A MODERN ARCHITECTURE FOR RESIDENTIAL PROPERTY INSURANCE RATEMAKING

JOHN W. ROLLINS

Abstract

This paper argues that obsolete rating architecture is a cause of decades of documented poor financial performance of residential property insurance products. Improving rating efficiency and equity through modernization of rating and statistical plans is critical to the continued viability of the products. In particular:

- *The overall rate level should reflect an appropriate provision for the cost of capital held for catastrophic events, and the cost of capital should be allocated appropriately in development of rating factors.*
- *The indivisible premium concept should be replaced with peril-based rating, and rating factors developed or adjusted to apply to peril-specific partial base rates.*
- *Catastrophe simulation and geographic coding technology, incorporating non-historical experimental data sets, should be applied to the development of base rates, territory boundaries and factors, and classification plans.*
- *Rating for the numerous miscellaneous exposures and coverage options, as well as maintenance of statistical plans, should be aligned with the peril rating concept.*

The author develops an architecture and techniques for ratemaking that satisfy the above precepts for the homeowners product in a hurricane-prone state. The transition from indivisible to divisible base premium facilitated by this architecture is illustrated in case study fashion, with practical implementation challenges and solutions discussed. Many ideas are transferable to

ratemaking for other residential and commercial property products.

ACKNOWLEDGEMENTS

The author's thanks go to Steve E. Wallace, CPCU for preparation of the figures and all Geographic Information Systems (GIS) analysis supporting the paper, and to Rade T. Musulin for salient comments on, and thorough review of, early drafts.

1. MOTIVATIONS: THEORETICAL

The insurance industry has earned a chronically inadequate rate of return on its chief residential property line, the homeowners product, since the 1980s. Catastrophic ("cat") events, the toxic mold phenomenon, the growing popularity of vicious dogs, outbreaks of sinkholes, and other root causes of loss have repeatedly surprised insurers in recent years. To date, responses have been almost exclusively reactive: underwriting restrictions, coverage limitations and sharp corrections in overall price level.

The classical "indivisible premium" rating plan in common use for residential property products is a significant obstacle limiting the industry to reactive responses of questionable economic *efficiency* and actuarial *equity*. Actuaries can show strategic leadership by engineering a proactive response—the development of a modern architecture for ratemaking that improves overall rate level efficiency as well as risk classification equity. The classical plan is demonstrably obsolete, particularly in catastrophe-prone areas, and greatly hinders the ability of insurers to identify, segregate and monitor the component drivers of loss costs. Harmonious advances in technology and actuarial science now allow us to overcome the obstacles to modern rating architecture.

Specifically, these structural changes to rating plans are overdue:

- Actuarially sound prices should reflect an explicit provision for cost of capital, in addition to actual non-cat loss costs, expected cat loss costs from simulation tools (“cat models”), and underwriting expenses.

- Indivisible base premium should be replaced with several partial base premiums by peril; for example, hurricane, other wind, fire, liability/medical, and all other perils (AOP).
- Partial base premiums should be modified by distinct class and territory (geographic location) rating plans for several reasons. Property attributes affecting equitable risk classification vary significantly by peril, and the cost of capital is not generated (and should not be allocated) uniformly among perils.
- Rating for base premium adjustments and miscellaneous endorsements should be recalibrated to take advantage of the unbundling of base premiums.

Why does the classical rating plan doom insurers to poor long-run underwriting results? Recalling fundamental principles of actuarial science [4], improper insurance prices can result from two distinct ratemaking failures:

1. Failure to recover all costs associated with risk transfer in the final premium;
2. Failure to differentiate rates for identifiable classes of risks with demonstrable differences in expected cost of risk.

Indivisible base premium in residential property insurance facilitates both failures. Two components represent the bulk of the premium for the product—expected loss costs and cost of capital. In turn, these components are generated by an aggregation of individual perils insured against—the largest contributors often fire, liability, and windstorm. In recent years, it has become apparent that the loss costs and costs of capital for distinct perils are distributed in an extremely lopsided fashion or “maldistributed”[1]

---

[1] The use of this term is with a respectful nod to Bailey and Simon’s seminal 1959 paper on class ratemaking.

with respect to many classification attributes, particularly territory. As an architectural matter, indivisible base premium precludes the proper allocation of costs to class and territory, disallowing development of distinct and non-interacting class plans and for each peril based on construction features, not to mention distinct territory boundaries and rating factors. A corollary is that the recognition of the full cost of capital in overall rate level is discouraged due to an inability to spread it fairly among risks.

Now consider the consequences of failure to fairly allocate costs to class and territory by peril. Even if overall premium level generates adequate revenue to fund the losses of the diverse book of business, rating factors must apply to multiple and perhaps unrelated perils, generating unavoidable and perhaps severe premium subsidies. As some insurers improve rating plans to target the risks who are overpaying for certain perils, adverse selection by the affected risks will leave the insurers who fail to modernize with underpriced segments of the market, which generate poor underwriting results until overall rate level is raised. Raising the overall rate level without improving the distribution of premiums by rating factor amplifies the adverse selection, perpetuates the cycle and leads to a "death spiral" for the insurer. Cummins [7] contains a formal development of the economics of adverse selection.

The indivisible premium is a remnant of historical technology and marketing architecture. When agents were expected to quote policies in the field with a pencil and rating manual, simplicity of rating logic was paramount. The days of hand-rating are long gone in standardized personal lines products, but the rating plan based on that limitation persists. Technology is an enabler of modern rating architecture in the form of rating engines accessible from the field, as well as in geographic information systems and simulation modeling applications. Regardless of theoretical appeal, implementation of peril-specific rating would have been difficult even twenty years ago.

In addition, residential property insurance was historically marketed as “complete” coverage for the hazards inherent in the lifestyle of the typical homeowner. Today’s consumers are increasingly demographically diverse and willing to choose products to fit their needs. Policy forms have evolved in response to these trends, and it is imperative that the pricing of personal lines products also evolve with the spectrum of exposures insured.

Many actuarial concepts discussed in this paper are venerable. Its contribution is to synthesize them in new ways in response to a specific challenge—the *transition* from a classical to a modern component rating architecture. Once this transition is accomplished, maintenance of some aspects of the rating plan using classical actuarial methods (such as the “loss ratio” method of determining rating factors) may still be optimal. The goal is to get the actuary across a sort of river Styx of property insurance ratemaking while ensuring that each part of the transition withstands review of, and is consistent with, canonical principles. Indeed, it is critical to undertake such a modernization in order to remain true to many of the Actuarial Standards of Practice, particularly those of more recent vintage.[2] When standing on the other side, one hopefully can look back and recognize some of the architecture as embodying potentially long-lasting innovations in actuarial techniques.

2. MOTIVATIONS: PUBLIC POLICY AND PRODUCT CHANGES

Notwithstanding theoretical motivations, necessity is the mother of invention. This paper may also be read as a case study of the actuarial response to a pricing challenge manifested in public policy. The State of Florida passed into law a statewide Unified Florida Building Code (FBC) that supersedes all local

---

[2] A thoughtful review of ASOPs 12, 23, 29, 30, and particularly 38 and 39 is helpful before and after reading this paper. Such a review should go a long way to convince the practicing actuary that the motivations are consistent with upholding these Standards of Practice.

codes for buildings permitted after March 1, 2002. One goal of the FBC is to improve the resistance of new construction to windstorm losses by specifying robust features and construction techniques to be used, in accordance with the recommendations of scientists and engineers. The code is heavily geography-dependent, differentiating among many elements based on the wind speed "zone" in which the site is located. In particular, properties located in the "120-mph" (in a 100-year event) and above wind zones must be built with significant levels of resistance to wind. Zones are (generally) concentric boundaries defined by the standards of ASCE 7-98 (see Figure 1).[3]

The insurance industry strongly supported the FBC, and its enabling legislation contained a quid pro quo—that insurers would develop class plans to provide rate differentials for devices that demonstrably mitigate windstorm losses, whether such devices were included on new construction *or* extant on, or retrofitted onto, existing structures. The Florida Office of Insurance Regulation (OIR) commissioned a public domain study from Applied Research Associates, Inc. (ARA) that developed a mitigation class plan containing benchmark class factors for various combinations of construction features and techniques [2], and an analogous study was conducted by Applied Insurance Research, Inc. (AIR) in support of a mitigation class plan filed by Insurance Services Office, Inc. (ISO). The deadline for individual companies to make rate filings to implement a mitigation class plan was February 28, 2003.

This mandate is the death knell for indivisible premium rating plans in Florida. This paper shows that the maldistribution of loss and capital costs by territory and peril makes such a lack of rating resolution intolerable in the presence of a windstorm

---

[3] The exception to this statement is along parts of the Florida Panhandle, where the political influence of home-builder associations caused a "one mile from the coast" rule to delineate areas where 120-mph standards for building materials are to apply. Examining Figure 1, the areas excepted comprise most of several west Florida counties.

FIGURE 1

mitigation class plan. The hurricane share of all-perils loss costs varies between 20% and 75% by county, and the fire share varies between 5% and 35%. No compact set of actuarially sound class factors would be workable against such a variable premium base. In parallel, it is also a great improvement to target the existing Public Protection Class (PPC) factors to the proper fire premium base.

The classical design has been tolerated by the insurance industry and its advisory organizations for too long, probably because the magnitude of the errors is manageable in areas of the United States where the distribution of loss costs is more geographically consistent and the contribution of catastrophic events to the aggregate loss costs is moderate. In Florida, the mitigation class plan is a catalyst for the development of base rates and rating factors by peril, as well as the redefinition of territories using GIS mapping software and the extension of catastrophe modeling technology into windstorm class and territory ratemaking. However, the concepts are applicable to homeowners pricing in other geographic areas, and more generally to other property insurance pricing exercises.

Public policy also influences emerging non-catastrophic causes of loss. Statutory coverage mandates and resistance to coverage restrictions in states with "prior approval" policy form regulation have contributed to the skyrocketing portion of policy loss costs associated with sinkhole claims in Florida and toxic mold claims in Texas and elsewhere. Florida statutes require sinkhole coverage and severely restrict claim settlement options, resulting in frequent total or near-total losses after moderate settling and cracking occurs in the residential structure. While mold is only a cause of loss as a result of another covered peril, the loss adjustment expenses and risk of large judgments have been well documented.

This paper is not about specific emerging perils; the point is that having the ability to segregate base premiums allows a "quarantine" of the loss costs associated with these perils at an earlier statistical stage. Pricing must keep up with the ever-expanding coverage in the property insurance product.

3. MOTIVATIONS: TECHNOLOGY AND CATASTROPHE MODELING

It is now settled actuarial science that actual losses from cat events over short experience periods should be replaced in ratemaking data by long-run expected cat losses derived from a simulation tool and the insurer's expected exposures. See Clark [6] for an excellent fundamental justification for building cat models to replace historical cat losses. In addition, several authors have tackled aspects of the problem of incorporating simulated cat losses into the overall rate level and rating factor calculations, notably Walters and Morin [18] and Burger et al. [3].[4]

A few features of cat models[5] are particularly relevant and are exploited in populating the new rating architecture:

1. They are peril-specific—one model may be used for hurricanes, another for severe thunderstorms (including tornado and hailstorm), and yet another for earthquake analysis. It is thus natural to segregate covered perils for ratemaking in such a way that the cat model can be used to build the rates for each peril separately and adequately.
2. Cat models are fundamentally exposure rating tools—loss costs can be generated from any set of relevant data, whether actual or experimental. Scenarios can be contrived and tested to develop rating factors, reducing the need for complex normalizations of experience data.
3. Some vendors offer models that output the complete empirical distribution of event losses. From this, annual losses are easily aggregated. Therefore, in addition to expected losses, we can generate moments, percentiles, and more sophisticated risk metrics for any modeled property (whether real or experimental) or aggregation thereof. These metrics are critical in deriving proxies for cost of capital and allocating risky expected losses to class and territory.

