 | 92.8 | 100.0 | 99.3 | 100.0 |
| 60 | 93.1 | 94.8 | 100.0 | 100.0 | 100.0 |
| 70 | 95.6 | 96.6 | 100.0 | 100.0 | 100.0 |
| 80 | 97.3 | 97.9 | 100.0 | 100.0 | 100.0 |
| 90 | 98.7 | 99.2 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

All Other Losses
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 38.9% | 64.0% | 82.8% | 92.0% | 98.9% |
| 10 | 56.9 | 78.5 | 91.3 | 96.3 | 100.0 |
| 20 | 74.6 | 89.8 | 96.2 | 98.3 | 100.0 |
| 30 | 83.9 | 94.2 | 97.8 | 99.3 | 100.0 |
| 40 | 89.5 | 97.0 | 98.7 | 100.0 | 100.0 |
| 50 | 93.3 | 98.3 | 99.2 | 100.0 | 100.0 |
| 60 | 95.7 | 99.0 | 99.5 | 100.0 | 100.0 |
| 70 | 97.3 | 99.4 | 99.8 | 100.0 | 100.0 |
| 80 | 98.4 | 99.7 | 99.9 | 100.0 | 100.0 |
| 90 | 99.3 | 99.9 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Underlying Loss Dollars/Claim Counts
Amount of Insurance Ranges

| | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| Fire: Loss Dollars | $3,911,408 | $17,945,684 | $36,261,297 | $44,669,984 | $19,201,417 |
| Fire: Claim Counts | 992 | 4,255 | 6,404 | 6,014 | 2,352 |
| Wind: Loss Dollars | $250,442 | $1,894,150 | $4,051,375 | $5,736,626 | $2,000,768 |
| Wind: Claim Counts | 110 | 834 | 1,694 | 1,604 | 526 |
| Other: Loss Dollars | $3,150,320 | $14,151,551 | $16,043,644 | $12,956,945 | $5,203,120 |
| Other: Claim Counts | 1,971 | 8,060 | 9,150 | 7,176 | 2,797 |

## EXHIBIT 16

### Loss Cost Distribution as a Percent of Insured Value
### Retail/Wholesale Risks Only

Fire Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 22.7% | 35.1% | 41.9% | 46.5% | 60.8% |
| 10 | 36.2 | 48.3 | 56.1 | 61.0 | 75.6 |
| 20 | 52.9 | 64.4 | 73.7 | 77.9 | 91.9 |
| 30 | 64.9 | 75.2 | 84.2 | 87.9 | 98.0 |
| 40 | 74.0 | 82.8 | 90.4 | 94.4 | 100.0 |
| 50 | 81.6 | 89.1 | 94.8 | 98.2 | 100.0 |
| 60 | 86.5 | 92.4 | 97.0 | 99.5 | 100.0 |
| 70 | 90.5 | 94.8 | 98.1 | 99.9 | 100.0 |
| 80 | 94.2 | 97.0 | 99.0 | 100.0 | 100.0 |
| 90 | 97.4 | 98.6 | 99.7 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Wind Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 35.3% | 60.4% | 86.5% | 83.1% | 97.6% |
| 10 | 53.3 | 71.2 | 93.6 | 86.4 | 100.0 |
| 20 | 76.4 | 79.3 | 98.2 | 89.5 | 100.0 |
| 30 | 87.7 | 84.1 | 100.0 | 92.5 | 100.0 |
| 40 | 93.4 | 87.3 | 100.0 | 95.5 | 100.0 |
| 50 | 95.3 | 89.7 | 100.0 | 98.6 | 100.0 |
| 60 | 96.2 | 91.8 | 100.0 | 100.0 | 100.0 |
| 70 | 97.2 | 94.0 | 100.0 | 100.0 | 100.0 |
| 80 | 98.1 | 96.2 | 100.0 | 100.0 | 100.0 |
| 90 | 99.1 | 98.2 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