---

[4] The reader unfamiliar with cat models should thoroughly peruse these references, as neither their descriptions of the design and operation of cat models nor their justifications for the use of modeled losses in ratemaking are repeated here. However, the treatment of base rate and rating factor development here is generally consistent with previous literature and often builds upon concepts formalized by these authors.

[5] All simulated cat losses used in this paper were derived from the CLASIC/2™ catastrophe models for Atlantic Hurricane and U.S. Severe Thunderstorm (“other wind”), products of AIR Worldwide Corp.

4. Every property is "geo-coded" with exact longitude and latitude, allowing us to place "pins" on maps and analyze statistics from any geographic aggregation we wish. Optimal territory boundaries with respect to gradients in loss and capital costs can be quickly identified with GIS software and scenario testing. This contrasts with the limitations of ZIP code experienced by some earlier authors.

The following case study leverages each of these key attributes of the simulation tools. The advancement of modeling science and related technology is the enabler of much of the work to follow.

4. OVERALL RATE LEVEL CHANGES

Following is a complete study of ratemaking for residential property lines, not simply a description of modern enhancements. Accordingly, first comes a discussion of the development of overall rate level changes. Components that will be targeted by our detailed rating architecture are highlighted.

A comprehensive description of classical overall rate level indications for homeowners insurance in a pre-catastrophe modeling environment is contained in Homan [10], and a concise, thorough review of basic techniques in McClenahan [14]. The following data is used to develop the indicated change in rate levels:

- Five accident years of direct paid and case-incurred losses and "defense and cost containment" (D&CC) expenses, organized by calendar year (development age), with cat losses identified;
- Five calendar years of direct written and earned premiums, and the historical rate tables necessary to bring them to present rate levels using the extension-of-exposures technique;
- Five calendar years of direct earned exposures (house-years and total values insured or "TVI");

- Three calendar years of underwriting expenses, including "adjusting & other" expenses (A&OE) associated with claim administration, allocated to category and line of business by the accounting function;
- Modeled expected cat losses by line of business, produced by a simulation tool from exposures in-force as of a given date;
- The latest calendar year's ceded catastrophe reinsurance premiums;
- Various Annual Statement data required to generate a regulated profit provision.

Exhibit 1 shows the development of the indicated overall rate level change. The formula[6] is:

$$\Delta = \frac{x + f + f_R}{1 - v} - 1 \tag{1}$$

where:

x = the weighted average experience ratio;

f = the fixed (not varying directly with premium) underwriting expense ratio to direct premium;[7]

f_R = the fixed non-loss reinsurance costs (premium in excess of modeled expected losses), expressed as a ratio to direct premium;

v = the variable expense rate per dollar of direct premium, which includes the profit provision calculated in accordance with regulations[8] and treated as a percent of premium.

---

[6] The general convention here is to let capital letters represent quantities in dollars (or dollars per policy) and lowercase letters represent factors or ratios to premium. Greek letters represent relativities or constants. Carets (^) represent modeled amounts.

[7] Some actuaries include a trend adjustment in the expected future fixed expense ratio to reflect inflation of underwriting expense elements.

[8] Florida statutes prescribe a profit load calculation very similar to the Calendar Year Investment Income Offset Method described by Robbin [9], with the assumed "fair" profit at 5% of premium. An economically "fair" profit provision would compensate the insurer for a variety of business risks, well documented in actuarial literature. The statutory load considers only time value of money on reserves held; we load the catastrophe cost of

The derivation of each component of the overall rate level change will be discussed in turn, illustrated for the hypothetical A-Florida Insurance Company.[9]

Average Experience Ratio

The weighted average experience ratio is the inner product of the vector of experience ratios for each calendar/accident year and a vector of selected weights. In Exhibit 1, we reflect typical judgments about the relationship of credibility to age of experience period in our weight selections.

The annual experience ratios themselves are developed as:

$$x_i = \frac{L \times l \times t_L \times (1+u) + \hat{C} \times (1+u_C) \times t_C}{P \times \delta \times t_P} \tag{2}$$

where:

L = losses plus D&CC, excluding cat losses for modeled perils;

l = loss development factor to ultimate;

t_L = selected loss cost (pure premium) trend factor;

u = loading for A&OE as a proportion to losses;

$\hat{C}$ = modeled expected annual cat losses;

u_C = the expected ratio of loss adjustment expenses (LAE, which includes D&CC *and* A&OE) to losses for catastrophic claims;

t_C = exposure de-trend factor for modeled cat losses;

---

capital elsewhere in the fair premium. Other valid risks potentially compensated by the profit load are not treated in this paper.

[9] As the reader follows through several A-Florida exhibits, note that numbers generally "tie" within and across exhibits as much as possible, for tutorial purposes. However, the numbers used are not necessarily representative of actual data or benchmarks for individual companies nor the industry as a whole.

P = direct collected earned premiums including any expense fees;

δ = on-level factor to restate premiums as if earned at present rate levels;

t_P = selected premium (per earned house-year) trend factor.

Losses might be paid or case-incurred, as long as the development factor is estimated on the same basis. The estimation of development factors is not reviewed.

The loss cost trend factor and premium trend factor reflect expected changes in economic conditions making the expected losses and premiums *per exposure unit* in the prospective period different than that observed in the experience period. To estimate these factors, compiled are calendar quarter earned house-years, earned TVI, earned premiums, and paid losses plus D&CC for twenty or more consecutive quarters as shown in Exhibit 2. Time indices for each quarter are aligned as the regressor variable. The earned rate (premium per house-year) is the basis for premium trend and the loss cost (paid losses per house-year) is the basis for loss trend. The trend in earned house-years itself will be used in the de-trending of cat losses later.

An exponential regression line is fitted to each response variable. The exponential coefficient in each equation is the least-squares best fit annual change. Two-, three-, four-, and five-year domains are fitted and examined, and a representative annual change selected for each series. The trend period is the power to which the annual change is raised to derive the final trend factor for each experience period, and is determined as the number of years between the midpoint of the experience period and the midpoint of the anticipated effective period of the proposed rates. Exponentiating the annual change for the trend period provides the final trend factor, which is carried to Exhibit 1.

The volume of exposures underlying every item in formula (2) (for an individual experience year) should be the same. This is why loss *cost* (per policy) trends and earned rate trends are used to adjust the losses and premiums in each experience ratio. Accordingly, the de-trend factor for modeled cat losses is necessary to state the expected cat losses on the same volume of exposures as is underlying the approximate midpoint of each experience period. By nature, cat models produce losses given in-force exposures as of a predetermined (but presumably recent) date. Due to run-time, data storage, and labor costs, it is impractical to repeatedly simulate losses using in-force exposures from several historical years. As an alternative, the selected annual change in earned house-years from Exhibit 2 is raised to a negative power representing the trend period between the in-force date used in the cat model and the midpoint of each experience period to derive a de-trend factor. The factor is applied to the single modeled expected loss estimate to get the cat losses that are loaded into each period shown on Exhibit 1.[10]

Note that the match between the attributes of excluded actual cat losses and modeled expected cat losses should be as close as possible for actuarially efficient ratemaking. Claims departments are often responsible for coding individual claims as "catastrophic," and there is generally no mandate for consistency with the basis used for simulated cat losses. For example, if modeled hurricane losses reflect only landfalling hurricanes, but the claims unit designates weak, bypassing tropical storms as the basis for many "cat" claims received during a season, the excluded losses are broader than the simulated losses that replace them, making overall rate level indications inadequate. Actuaries should be vigilant and proactive in setting parameters for cat loss coding with respect to:

1. Event definitions (example: hurricane versus tropical storm)

---

[10] The de-trended cat losses are *not* then trended forward to the midpoint of the effective period because the modeled loss per exposure unit for cat perils is not inherently inflationary. Annual updates to models reflect the latest meteorological and scientific knowledge but not cost trends per dollar of value insured.

2. Time periods (example: 72 hours during which losses are eligible for “cat” treatment)
3. Geographic areas affected (example: areas subject to government warnings)
4. Lines of business (example: exclusion of liability losses from “cat” eligibility)

It is wise to consider the associated definitions in company reinsurance treaties as an example when developing parameters for cat loss reporting.

The expected ratio of LAE to losses for catastrophes will depend heavily on how the insurer’s claims department handles these events. Use of mobile claims centers and contracting of outside adjusters may affect the assumed ratio. Historical data on specific past events can be used as a guide in some cases; sometimes the ratio is very low (because the losses in the denominator are high, not because adjusting catastrophic claims is cheap) when the insurer’s own claims personnel are the bulk of the adjusting corps. Hence, a provision for catastrophic LAE is omitted from the example for simplicity.

The collected premium can be placed on-level by either the parallelogram method or the extension-of-exposures method discussed in Homan [10], though the latter is of great help when it comes to estimation of rating factors. If the parallelogram method is used, the factor for each experience period will be derived explicitly from knowledge of overall rate changes and effective dates thereof, as detailed in McClenahan [14]; if the extension method is used, the raw premium data must be linked to all necessary categorical variables (class, territory, etc.) used in ratemaking and complete sets of historical rate tables or “ratebooks” must be available to compute the premium for each policy as if it were written on the current ratebook. Then the factor in formula (2) is implicitly the ratio of on-level to collected direct earned premium. Neither method will be discussed in detail here.

Underwriting and Adjusting Expense Ratios

Once the experience ratios are determined with formula (2), one must consider underwriting and adjusting expenses, reinsurance costs, and profit. Exhibit 3 shows an analysis of expense provisions. Recent calendar year underwriting expense ratios for each component:

- Commissions and brokerage;
- Other acquisition expenses;
- General (overhead) expenses;
- Premium taxes (which must be shown separately in some states);
- Other taxes, licenses and fees;

are used to estimate future expected expense ratios. It is tempting to select the multi-year average, but trends in expense ratios often reflect structural changes in finance or operations and must be given some credence in the selection of future ratios.

An assumption must also be made about the proportion of each component that varies directly with the premium charged. Commissions and most taxes and fees are assessed as percentages of net premium and thus treated as 100% variable. General expenses are almost exclusively allocated amounts of fixed overhead amounts and a 100% fixed assumption is usually appropriate. Other acquisition expenses include some fixed administrative costs, but also the cost of field inspections and policy-specific costs that may vary with premium size. This study assumes 50% of expenses in this category are fixed. Underwriting expense ratios are usually expressed to direct written premium, as they are almost fully incurred prior to policy inception.

Fixed underwriting expenses reported by line actually reflect accounting department allocations of companywide expenses to line of business. Actuaries are strongly encouraged to review the allocation procedures and judge whether the allocation basis accurately captures the true expenses associated with the line, especially in the presence of historical cat events. Often a premium-based allocation (the preference of many accountants) will be sufficient. For catastrophe reinsurance costs, this method will *not* be accurate, as discussed below.

A caution is in order about bulk assessments from residential property residual markets and guaranty funds, usually found in the "other taxes, licenses and fees" category. In some states, these assessments can be recouped over a given time period from policyholders via a premium surcharge. If the company chooses to surcharge, assessments should be removed from the expenses used for ratemaking to avoid redundant recovery of the cost. If recoupment is not allowed, a different problem arises—in the absence of a cat event in the historical three-year period, a tax provision that includes no residual market deficits will be inadequate in the long term. The annual expected value of assessments is material to the expense ratio despite a "lucky" zero over a short term. The same arguments that urge consideration of expected direct catastrophe losses in ratemaking should convince the actuary that the company's share of long-term expected residual market deficits should be considered in expenses in ratemaking. Failure to do so will harm profitability in the same fashion as would ignorance of the long-term impact of cat losses.

Adjusting and other expenses are usually related to the sum of paid losses and D&CC, rather than premiums. Since these amounts are generally line-specific rather than allocated companywide amounts, the calendar year ratios fluctuate more than those for underwriting expenses and the long-term average should influence the selection unless emerging causes of loss (such as mold, which involves extensive pre-settlement scientific testing) are driving a structural change in claim adjustment expenses.

Cost of Capital

The cost of capital held to protect the insurer against infrequent catastrophic events that produce losses far in excess of the long-term average for the peril must be considered in ratemaking. The held capital may be internally generated, borrowed from investors, or "rented" from reinsurers. Most insurers capitalize their cat risk using a combination of sources, with the largest often being reinsurance. Reinsurance may be available from private sources, which include a market-determined cost of capital in their premium, and/or public sources, which generally do not. Musulin and Rollins [15] contains a description and comparison of private and public property cat reinsurance options in Florida and a breakdown of the reinsurance premium as follows:

$$P_R = \hat{C} - R(\hat{C}) + \theta + T \tag{3}$$

where:

$\hat{C}$ = expected direct cat losses (i.e. modeled gross annual losses);

$R(\hat{C})$ = expected net retained cat losses (determined by reinsurance program design);

θ = charge for cost of capital (a.k.a. reinsurance risk load);

T = transaction costs (such as brokerage and reinsurer administrative expenses).

A spectrum of approaches exists for efficiently reflecting the cost of catastrophic events in ratemaking, such as:

1. Treatment of the entire reinsurance premium (appropriately allocated to line) as a fixed expense in ratemaking and consideration of only non-cat and retained cat losses in the loss portion of the experience ratio. This method would be most appropriate for a heavily reinsured com-

pany to which differentiation of other rating factors according to modeled losses was not important. It has the advantage of not requiring detailed cat model output.

2. Loading of simulated expected direct cat losses in place of actual cat losses in the numerator of the experience ratio, and adjustment of those losses for a cost of capital charge calculated directly from assumptions, with no tie to the empirical market-determined cost of capital. This method might be required for an entity that has no benchmarks, such as an insurer that funds catastrophes solely from internal capital, a residual market, or a rating advisory organization.

3. A blended method, where the loss portion of simulated catastrophe costs is reflected directly in the experience ratio, and the cost of capital portion is treated as a fixed expense reflecting the market charge indicated by the non-loss portion of reinsurance costs. This is the method used here, so that $f_R = (\theta + T)/P$.

Homan [11] uses the first approach in his treatment of reinsurance costs in property ratemaking, and Rollins [17] has contrasted the relative strengths and weaknesses of the three approaches.

Already included in formula (2) are the total direct expected cat losses by removing actual cat losses and adding modeled gross annual losses to each year's experience ratio. A provision for non-loss reinsurance costs in formula (1), in order to provide for all costs associated with risk transfer, should consist of the reinsurance premium, less expected ceded cat losses, as a ratio to direct premium, or

$$f_R = \frac{P_R - (\hat{C} - R(\hat{C}))}{P}. \tag{4}$$

Since θ and T in formula (3) are not observed directly, this is the practical formula for the total non-loss portion of reinsurance costs.[11]

The fixed reinsurance cost provision from typical data is derived in Exhibit 4. Direct earned premiums for the line, the portion subject to the cat reinsurance program, modeled gross annual losses, and actual cat reinsurance premiums ceded to various sources are compiled. The reinsured portion of modeled losses is derived by subtracting the retention (often based on subject premium) and the losses not covered due to coinsurance features of the treaty (typically 5% of losses above the retention). The actual ceded premium is normally significantly larger than this amount, and the difference represents cost of capital and transaction costs. For the overall rate level indication, the fixed reinsurance costs are expressed as a ratio to direct earned premium. In addition, it is useful later to think of these costs as a load to the gross ceded losses or "capacity charge" per dollar of expected loss. The fixed cost provision is carried to Exhibit 1.

Note that the ceded premiums are specific to the line of business under review. In practice, ceded cat reinsurance premiums are rarely specified by line, only in aggregate. The actuary must assist accountants in allocating the ceded premiums to line of business. Exhibit 5 provides an example. Direct earned premiums by line are compiled, with the property portion extracted for (currently) "indivisible" premium lines of business. This becomes the subject premium for most cat reinsurance programs. The portion due to property perils must be estimated from loss cost data. The actual all-lines ceded premium is allocated to line based on the modeled gross annual losses, separable by line from

---

[11] The astute reader will note that the "blended" formula is actually incomplete. There is no cost of capital levied on the internal capital held for retained catastrophic losses. In a heavily reinsured company, we can ignore this part of the capital charge for simplicity of presentation. Obviously, the formula cost of capital for an insurer which retained all losses and built a risk load into rates directly would not be zero. This presentation assumes that the bulk of cat losses are ceded and that the associated cost of capital is revealed by the market.

catastrophe simulation output, rather than a direct premium measure. The direct premium, subject premium, and allocated ceded premium for the line under review are carried to Exhibit 4.[12]

5. STRUCTURE OF FAIR PREMIUM

Derivation of Fair Premium Components

Given the components of overall rate level, our next task is to design a rate structure that collects a fair premium through a combination of charges. When partial base rates vary by peril, yet some fixed expenses (the reinsurance provision) are not allocated equally to peril, the classic ratemaking formulas need some careful modification.

The overall rate level change is developed using the loss ratio ratemaking method. In contrast, the new base rates and rating factors are developed from loss costs. This is necessary because each base rate and relativity is new and peril-specific, and cannot be expressed as a change to a previous factor, yet conversion to premium rates and rating factors is necessary for pricing. Note that "loss ratio" ratemaking (which produces the indicated *changes* to existing base rates needed to reconcile the indicated overall rate level change with the expected rate level impact of the rate and rating factor changes) is not incompatible with divisible premiums once the modern plan is in place and divisible premium statistics are used to do periodic rate reviews. It is, however, incompatible with the *transition* from indivisible to divisible premium.

In the proposed rating plan, premiums are levied in three parts:

- *Base rates* by peril, which cover raw loss costs (and fixed reinsurance costs where necessary), "loaded" for variable underwriting expenses and profit;

---

[12] In Florida, the public reinsurer develops participating primary insurers' ceded premiums directly from exposure rather than in aggregate. Therefore, there is no need to allocate the public cat reinsurance premium.

- *Rating factors* by peril, which adjust each base rate for risk class and territory differences in expected costs;
- A single policy *expense fee* (to cover all fixed underwriting expenses other than reinsurance).

Recall the classic formula for policy-level fair premium, expanded to separate non-loss reinsurance costs from other expenses not varying with direct premium:

$$P = X + F + F_R + vP \tag{5}$$

where P represents fair premium dollars, X is the expected loss cost, F represents the fixed underwriting expense dollars associated with the policy, and F_R represents the associated fixed reinsurance cost dollars. Given the choice to structure our rating plan so that the fair premium is collected via a combination of base rate (B) and expense fee (E):

$$P = B + E \tag{6}$$

solving for P in formula (5) and setting it equal to (6) yields:

$$\frac{X + F_R}{1 - v} + \frac{F}{1 - v} = B + E$$

This formula suggests a natural decomposition, designating base rates to cover losses and fixed reinsurance costs, and expense fee to cover only fixed underwriting expenses, so that:

$$B = \frac{X + F_R}{1 - v} \tag{7}$$

$$E = \frac{F}{1 - v}. \tag{8}$$

In developing base rates for non-modeled perils, X is determined directly from experience data. For modeled perils, it is determined from the model output. Later, a choice will be made and justified to recover all fixed reinsurance costs in the base rate for the hurricane peril. F_R is determined from the reinsurance data described above. Finally, recovery of all fixed underwriting expenses is in the policy expense fee, using:

$$E = f \times \bar{P} \tag{9}$$

where $\bar{P}$ is the average premium per policy from experience data.

The decomposition of fair premium may affect rating factors as well, depending upon actuarial assumptions. Class rating factors by peril are derived from class loss cost relativities, which in turn are determined from experience data or model output. Assume a loss cost relativity is α, so that the class loss cost is:

$$X' = \alpha X.$$

If fixed reinsurance costs are included in the base rate and *not* increased or reduced in proportion to the expected loss cost for the class, then the indicated class rate is:

$$B' = \frac{X' + F_R}{1 - v}$$

per formula (7). Substituting for X', the ratio of the class to base rate (a.k.a. the correct class factor) is:

$$\rho = \frac{B'}{B} = \frac{\alpha X + F_R}{X + F_R} \tag{10}$$

as the variable expense ratio cancels out of the quotient.

Note that in cases where:

1. One chooses not to recover a portion of fixed reinsurance costs in the base rate for the peril, or;
2. One assumes that fixed reinsurance costs allocated to the class vary in proportion to class loss costs;

the formula reduces to α and the loss cost relativity is the correct premium relativity. Though non-loss reinsurance costs were assumed "fixed" for the overall rate level calculation, the assumption about whether they should be treated as fixed by class or territory is crucial for derivation of the proper rating factors. The choice to recover all non-loss reinsurance costs in the hurricane base rate means that the classical formula for rating factors will apply for non-hurricane perils. For the hurricane peril, an example is shown of class (mitigation) factors calculated using the non-proportional assumption for these costs, and territory factors calculated using a modified proportional assumption for these costs. Also note that the formula can be expressed using an expected loss *ratio* and fixed reinsurance cost *ratio* to unmodified premiums (for the peril in question), since the premium dollars cancel out in formula (10).

Basic rating logic for the proposed structure is outlined in Exhibit 17. The rates and factors shown are for purposes of example only and do not have any particular significance. The derivation of base rates and various rating factors follows in later sections for each peril:

- Fire
- Hurricane
- Other Wind (non-hurricane windstorm, including tornado and hail)
- Liability/Medical
- All other perils (AOP)

Total "key" premium and total base premium are the sum of the key and base premiums, respectively, for each of the five components. Key premium (retaining the terminology used in the classical plan) represents the actuarially sound rate for first-dollar coverage on a risk of a base amount of insurance. Base premium is key premium adjusted for:

- The total value insured relative to the base amount, and
- The chosen deductible.