All Other Losses
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 39.3% | 62.4% | 78.5% | 86.3% | 96.1% |
| 10 | 57.5 | 76.8 | 88.6 | 93.6 | 100.0 |
| 20 | 75.5 | 88.6 | 95.2 | 97.3 | 100.0 |
| 30 | 85.0 | 93.4 | 97.4 | 99.1 | 100.0 |
| 40 | 90.4 | 96.5 | 98.4 | 100.0 | 100.0 |
| 50 | 94.3 | 98.0 | 99.1 | 100.0 | 100.0 |
| 60 | 96.5 | 98.6 | 99.6 | 100.0 | 100.0 |
| 70 | 97.8 | 99.1 | 99.9 | 100.0 | 100.0 |
| 80 | 98.9 | 99.5 | 100.0 | 100.0 | 100.0 |
| 90 | 99.5 | 99.8 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Underlying Loss Dollars/Claim Counts
Amount of Insurance Ranges

| | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| Fire: Loss Dollars | $1,264,290 | $8,248,433 | $14,900,024 | $13,942,029 | $5,616,187 |
| Fire: Claim Counts | 370 | 1,721 | 2,280 | 1,530 | 466 |
| Wind: Loss Dollars | $98,439 | $874,320 | $1,491,976 | $1,676,508 | $641,056 |
| Wind: Claim Counts | 49 | 358 | 601 | 414 | 125 |
| Other: Loss Dollars | $1,305,334 | $6,958,824 | $8,039,272 | $5,542,385 | $1,453,671 |
| Other: Claim Counts | 849 | 3,830 | 4,144 | 2,489 | 652 |

## EXHIBIT 17

### LOSS COST DISTRIBUTION AS A PERCENT OF INSURED VALUE
### SERVICE/OFFICE RISKS ONLY

Fire Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 25.6% | 39.3% | 44.9% | 56.7% | 78.0% |
| 10 | 39.9 | 53.7 | 58.5 | 71.1 | 91.9 |
| 20 | 57.0 | 70.1 | 75.1 | 84.7 | 97.4 |
| 30 | 68.2 | 79.9 | 85.0 | 92.0 | 98.0 |
| 40 | 77.2 | 86.8 | 91.2 | 96.7 | 100.0 |
| 50 | 84.4 | 92.0 | 95.2 | 99.5 | 100.0 |
| 60 | 89.0 | 94.6 | 97.0 | 100.0 | 100.0 |
| 70 | 92.4 | 96.4 | 98.2 | 100.0 | 100.0 |
| 80 | 95.3 | 97.9 | 99.1 | 100.0 | 100.0 |
| 90 | 97.9 | 99.1 | 99.6 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Wind Losses Only
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 24.6% | 64.9% | 80.5% | 79.8% | 99.6% |
| 10 | 39.2 | 77.9 | 89.8 | 86.9 | 100.0 |
| 20 | 57.4 | 87.7 | 95.5 | 96.3 | 100.0 |
| 30 | 69.9 | 91.9 | 98.9 | 100.0 | 100.0 |
| 40 | 79.3 | 94.4 | 100.0 | 100.0 | 100.0 |
| 50 | 86.5 | 96.9 | 100.0 | 100.0 | 100.0 |
| 60 | 91.5 | 98.7 | 100.0 | 100.0 | 100.0 |
| 70 | 95.0 | 99.9 | 100.0 | 100.0 | 100.0 |
| 80 | 97.1 | 100.0 | 100.0 | 100.0 | 100.0 |
| 90 | 98.5 | 100.0 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

All Other Losses
Amount of Insurance Ranges

| Loss as a Percent of Insured Value | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 38.0% | 62.3% | 83.8% | 93.2% | 100.0% |
| 10 | 56.1 | 78.0 | 92.3 | 97.1 | 100.0 |
| 20 | 73.6 | 90.2 | 96.2 | 98.1 | 100.0 |
| 30 | 82.7 | 94.9 | 97.6 | 99.0 | 100.0 |
| 40 | 88.5 | 97.5 | 98.7 | 99.9 | 100.0 |
| 50 | 92.4 | 98.6 | 99.2 | 100.0 | 100.0 |
| 60 | 95.0 | 99.2 | 99.4 | 100.0 | 100.0 |
| 70 | 96.7 | 99.6 | 99.5 | 100.0 | 100.0 |
| 80 | 98.1 | 99.8 | 99.7 | 100.0 | 100.0 |
| 90 | 99.0 | 99.9 | 99.9 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Underlying Loss Dollars/Claim Counts
Amount of Insurance Ranges

| | $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| Fire: Loss Dollars | $2,245,536 | $7,464,529 | $15,012,368 | $15,691,044 | $7,399,404 |
| Fire: Claim Counts | 562 | 1,938 | 2,665 | 2,340 | 775 |
| Wind: Loss Dollars | $137,720 | $709,647 | $1,709,296 | $2,279,065 | $747,485 |
| Wind: Claim Counts | 52 | 343 | 648 | 629 | 160 |
| Other: Loss Dollars | $1,731,669 | $5,830,461 | $6,022,589 | $4,102,566 | $1,272,306 |
| Other: Claim Counts | 1,024 | 3,219 | 3,443 | 2,471 | 685 |