The choice of base amounts and deductibles is discussed later. Each component is rated for territory and most for class,[13] and non-liability components are rated for value insured and deductible as well. The general total base premium formula reflecting N different perils is:

$$P = \left(\sum_{i=1}^{N} B_i \times \rho_i \times \tau_i \times k_i \times d_i\right) + E \qquad (11)$$

where

B = base rate;

ρ = class factor;

τ = territory factor;

k = key factor (for non-liability perils);

d = deductible factor (for non-liability perils);

E = expense fee.

Once total base premium is determined, the application of various charges and credits (primarily for coverage modifications) results in "adjusted base premium" that is comparable to that in the classical rating plan. However, the existence of component partial base premiums allows credits and charges to apply to only the components of base premium judged actuarially relevant, with appropriate modifications to the percentage charges and credits. Adjustments to base premium will be discussed further below.

Implications of Fair Premium Structure

Let us review some actuarial advantages and note some practical benefits of peril-specific base premiums, all of which contribute to a more sustainably competitive pricing of individual risks in a 21st-century property insurance environment.

---

[13] This is a general term, encompassing the construction/protection factor (Fire), increased limits factor (Liability), and mitigation factor (Hurricane).

1. Fixed (non-loss) reinsurance costs can be allocated appropriately by peril to specific base rates and rating factors.

2. The share of actuarially sound base premiums by peril may be highly geography-dependent. Class and territory rating factors should be calibrated to the expected experience differentials for individual perils and applied by peril.

3. Territory boundaries should reflect loss cost gradients, which are heterogeneous by peril—distance to coast drives those for hurricane, other geographic features drive those for non-hurricane windstorm, and political boundaries may drive those for other perils. Peril-specific development of territory boundaries allows more accurate rating factors by peril.

4. The existing construction types used in rating are primarily designed for differentiating fire danger, and the relative wind damageability inherent in these classes overlaps with an explicit windstorm mitigation class plan. Base premium separation allows targeting of classification features to the perils they affect.

5. It is shown later that amount of insurance ("key factor") curves and the loss distributions for deductible factors differ greatly by peril. Peril-specific rating allows proper differentiation of base premiums by value insured and deductible amount.

6. Percentage deductibles are (at this time) specific to the hurricane peril in Florida, due largely to statutory mandates to offer flat deductibles. The current rating plan must adjust for flat dollar/percent deductible combinations through a complex set of tables a problem removed in the unbundled rating plan.

7. The hurricane portion of premium must be reported separately by territory per regulatory instruction in Florida.[14] Currently, this is typically done via a complex set of extraction factors by territory a complexity removed in the unbundled rating plan.
8. Actuarially sound hurricane rates must be determined with the help of catastrophe simulation models, facilitated by separation of this peril in the rating plan.
9. Proposed mitigation credits in all industrial/engineering studies done to date are calculated as a percentage of windstorm premium. A crucial assumption about the wind portion of base rates would be necessary to convert them for usage with the current rating plan.
10. Experience data on "other wind" (tornado, hail, straight-line wind) events is sparse and of low credibility for ratemaking, but a catastrophe simulation model can assist in determining the peril-specific rates.
11. Liability peril-specific rates allow the application of benchmark increased limits factors (which assume liability-only premium) rather than the dollar charges used in some current rating plans.
12. Liability premium should be separated for any loss reserving, as well as ratemaking and most management reporting exercises a task facilitated by the unbundled rating plan.
13. Many endorsements and some base premium adjustments change peril-specific exposures, and the charges or credits for these should be calibrated to the appropriate portion of the base rates.

In summary, key and base premiums will be determined by peril and added together to determine the total key and base

---

[14] Rule 4-170.014(12) of the Florida Administrative Code.

premium. Each partial base premium will be calculated with a peril-specific partial base rate, territory factor, class factor, key (amount of insurance) factor, and deductible factor. This modernization of the rating plan streamlines many aspects of property insurance ratemaking.

6. DEFINITIONS FOR RATEMAKING

Territory Boundary Definitions

Appropriate territory definitions are a critical companion to peril-specific rating. Given a Cartesian surface or geographic map where loss costs are expressed as a function of latitude and longitude, risk classification principles [1] imply that territory definitions should correspond to loss cost gradients (contours on the map). Previous authors have explored the use of loss cost gradients and GIS software to define territories, but their approaches have generally been based on data organized at the ZIP code level [5, 13].[15] Unfortunately, the public purpose of ZIP codes is such that they do not represent a sufficiently granular starting point for the analysis of hurricane loss potential.[16] The basic problem in property insurance is that loss cost gradients may vary widely by peril, and in fact the direction of the gradient for one peril may frequently be opposite that for another. In plain English, the contour maps by peril may not “match up” very well.

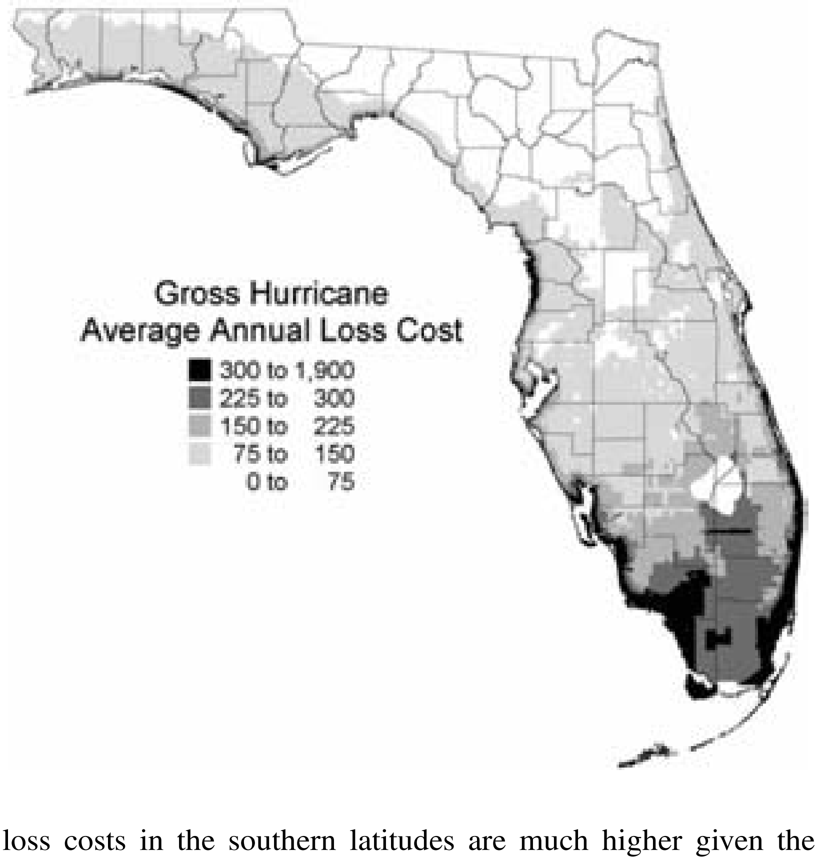
In Florida, there is significant conflict among meteorological indications, as well as conflict between meteorological and political boundaries. Modeled hurricane loss cost gradients largely reflect proximity to the coastline, meaning the optimal set of territories would make a contour map of the state look somewhat like an onion, with concentric closed polygons. In addition, the

---

[15] To be fair, Kozlowski and Mathewson advocated the use of square-mile loss densities given that the data is available.

[16] ZIP codes are based on urban demographics and tend to be convex polygons rather than thin “strips” parallel to coastlines, which is the general pattern of hurricane loss cost gradients.

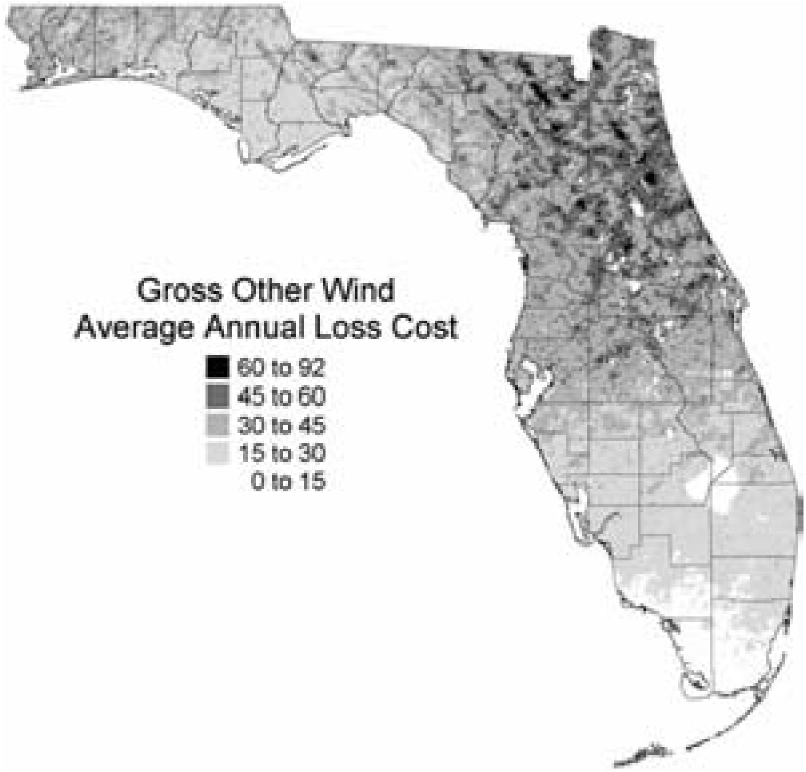
FIGURE 2



loss costs in the southern latitudes are much higher given the same distance to coast. Figure 2 maps modeled expected annual hurricane loss costs by land survey "section" defined by the Public Land Survey System—a unit of one square mile. The data set is weighted equally in each section, as explained below.

In contrast, modeled loss costs for other wind do not follow the geographical pattern of those for hurricane. In fact, they tend to be negatively correlated with the hurricane indications in similar groups of sections. Figure 3 maps the modeled other wind loss costs by section on the same data set.

FIGURE 3



Loss cost gradients for AOP and liability rating largely reflect demographics, though meteorological and geological phenomena significantly impact sinkhole and lightning losses. On the liability side, urban areas tend to be more litigious, and on the property side, urban areas may be more prone to theft and vandalism losses. Traditional (and ISO) territory boundaries for the classical rating plan were derived primarily from municipality and county lines. These lines may serve as sales territories as well. In short, for actuarial and practical reasons, political lines may still have a place in a modern territory rating system.

For the fire peril, two sets of geographic factors may apply—a construction/PPC factor and a territory rating factor. A solid argument can be made for the elimination of territory factors in fire once construction/PPC factors are redefined to apply to the fire-only partial base rate. On the other hand, regional or demographic differences in loss costs may persist even after adjusting for the level of fire protection by area. This case study found enough variation in fire hazards among territories to justify continued use of a territory rating factor in addition to the construction/PPC factor.

All peril-specific actuarial considerations must be weighed in promulgating revised territory definitions. In addition, practical considerations favor having a single set of boundaries, and those boundaries being determined by landmarks (such as major roads and bodies of water) that are recognizable to salespeople and consumers. In summary, territory boundaries are based on the intersection of all of the following geographic data sets:

1. Actuarially defined contours reflecting loss cost gradients by peril and convenient landmarks that are located close to the modeled contours;
2. Classical (existing) company territory definitions, which segregate barrier islands and some coastal areas;
3. ISO territory definitions (which generally follow county lines, with some municipalities and a few barrier islands separated);
4. Existing county lines.

Consideration of existing company territory boundaries is extremely important for the processes of transitioning individual policy/location records to the new lines. A one-to-many relationship between each existing territory and the new territories allows a simple “lookup” rather than a geo-coding exercise in policy management systems. Likewise, consideration of existing

FIGURE 4

advisory organization lines is valuable for implementing statistical reporting under the modern rating architecture.

Overlaying all of the listed data sets geographically produced 187 new distinct territories.[17] Figure 4 maps this set of proposed territory definitions.

Analysis of loss cost gradients for non-hurricane perils indicated that no significant actuarial advantage (reflecting steep

---

[17] To facilitate coding and statistical conversion, existing three-digit codes are redefined as the county code (01-67) plus a third digit of 1 for the territory closest to the coast, followed by 2, 3,. . . further inland, or 0 for a county which contains only one territory.

gradients in loss costs) was to be gained by rating at a level more resolved than county. Therefore, the remainder of the paper shows rating factors that vary at the county level for non-hurricane perils and the territory level for the hurricane peril.

Definition of Base Structure

Any base rate for property insurance reflects an assumption about the "base" structure insured. For non-modeled perils, this is important because all rating factors are keyed to the base house. For modeled perils, the definition helps incorporate public classification studies and build territory factors.

First, base values insured by policy form for the calculation of key factors are:

Form	Base Value	Coverage
HO-2	$100,000	A (building)
HO-3	$100,000	A
HO-4	$10,000	C (contents)
HO-6	$10,000	C
HO-9	$100,000	A
MH-2	$20,000	A
MH-3	$20,000	A

These values are generally consistent with those used by advisory organizations such as ISO.

Other base attributes, most following industry norms, are as follows:

- Base deductible is a flat $500 for all perils other than hurricane.
- Base deductible for hurricane is 2% of the coverage A amount, in keeping with the Florida practice of percent rather than flat dollar deductibles for hurricane. This also aligns the proposed rating plan with the public domain studies promulgating class factors for mitigation attributes.

- Base liability limit is \$100,000 and medical payments limit is \$1,000.
- Base fire protection class (PPC) is 9 (on the ISO scale of 1 to 10).[18]
- Base construction type (for fire premium) is frame.
- There is no base territory—the territory factors for hurricane, other wind, liability, and AOP are expressed and balanced relative to the statewide average of 1.00.

In the rating factor analyses for fire, AOP, and liability discussed below, actual experience data is used to develop indicated factors and various adjustments are made when it is necessary to bring experience to a "base class" level for a particular attribute.

In contrast, the rating factors for modeled perils are determined from an experimental data set consisting of hypothetical "base" structures placed around the state. An input data set was built containing one base structure in the geographic land centroid of every square mile section of the state—55,930 modeled locations in all. This is similar to, but much more extensive than, the approach taken by ARA in their public domain study. Base house attributes are as follows:

- HO-3 policy form insured for all perils;
- \$100,000 coverage A, coverages B/C/D at 10%/50%/20% of A (respectively);
- A \$500 other wind and a 2% hurricane deductible;
- Frame construction type;
- Gable roof attached with clips and covered by standard shingles;

---

[18] Most companies and ISO use 3 as the base; our departure reflects the predominantly rural demographic profile of our policyholders.

- A garage with unreinforced door and no other opening protection (i.e. storm shutters).

In other words, the base house is of base rating values and "unmitigated" with respect to hurricane damage, roughly as defined in the ARA study.[19]

It is advantageous to use experimental data sets for rating factor development for modeled perils for several reasons. Actual exposure data generally reflects vastly different property profiles by region. These maldistributions extend to nearly every rating variable—average total value insured, average windstorm mitigation and fire protection level, average deductible amount, and others. Hurricane or other wind modeled relative loss costs generated from these lopsided exposure profiles would be so biased as to be nearly useless.

A related problem is that of "missing" exposure. In the extreme case, the lack of exposure in a new, more refined coastal territory could result in an indication of a zero rating factor as a zero loss cost for the region is produced by the model. Alternatively, much of the existing exposure in coastal territories could be written on an "ex-wind" basis, whereby the hurricane peril is excluded from the policy. If the exclusions are noted in the data supplied to the model, the same problem will result. In short, when the territory boundaries are redefined, it is essential to consider the full spectrum of possible exposures in geographical rating factors. This is possible only with a contrived data set.

7. BASE RATES AND EXPENSE FEES

Recalling formulae (7) and (8), base rates and expense fees are built from loss costs, fixed (non-loss) reinsurance costs, and

---

[19] In a parallel study for mobile-homeowners, an analogous experimental data set was built for a mobile home with MH-3 policy form, $20,000 coverage A and associated standard relationships for coverages B/C/D, and a "mobile home" construction type with no mitigation devices.

fixed underwriting expenses, all expressed in dollars per policy, then loaded for variable expenses and profit. In turn, these components are determined from cat models (for hurricane and other wind perils), historical loss and exposure data and distributions (for non-modeled perils), and the breakdowns of underwriting and reinsurance expenses used in the overall rate level change calculations.

Exhibit 6 shows how base rates are constructed for modeled perils. First, the fixed reinsurance costs for the homeowners line of business are allocated to policy form on the basis of the product of the latest year's actual distribution of exposure (earned house-years) by policy and the known base coverage amount, or "earned TVI at base value insured." The indicated loading in the base rate is just the ratio of allocated fixed reinsurance costs to earned house-years (policies).

To obtain the loss portion of the base rate, the cat model is run against the experimental data sets and the simulated expected gross annual losses are recorded for every location. Location results are aggregated statewide to obtain the overall average loss for the base structure in a season.[20] The final base rate for hurricane, by policy form, is the loaded sum of the loss cost and fixed reinsurance cost. Recall we have chosen to allocate all non-loss reinsurance costs to the hurricane peril, so the other wind base rate by form is just the loaded loss cost.

The analogous base rates for non-modeled perils are based on historical data and developed on Exhibit 7. When using the loss

---

[20] Model results are less credible for HO-4 (renters) and HO-6 (condominium unit-owners) policy forms. The choice was made to reduce modeled loss costs for the site-built homeowners forms, based on the ratio of the sum of base coverage A/B/C/D amounts for the forms, to derive a reasonable hurricane loss cost for HO-4 and HO-6 forms. Specifically, the HO-4 policy provides a \$10,000 base for contents coverage, no coverage for structures, and "loss of use" coverage of 20% of the contents coverage, while the HO-3 provides a \$100,000 base amount for dwelling coverage, 10% of the dwelling amount for other structures, 50% of the dwelling amount for contents, and 20% of the dwelling amount for loss of use. The ratio of total modeled coverage between these two forms is therefore $(10 + 2)/(100 + 10 + 50 + 20)$, or about 6.7%. This assumes the same average damageability ratios over all coverages.

cost ratemaking method along with historical property exposure data, several distributional adjustments may be necessary. For the fire peril, the average underlying key factor (a function of TVI) and average underlying construction/PPC factor are likely highly divergent by policy form. The exposure base, the denominator of the loss cost, is multiplied by the average underlying factor in the *proposed* rate structure (for each maldistributed rating factor) to restate it at a "base class" level for determining the base rate. Similar adjustments apply for average underlying limits in the base rate for liability and average underlying TVI in the AOP base rate. The adjusted loss cost must still be loaded for variable expenses and profit, of course.

The need for distributional adjustments to the loss cost based on proposed rating factors means that these rating factors must be determined before the final base rates are. This is necessary for an efficient and equitable rate structure when rates are developed from the ground up. Later, it is shown that we achieve adequate revenue under the modern rating plan by "solving for" the base rate that matches indicated overall rate level to estimated rate impact.

Expense fees by policy form are developed on Exhibit 8. The ratio of the latest year's earned premiums (including such fees) to earned house-years represents an average premium per policy. The fixed expense ratio is applied to this value, and loaded to obtain the indicated fee. In practice, round numbers are often selected for expense fees and they are often set equal for similar policy forms.

8. TERRITORY AND CLASS RATING FACTORS

In the basic rating logic, territory factors apply to every peril. In addition, class factors apply to fire (construction/protection) and hurricane (mitigation), and increased limits factors adjust the liability premium. Base premiums for each non-liability peril reflect coverage adjustments for amount of insurance and amount of (or percentage) deductible.

Territory Factors—Modeled Perils

Exhibit 9 presents one method of determining hurricane territory rating factors that incorporate an allocation of fixed reinsurance costs. Most actuarial techniques for the development of rating factors use only the mean loss cost to modify the base rate. This method uses the modeled mean loss costs by territory to modify the loss portion of the base rate, and the standard deviation of these loss costs to modify the fixed reinsurance cost portion of the base rate.

Recalling formula (7), F_R denotes the fixed (non-loss) reinsurance expense dollars per policy. The bulk of non-loss reinsurance costs reflect some measure of risk as perceived by the reinsurer. Many risk metrics (as functions of the possible loss outcomes on a portfolio of policies) exist, and it is beyond the scope of this paper to capture the essence of the (considerable) actuarial debate over the best metric for reinsurance premium development. The assumption used here is simple and squares with observations of the global reinsurance market:

$$F_R = K \times S_L \tag{12}$$

where

S_L = the standard deviation of the modeled annual losses—readily available by location or in geographical aggregate from the cat model;

K = an empirical scale factor that relates the volatility in modeled losses to the actual non-loss ceded reinsurance premium.

In other words, assume that reinsurers charge for cost of capital in proportion to the standard deviation of annual losses. While reinsurance pricing models tend to be proprietary, there is longstanding support in both actuarial literature [8] and market practice to brand this assumption reasonable.

We choose the scale K_i identically for each territory so that the exposure-weighted F_R by territory, based on S_L, balances to the aggregate F_R derived on Exhibit 4 (expressed per unit of losses). The success of the technique does not require this choice—the scale factor could be set lower in some territories and higher in others to reflect second-order assumptions about the capacity charges levied by reinsurers in different areas.

The modeled number of exposures (essentially a land-area weight given the construction of the experimental data sets), modeled (mean) loss cost, and modeled standard deviation of losses are collected for locations falling in each proposed territory. Note that the overall modeled loss cost is the exposure-weighted average by territory, but the aggregate standard deviation is *not* additive—it must be collected directly from the model output. By design, the allocated fixed reinsurance costs, reflecting the scale factor, do average (exposure-weighted) to the aggregate fixed costs derived in the overall rate level indication.

The sum of the modeled loss cost and fixed reinsurance cost for each territory is the basis for the cost relativity to the statewide average. This relativity is the theoretical territory factor. In practice, allowance is made for a tempering of the indicated rating factor toward unity due to competitive or regulatory pressure. This is not "credibility weighting" because the modeled loss costs are fully credible in a convergent hurricane model.[21] The tempering is a non-actuarial exercise. If it is present, the resulting factors must be rebalanced to unity.

The techniques may be applied in an identical fashion to experimental data sets for both homeowners and mobile home forms. This study found that the statewide range of territory factors was slightly wider for mobile homes.