## EXHIBIT 18

### LOSS COST DISTRIBUTION AS A PERCENT OF INSURED VALUE
### RESTAURANT RISKS ONLY

| Loss as a Percent of Insured Value | Fire Losses Only Amount of Insurance Ranges $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 20.3% | 38.9% | 60.0% | 51.9% | 83.3% |
| 10 | 30.7 | 49.8 | 73.9 | 68.9 | 93.3 |
| 20 | 46.2 | 64.1 | 87.9 | 86.9 | 100.0 |
| 30 | 57.7 | 73.8 | 93.5 | 94.6 | 100.0 |
| 40 | 67.6 | 80.1 | 96.9 | 97.6 | 100.0 |
| 50 | 75.3 | 84.6 | 98.3 | 98.7 | 100.0 |
| 60 | 80.8 | 88.5 | 99.1 | 99.4 | 100.0 |
| 70 | 85.8 | 92.3 | 99.5 | 100.0 | 100.0 |
| 80 | 90.5 | 95.5 | 100.0 | 100.0 | 100.0 |
| 90 | 95.3 | 97.8 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| Loss as a Percent of Insured Value | Wind Losses Only Amount of Insurance Ranges $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 23.6% | 58.8% | 87.1% | 98.0% | 100.0 |
| 10 | 41.2 | 67.1 | 91.7 | 100.0 | 100.0 |
| 20 | 56.0 | 74.2 | 99.2 | 100.0 | 100.0 |
| 30 | 68.4 | 80.6 | 100.0 | 100.0 | 100.0 |
| 40 | 76.5 | 86.1 | 100.0 | 100.0 | 100.0 |
| 50 | 80.7 | 88.7 | 100.0 | 100.0 | 100.0 |
| 60 | 84.8 | 91.2 | 100.0 | 100.0 | 100.0 |
| 70 | 88.9 | 93.8 | 100.0 | 100.0 | 100.0 |
| 80 | 93.1 | 96.3 | 100.0 | 100.0 | 100.0 |
| 90 | 97.2 | 98.9 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| Loss as a Percent of Insured Value | All Other Losses Amount of Insurance Ranges $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| 5% | 49.5% | 78.5% | 97.9% | 99.7% | 100.0% |
| 10 | 67.8 | 89.2 | 99.3 | 100.0 | 100.0 |
| 20 | 85.5 | 93.5 | 100.0 | 100.0 | 100.0 |
| 30 | 93.0 | 95.2 | 100.0 | 100.0 | 100.0 |
| 40 | 96.4 | 96.8 | 100.0 | 100.0 | 100.0 |
| 50 | 97.7 | 98.2 | 100.0 | 100.0 | 100.0 |
| 60 | 98.9 | 99.1 | 100.0 | 100.0 | 100.0 |
| 70 | 99.7 | 99.8 | 100.0 | 100.0 | 100.0 |
| 80 | 99.8 | 100.0 | 100.0 | 100.0 | 100.0 |
| 90 | 99.9 | 100.0 | 100.0 | 100.0 | 100.0 |
| 100 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

| | Underlying Loss Dollars/Claim Counts Amount of Insurance Ranges $1,000–$25,000 | $25,000–$100,000 | $100,000–$300,000 | $300,000–$1,000,000 | Greater Than $1,000,000 |
|---|---|---|---|---|---|
| Fire: Loss Dollars | $392,956 | $1,856,015 | $2,764,497 | $9,306,687 | $4,336,847 |
| Fire: Claim Counts | 53 | 495 | 829 | 1,242 | 856 |
| Wind: Loss Dollars | $12,084 | $236,522 | $397,060 | $798,827 | $403,638 |
| Wind: Claim Counts | 6 | 93 | 195 | 285 | 185 |
| Other: Loss Dollars | $103,325 | $1,299,982 | $1,630,079 | $2,743,585 | $2,243,363 |
| Other: Claim Counts | 94 | 966 | 1,298 | 1,832 | 1,335 |