---

[21] The Florida Commission on Hurricane Loss Projection Methodology, an agency charged with certifying the validity of catastrophe models used in rate filings in the state, uses a standard by which modeled mean loss costs must "converge" within a certain tolerance at the ZIP code level. The simulation size required for convergence can be very large (50,000 years in the case of at least one model).

Though loss and fixed reinsurance costs must both be considered in all rating factors for the hurricane peril, formula (10) does not apply directly when this technique is used because:

- The rates are balanced to the statewide average of unity, so there is no base territory relative to which credits and debits are expressed;
- The fixed reinsurance costs are allocated directly in the calculation of the territory factors using the standard deviation of modeled losses.

An adjustment to loss cost relativities may be necessary when mitigation class factors are developed later.

The territory factors for the other wind peril are developed using identical experimental data sets, with the exception of lowering the base deductible to $500. The same basic technique is applied to the model output, with the deletion of the allocation of fixed reinsurance costs—the modeled mean loss cost relativities are the sole basis for the (possibly tempered and rebalanced) territory factors. The advent of simulation models for other wind offers the opportunity to exorcise the last vestiges of the classical ISO "excess wind procedure" and its brethren from ratemaking for infrequent catastrophic events.[22]

Territory Factors—Non-Modeled Perils

Standard one-way actuarial techniques are applied to the problem of setting territory rating factors for AOP, liability, and fire (if desired) from historical experience. Exhibit 10 shows an analysis of AOP territory factors for completeness.

In a loss ratio ratemaking approach, the actuarially correct inner product used to balance the average statewide factor to

---

[22] See Burger et al. [3] for an excellent contrasting description of the use of cat models for hurricane and an excess wind procedure for other wind.

unity would be that of:

- Adjusted relative loss ratios (losses divided by premiums stated at present level and adjusted to "base" or statewide average territory level) by territory, and
- A weighting vector of earned premiums (on present base territory level) by territory.

In the loss cost approach used in our study, the appropriate weight becomes whatever exposure base is used to calculate relative loss costs. Earned total value insured is the base (one unit of earned TVI is equal to one house insured for \$1,000 for one year), so it is used both to calculate relative loss costs and to balance the statewide average territory factors to unity.

Classical (limited-fluctuation) credibility is applied to the relative loss costs, again using earned TVI as the base, to obtain final indicated factors. Many other credibility techniques could be applied, but a survey of them is beyond the scope of this paper. The full credibility standard V_f is chosen by judgment, and the credibility for a single territory is

$$Z_i = \sqrt{\frac{V_i}{V_f}}. \tag{13}$$

Again, it is possible that selected territory factors may differ from indications for non-actuarial reasons. The selected territory factors are rebalanced to a statewide average of unity using the weighting discussed above.

Depending on claim volume, territory factors for the liability peril may be set using regional aggregations of territories. Alternatively, regional loss cost relativities might serve as the complement of credibility for territory-level relativities. In fact, these regions do not have to be geographically contiguous if liability trends tend to follow city and suburban demographics. In any case, the same techniques are applicable except that loss data should also be converted to basic limits to avoid demographic bias.

Class Factors—Hurricane (Mitigation)

Property insurance has always been rated by type of construction, but construction rating attributes were historically designed to rate the predominant peril of fire. The blunt distinction between frame and masonry wall construction was often deemed sufficient. As hurricane has replaced fire as the cause of loss underlying the plurality of the base premium in some states, construction class plans should evolve accordingly. The modern rating architecture should include class plans based on distinct construction attributes for both fire and hurricane perils.

In hurricane, a "mitigation" class plan focuses on features, techniques and devices specifically designed (and often retrofitted to the home after initial construction) to reduce such losses. As discussed earlier, Florida statutes now enumerate several devices that must be considered in the development of the class plan. The public domain ARA study is also required reading for those seeking to understand the rationale for the choice of devices that serve as elements of the class plan. The study found that the following devices significantly reduce hurricane losses and should be treated as "primary rating factors":

- *Roof shape* (gable, hip, flat, and others)
- *Roof covering* (shingles compliant with FBC, shingles not compliant with FBC, tile, metal, and others)
- *Secondary water resistance* of roof (present in the form of taped or sprayed sealant, or not)
- *Roof-to-wall* connection (toe nails, clips, hurricane wraps of single or double layers)
- *Roof deck attachment* method (four categories based on nail size and spacing)
- *Opening protection* (engineered storm shutters, non-engineered attachments such as anchored plywood, or none at all)

The study noted several additional attributes that reduce hurricane losses enough to be treated as "secondary rating factors":

- Opening protection *coverage* (windows only or all openings including doors and garage doors)
- *Gable end bracing* (present or not)
- *Wall construction* (the traditional fire class variable, frame or masonry)
- *Wall-to-foundation restraints* (present or not)

An actuarially interesting result of the study is that the reductions in expected loss cost for various combinations of devices turn out to be highly interactive, meaning that the class factors cannot be set for individual devices and multiplied or added across all devices present to determine the appropriate comprehensive class factor. Instead, a multi-dimensional table of modeled primary rating factors for each combination is needed, such as the one shown in Exhibit 11.[23]

The indicated reductions in loss costs for the various combinations also depend upon the terrain category (flat, swampy, hilly) associated with the property location. ARA divided the state into two basic terrain categories that they denoted "B" and "C." A reasonable choice is to map the terrain category definitions shown in the study to the proposed territory structure, designating each entire territory as one category to facilitate the determination of class factors from the tables without additional geo-coding.

Given the raw loss cost relativities, the final class factors must still embody a key actuarial assumption. When the mean loss cost is reduced (relative to the unmitigated base structure) for a house by application of mitigation devices, should its allocated portion

---

[23] Exhibit 11 shows the actual factors promulgated in the ARA study, relative to a base structure which is largely unmitigated and carries a 2% hurricane deductible.

of fixed reinsurance costs be reduced as well? If so, should it be reduced in proportion to the mean or should the reduction be tempered? Recall that formula (12) assumes that fixed reinsurance costs are proportional to the standard deviation of modeled losses. Even if one believes this assumption is valid at the individual risk level, it is entirely possible that a reduction in mean losses could decrease S_L less than proportionally, or even increase it. Alternatively, other seemingly intuitive assumptions—for example, that the coefficient of variation of modeled losses would remain constant when a mitigation regime were applied—would lead to a fully proportional reduction in fixed reinsurance costs (and therefore class factors that are identical to the raw loss cost relativities).

Under the assumption that non-loss reinsurance costs are truly "fixed" even in the presence of mitigation, the class factors may be derived from the loss cost relativities using formula (10), where α is the relative loss cost, X is the permissible loss ratio from Exhibit 1, and F_R is the fixed reinsurance cost ratio from the same exhibit. For example, a loss cost reduction of 20% for a device, along with a permissible loss ratio of 65% and a fixed reinsurance cost ratio of 10% would lead to a class factor of

$$\rho = \frac{(1-20\%)\times 65\% + 10\%}{65\% + 10\%} = .827.$$

In addition to the key issue of reductions in fixed reinsurance costs, the public domain studies have been silent on several important issues for ratemaking:

- Should this mitigation class plan apply to losses from other wind (non-hurricane storms containing tornadoes, hail, and severe straight-line wind)? If not this plan, what about a modified alternative? Other wind causes of loss were not considered.
- Should this mitigation class plan apply equally to owners, renters, and condominium policy forms? It stands to reason that the factors should be modified when contents coverage is

the predominant exposure under the policy. Yet little guidance was provided in the studies.

- How should mitigation class plans be modified for commercial construction exposures?
- How should mitigation experience data from actual catastrophic events, as they are occasionally experienced, be assimilated into the class factors? It would be hubristic indeed to assume that mitigation devices and combinations thereof will perform exactly as modeled when we observe the effects of a real hurricane. To the extent they do not, what is the actuarially appropriate credibility for the vital data from actual events in future class factors?

In summary, actuaries and their scientific partners have a long way to go in developing comprehensive mitigation class plans for the relevant perils. To the extent we do not ask all the right questions, unpalatable answers may be forced upon the insurance industry.[24]

Class Factors—Fire (Construction/PPC)

In the classical rating plan, class factors are targeted at the fire peril and two attributes of residential structures: the resistance of the structure to fire damage, and the level of fire protection afforded by the community in which the structure is located. These two attributes are highly interactive—masonry construction, which is more fire resistive, is more common in suburban environments where fire hydrants are prevalent and fire stations plentiful. Therefore, rating factors are developed using "two-way" actuarial analysis, as detailed by many contributors to actuarial literature.

This study breaks no new technical ground here—fire peril experience data is used along with a two-way "minimum bias" procedure to develop sound construction/PPC factors for the modern

---

[24] Regulators in Florida have already encouraged blanket application of the class factors for residential structures to HO-4 and HO-6 policies and other wind base rates.

rating plan. No exhibits on this topic are included, but following are some empirical results associated with a peril-specific analysis:

- The "spread" of construction/protection class factors is much wider when only the fire peril experience is considered in the analysis, as losses for other perils are not part of the experience base. Non-fire losses, which do not vary significantly by fire rating attributes, serve as ballast dampening the construction/protection class factors toward unity in the classical plan. This result confirms one of the stated advantages of the modern rating plan—greater rating resolution for non-catastrophic perils.
- Significant differentials in loss experience are found for individual (ISO) protection classes 4, 5, and 6, prompting development of separate factors for these classes. Most insurers combine classes 1–5 or 1–6 and use the same rating factor in classical rating plans.
- Fire experience for hybrid construction types such as brick veneer (over frame) and "hardi-plank" siding varies significantly from that for either full frame or full masonry construction. Expansion of the classical "frame vs. masonry" construction class distinction to include an intermediate rating class for these hybrid types is advised.

9. KEY, DEDUCTIBLE, AND LIMIT FACTORS

As Exhibit 17 shows, the modification of base rates for territory and class leads to partial key premiums by peril. The key premiums are further modified for attributes reflecting the volume of coverage provided, via key factors, deductible factors, and increased limit factors (for liability), to obtain partial base premiums. It turns out that the incongruities in the loss distributions for fire, AOP, and modeled perils are significant enough to warrant separate development of key and deductible factors for each peril. In addition, the presence of percentage deductibles for hurricane requires a separate set of deductible factors.

Key Factors—Non-Modeled Perils

The reflection of value insured is probably the single most important rating factor in pricing property insurance. Given its critical importance, it is one of the most under-represented topics in the actuarial literature. Background research for this study was frustrated by little existing guidance on techniques for developing key factors from experience data for even an indivisible premium, and absolutely none on key factor relationships for distinct perils when rated separately. Most papers on homeowners pricing do not treat the subject at all. Homan [10] provides a clever frequency/severity approach for an all-perils development, but his reliance on industrywide loss cost distributions for the complement of credibility is not helpful when no analogous complement is available by peril.[25] In summary, one is caught between the "rock" of low credibility of experience data by peril within small ranges of insured value, and the "hard place" of no suitable complement of credibility in the form of larger-scale studies.

In response, an approach is developed for AOP and fire perils based on accumulations of experience data at successive levels of value insured. It reflects the value of experience data while facilitating smoothing of the indicated loss costs to produce tables that square with actuarial theory.

Exhibit 12 shows the development for the fire peril. Five calendar years of experience is segregated by $5,000 ranges of (coverage A only) TVI. First, the average classical all-perils key factor for the midpoint of the range is shown for reference, along with the earned house-years and paid fire losses (with D&CC). Second, the exposure and losses for all TVI ranges up to and including the current range is accumulated, and the cumulative loss cost calculated.

---

[25] Homan also includes a treatment of fixed expenses, which is not necessary when an explicit expense fee is charged—as it is in the fair premium structure developed here.

Why accumulate? Theoretically, the key factor represents the loss cost at a given (incremental) TVI range relative to the loss cost at the base value, but the loss cost series for individual TVI ranges is simply too volatile to use directly. Instead, use the more stable cumulative loss cost series to mark selected cumulative loss costs at "target" points (generally every \$25,000 of TVI), and calculate the implied incremental loss cost in the target range by decomposing the cumulative value as follows.

The known cumulative losses can be represented as the sum of a series of incremental loss costs times incremental exposure in each TVI range up to the current one:

$$L_k = \bar{\lambda}_k \bar{W}_k = \lambda_1 W_1 + \cdots + \lambda_k W_k$$

where:

λ_i = the incremental loss cost in each range ($i = 1,2,\ldots,k$);

W_i = the exposure weight in each range;

and bars above indicate cumulative totals for ranges "up through" an amount. Then solve for the incremental loss cost for the current range (denoted by k) from the cumulative totals and the exposure in the current range:

$$\lambda_k = \frac{\bar{\lambda}_k \bar{W}_k - \bar{\lambda}_{(k-1)} \bar{W}_{(k-1)}}{W_k}. \tag{14}$$

Once the implied key factors are found for each of the target ranges, interpolate linearly between every two target points to find the key factor for the \$5,000 ranges in between.

When selecting cumulative loss costs at target points, one must be careful to keep the implied marginal key factor (difference between key factors for successive \$5,000 ranges) between the theoretical lower and upper bounds of:

- Zero (meaning no additional losses are expected despite the increase in policy limit), and

- .05 (meaning all losses are total and will "burn through" the additional policy limit of 5% of the basic limit in a linear fashion).[26]

This is a non-trivial exercise requiring some trial and error. Exhibit 12 shows a reasonable curve given the credibility of some actual data and the theoretical limitations. Also, the factor for "each additional $5,000" beyond $250,000 primarily reflects the marginal factor in the last target interval.

The effects of fire protection, construction, and average TVI overlap severely in the rating plan. Higher-valued homes tend to be of masonry construction and located in well-protected suburban areas. Accordingly, the fire peril exposure amounts may be adjusted to ameliorate this distortion to the raw incremental and cumulative loss costs. Specifically, divide out the proposed construction/PPC rating factor from each exposure record in the statistical data to get a loss cost stated "on base class."

Key Factors—Modeled Perils

In catastrophe simulation models, the result for each simulated event at each location is typically the "mean damage ratio," a value representing the damage as a proportion of the value of the structure(s) insured. The value of the structure is given as a parameter by the user of the model and the mean damage ratio is applied to it to generate the modeled losses. Put another way, in the models there is an assumption of independence between the mean damage ratio for the structure and its insured value, all other attribute held constant. Most insurers make blanket (as opposed to policy-level) assumptions about insurance-to-value when populating an exposure data set for simulation, which proportionally affect the modeled cat loss costs for pricing purposes.

Assuming the values insured reported to the model are reflective of sufficient insurance to value, this attribute of cat models

---

[26] Recall that the base structure is defined as one of $100,000 TVI.

implies that the key factor table is linear with respect to TVI for the modeled perils. The hurricane base premium for a given $200,000 house is twice that for an identical $100,000 house. A further discussion of the appropriateness of this assumption appears in the ISO [12] filing to partition wind base premiums, as part of their statutory compliance filing of the Florida mitigation class plan. The note the ISO key premiums are nearly linear for the wind peril.

To some, the assumption may appear to be an unacceptable oversimplification and a weakness of using simulated catastrophe losses in pricing. For a heavily reinsured company, the argument over whether the key factor table should be driven by the linearity of modeled loss costs is largely academic. Market reinsurance costs are increasingly driven by the distribution of modeled losses, and the retailer of insurance must reflect its "wholesale" cost for each risk, as charged by the reinsurer, to avoid economically irrational underwriting.

A linear scale of key factors for both hurricane and other wind perils is thus reasonable. The key factors vary by policy form only because the base value insured differs by form. In Florida, one practical effect of the separation of key factors by peril is higher hurricane rates for high-valued homes. These homes were significantly subsidized by application of sub-linear key factors to indivisible premium, of which a plurality (if not a majority) is typically hurricane premium.

Deductible Factors—Non-Modeled Perils

Unlike key factors based on the aggregate loss cost distribution, deductible factors depend solely upon the loss severity distribution. An excellent review of general deductible pricing theory appears in Hogg and Klugman [9], and familiarity with the "loss elimination ratio" (LER) as the kernel of the deductible rating factor is assumed. This study provides strong evidence that the LER profile varies greatly by peril. In addition, one might expect that the LERs should vary significantly across many other rating factors, such as value insured, territory, and class. In order to maintain manageable rating logic, flat dollar deductible factors are allowed to vary by peril and TVI range, and by territory only for modeled perils.

The deductible factors for non-modeled perils are developed directly from five years of individual claim data. Flat dollar deductibles (\$500, \$1,000, and \$2,500) are the only options for non-modeled perils, in contrast with the percent (of coverage A TVI) deductibles offered for the hurricane peril and discussed below.[27] Each existing claim is stated on a "ground-up" basis by adding back the deductible amount associated with the claim.[28] The net of deductible claim amount is determined for each claim under each flat deductible option. The sum of all claims valued at each deductible option is compared to the ground-up losses to determine the empirical LER for each deductible amount. Then the deductible rating factor for each non-base deductible is calculated as

$$d_i = \frac{1 - \mathrm{LER}_d}{1 - \mathrm{LER}_{\mathrm{Base}}} \tag{15}$$

or the ratio of the losses retained (not eliminated) at the target deductible to those retained at the base deductible (of \$500 in this study).

These factors depend heavily on the underlying exposure (TVI) distribution of the empirical data, since the amounts of total losses vary by claim but the flat amount does not.[29] Ac-

---

[27] There is no theoretical reason percent deductibles by peril cannot be priced from experience data. In fact, one could argue that percent deductibles are actuarially superior for all perils because they "inflate" with the value insured and therefore with the corresponding loss severity distribution, a big help in preserving the loss elimination ratios underlying the rating factors. The resulting factors become obsolete over time much more slowly. Though state statutes tend to restrict deductible options depending upon TVI, at least one Florida insurer has recently introduced an all-perils percent deductible.

[28] This does not solve the "missing claims" problem of losses not exceeding the actual deductible which "would have been filed" if the deductible were smaller. This distortion is ignored here.

[29] The data was divided into TVI ranges which produced a credible and approximately equal amount of earned house-years in each range.

tuarial theory states that the LER for the same deductible option and the same underlying (unlimited) loss distribution will be smaller as the average TVI (policy limit) increases. Further, the relationship between the LERs for two (small amount) deductible options should be dampened as both options represent an ever-smaller portion of increasing TVI. This implies a two-way consistency test for deductible factors:

1. The selected factor for a given TVI range should (obviously) decrease as the deductible increases, and
2. The selected factors for a given deductible should converge toward unity as the TVI range increases.[30]

When this process is compared for multiple perils, one expects the loss distribution for perils which tend to result in more total losses (such as fire) to imply smaller LERs at all deductibles, and therefore deductible factors closer to unity, than those implied by a peril producing more partial losses (such as AOP). Therefore, across multiple perils a third consistency test applies:

3. The selected factor for a given TVI range and deductible option should be closer to unity for the more "severe" peril (the one with the more right-skewed distribution of loss amounts).

Exhibit 13 shows representative LERs and selected deductible factors that reflect all three tests.

Deductible Factors—Modeled Perils

Percent deductibles applicable only to the hurricane peril are the rule in Florida. They were originally introduced as an innovative way to reduce loss exposure without nonrenewals in the market turbulence following Hurricane Andrew in 1992. In lieu of experience data, this study uses the cat model to deter-

---

[30] Whether they start above or below unity is determined by the base deductible.

mine hurricane deductible factors by scenario testing over several model runs on the same experimental data sets, with only the deductible option changed in each scenario. Specifically, replacing the base 2% deductible with each of the other deductible options (in our study, 0.5%, 1% and 5%), the model is repeatedly run to determine the simulated loss elimination ratio.

Catastrophe simulation science indicates that the shape, as well as the scale, of hurricane loss distributions varies widely by territory. In fact, areas with high average hurricane loss costs also tend to have a greater frequency of severe storms that produce more near-total property losses. Ideal hurricane deductible factors should therefore vary by territory. In consideration of maintaining manageable rating logic, the study examines the scale (expected annual loss costs by territory) of the hurricane loss distribution by territory from the experimental base data set and divides the territory set into Low (less than $400 per year), Medium ($400–$599), High ($600–$1,099), and Extreme ($1,100 and over) hurricane intensity zones. The boundaries are determined by judgment, and intended to include a reasonable number of modeled locations in each zone—though most modeled points are in the Low zone, the higher-intensity zones must be segregated to produce reasonably accurate factors. The modeled losses are aggregated under each scenario in each zone, the relativities to the modeled losses at the base deductible are computed, and deductible factors selected. Exhibit 14 shows the results.

When using the model to price flat dollar deductibles as a modification to the base rate for a percent deductible, the problem of exogenous values insured pops up again, in a different disguise. Any flat amount represents a constant percentage of a single experimental base value insured, no matter what the choice. For example, the modeled losses, and therefore the loss elimination ratio, for a $500 deductible scenario will be identical to those for a 0.5% deductible scenario when the base value is

\$100,000.[31] The actual deductible factor charged in rating, even for the hurricane peril, should depend upon the empirical TVI distribution of the insurer's book, and indeed the TVI of each property. By design, this is not considered in the experimental data set.

Rather than resolving "the" proper way to differentiate flat dollar hurricane deductible factors by TVI range, the study settles on an adjustment to a base scenario (that for the 0.5% deductible, which is equivalent a flat \$500 deductible for the majority of units in the experimental data set). The implied relative loss cost for *AOP perils* by value range, shown on Exhibit 13, is the ratio of the complement of the loss elimination ratios in each range; the calculation is analogous to formula (15), but relates TVI ranges rather than deductible amounts. Select a relativity, then apply it to the modeled 0.5% deductible factors by zone to produce \$500 flat deductible factors that vary by both TVI range and zone. For example:

Low zone, under \$75,000:

$$1.17 \approx \frac{(1-25.0\%)}{(1-20.4\%)} \times 1.23$$

Medium zone, \$225,000 and over:

$$1.26 \approx \frac{(1-14.7\%)}{(1-20.4\%)} \times 1.18$$

and so on. The end result is a reasonable consideration of both value insured and territory loss distributions in the pricing of hurricane flat dollar deductibles. The calculation could be repeated for other flat deductible options.

The deductible factors for other wind, where only flat dollar deductibles are offered, are calculated using exactly the same procedure and modeled scenario testing, except that factors are

---

[31] This is true assuming that the model contains a "static" event set which is applied to every location. Some models build a "secondary uncertainty" randomization component into the analysis, which means the modeled losses for the same scenario on the same event set will still differ somewhat every time the model is run.

not differentiated by zone. This simplifies the process by removing one dimension from the matrix of rating factors. Catastrophe simulation science indicates that other wind aggregate loss costs are driven by expected event frequency and that the shape of the severity distribution of individual severe thunderstorm events is not as critically different by territory. Further, other wind is a much smaller portion of overall base premium in Florida, leading to the decision to waive this adjustment.

Limit Factors—Liability/Medical

This paper breaks no ground with respect to the actuarial techniques for calculating limit factors for the liability peril (coverage E), but there are still advantages to divisible base premium. Limit factors are often based on benchmarks obtained from the voluminous databases and advanced loss distribution analysis provided by advisory organizations such as ISO. With distinct liability base premium, there is an opportunity to move away from the cumbersome additive charges commonly used in residential property insurance and develop multiplicative limit factors for liability base rates with appropriate reference to industrywide data. The modern rating logic includes a liability base rate modified by a multiplicative factor.

Medical payments coverage (coverage F) is such a small part of the overall base premium that one may simply add the base rate to that for liability (after modification by the limit factor) and allow for the existing additive medical limit factors. Application of multiplicative factors to medical might even result in premium changes of less than one dollar, which is not practically desirable in most policy administration systems.

10. ADJUSTMENTS TO BASE PREMIUM

Many adjustments (charges and credits) are made to the base premium to determine a final homeowners policy premium, even without the presence of specific endorsements. The modern rating architecture allows several improvements to these adjustments:

- Some adjustments may be recalculated as a modification to an appropriate subset of the total base premium rather than a blanket modification of premium for possibly impertinent perils;
- Some adjustments for excluded perils may be accomplished by partial or total elimination of a portion of the base premium, simplifying the rating logic.

Exhibit 15 shows how charges and credits are recalibrated to a smaller premium base when changes must be revenue-neutral in aggregate. One may tabulate the statewide distribution of base premium by peril and policy form, then simply divide the current credit or charge by the proportion of the proposed premium base represented by the components to which the credit or charge is targeted, to make the modifier appropriate for the smaller base. Of course, the actuary may determine that larger or smaller revenue effects are indicated and use experience data to adjust the charges and credits in line with indications, provided the expected revenue gain or loss is acknowledged as an off-balance in the determination of overall rate level impact.

Some examples of actuarially sensible changes to adjustments to base premium are:

- *Wind and hail exclusion* may be accomplished by simply eliminating the base premium for hurricane and other wind in the total base premium calculation. Tabular factors formerly used for this purpose may be eliminated, streamlining rating logic.
- *Superior construction and storm shutter credits* may be eliminated, as they are superseded by the comprehensive windstorm mitigation class plan.
- The *seasonal occupancy charge* may be adjusted to apply to the (AOP + fire + liability) base premium, if it is believed that the wind resistance of the structure does not depend on occupancy.

- The *protective devices credit* for smoke and burglar alarm combinations may be adjusted to apply to (AOP + fire) base premium.
- The *age of home credit* may be adjusted to apply to the (AOP + fire) base premium, or eliminated with the advent of fire and hurricane class plans.
- The *town/row house charge* may be adjusted to apply to the (AOP + fire) base premium.
- The *replacement cost provisions charge* for "guaranteed replacement cost" endorsements may be adjusted to apply to the non-liability base premium.

11. IMPLEMENTATION ISSUES

The move to a modern rating architecture for residential property insurance affects many non-actuarial functional areas within an insurer, including:

- Operations (programming, policy management, statistical reporting)
- External affairs (filings, regulatory relations)
- Marketing (sales force, customer service training, competitive analysis)

Several specific items and issues with actuarial overtones and cross-functional impacts are discussed below.

Measurement of Overall Rate Level Impact

Most rate reviews proceed in three major steps:

1. Examine the indicated overall rate level change;
2. Determine base rates and rating factors (and rating logic as necessary);

3. Assess the overall rate level impact of the selected rate structure and reconcile it with the indicated overall change.

Step 3 is extremely important to both internal and external stakeholders in the insurance economy as well as to the actuary charged with maintaining profitability. It may be accomplished at several levels of granularity. When only a few base rates and rating factors are changing and there are no significant changes to the rating logic, aggregate estimates of the overall impact may be sufficient. The extreme case would be a single change to a base rate that applies to all policyholders, in which case the actuary could state with certainty the overall impact without analyzing the effect at the policy level. When the rating logic and territory definitions are completely redesigned and each base rate, class and territory rate table is developed from first principles, the other extreme applies. The overall rate level impact must be measured by re-rating every existing policy on the proposed rate structure.

The actuary must be prepared to build tools that compare "before and after" premiums for each existing policyholder and that can be run iteratively in a timely fashion. Again, technology is the enabler allowing the extraction of high-quality data and execution of rating logic quickly to measure rate impacts in this fashion. As the impacts are compared against the indications, the most efficient technique for iterative adjustment is a flat factor applied to the base rates by policy form.[32] This study does not vary the flat factor by peril, which has the effect of preserving the overall distribution of base premium.

Competitive and Residual Market Analysis

Even a policy-level measurement of static overall rate level impact is still insufficient to indicate the likely second-order or

---

[32] As a regulatory matter, some states require rate indications developed by policy form—in this milieu, the flat factor applied to the indicated base rates to achieve the overall indication should also vary by form.

dynamic effect on overall premium and policy volume (as prices incent consumer actions) and distributions by policy form, territory and class. Yet this is actually the effect of greater magnitude to the profitability and growth of the insurer in the long run. When all the insurers competing in a market have similar rate structures and the market is relatively stable, the effect of an overall rate level change that does not displace many existing customers differently than the overall average may perhaps be measured with ignorance of dynamic competitive effects. When an insurer makes a market-leading change to a modern rating architecture, the likely competitive effects must be examined in advance and monitored closely as the architecture is rolled out. Returning to Cummins [7] will remind the reader of how critically certain market attributes can affect the possibility of adverse selection against the insurer.

On the flip side, a modern rating plan is one of the few ways to gain a sustainable competitive advantage in the market without a significant investment in operational scale and surplus capacity. Further, marketing and underwriting restrictions should be comprehensively reviewed and aligned with the rating plan once it is implemented. Historical restrictions that reflected rate adequacy considerations in particular territories and classes may be rethought as the marketing plan is revisited. In summary, a more refined rating plan should facilitate some additional growth given constant surplus.

The regulators (and possibly private sources) in many states collect proposed premiums for standard rating examples (a.k.a. “risk profiles”), which are most often publicly available. These rate comparisons may also include the residual market rate from the insurer of last resort if there is one. The actuary can compile such comparisons as a leading indicator of changes in competitive position, at least for “typical” risks. Regulators may be interested in the proposed position of the insurer against public (residual market) as well as private competitors, depending on the level of political pressure against raising residual market rates to maintain minimal competition with the private market.[33] Exhibit 16 shows an example of a rate comparison that might be useful. The actuary should encourage all stakeholders to keep in mind several distortions inherent in rate comparisons:

- Comparing an individual insurer's proposed rates to the competition's current rates may produce a false sense of competitive position when rate levels are rapidly rising or falling industry-wide, due to the natural time lag between successive filings. Emerging causes of loss, capacity problems affecting reinsurance prices, and other phenomena may not yet be reflected in the current (more accurately, the last filed) rates of competitors or the residual market.
- Comparisons are often based on the "average" rate for a particular county or wider geographic region. The average may be weighted by an exposure distribution that does reflect that of the insurer, or it may not be weighted at all—a simple arithmetic average using one rating example for each territory within the area. The insurer implementing more refined territory definitions than its competitors produces an average for coastal areas that is most likely skewed upward in this case, because of its removal of inland subsidies to coastal business in a more refined hurricane territory structure. The example for a small coastal territory, perhaps even one in which the insurer has no current business, gets equal weight with the inland example from a much wider land area and more populated area letting the high coastal rate drive the average.

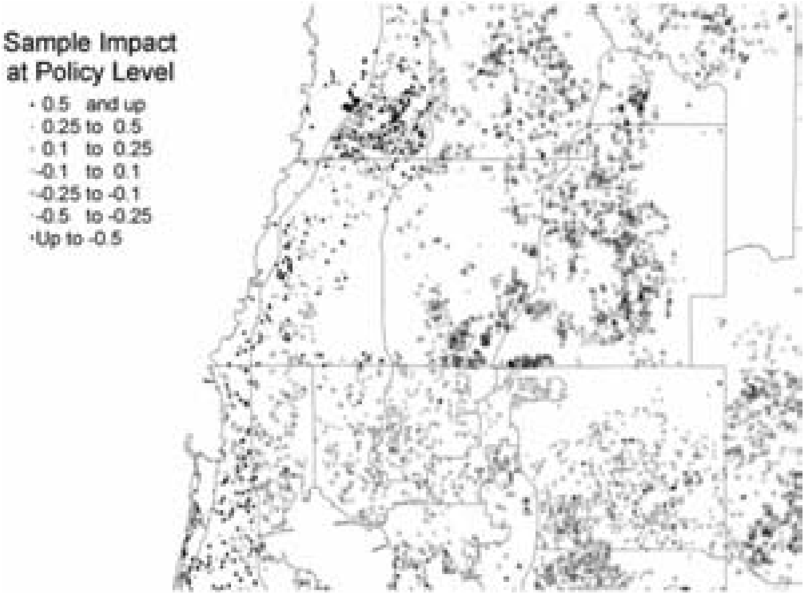
Rate Dislocations and Transition Planning

As critical as it is to understand the proposed rating plan's competitive impact on the ability to write new business in each

---

[33] In Florida, some residual market rates are set based on the highest premium reported by the top twenty private insurers (as ranked by premium market share) for a given rating example in each county, which focuses regulatory attention more directly on the differential between an insurer's proposed rates and those for the residual market in the same geographic area.

FIGURE 5



territory, it is just as important to manage customer retention when many existing insureds likely face significant rate changes. First, the actuary can inform the marketing and sales force by geographic area in a comprehensive fashion. Figure 5 shows an example of a "pin map" that delineates the proposed territory boundaries and contains a color-coded pin for each existing insured location. The shades indicate the spectrum of rate changes that will be experienced by each location.

Second, serious consideration should be given to a transition plan that caps annual swings in premium to a maximum and minimum percent value, phasing in the premium change for those subject to severe rate dislocations. There is a legitimate debate as to whether such plans are inherently unfairly discriminatory, as new business and renewals would be charged different rates for an identical risk. A complete discussion of the economics and public policy associated with such plans is beyond the scope of this paper, though it is noted that "swing limits," capping changes in rating factors in spite of credibility-weighted indications, are used throughout many accepted rating plans in most lines of insurance. In any case, the practical business advantages of a phasing-in of premium changes for existing insureds cannot be overlooked.

It sounds simple to implement such a plan, but the devil is in the details of how the premium subject to transition is calculated and carried forward from year to year. Basic logic for a plan that caps annual premium increases might be as follows:

1. Calculate P_0, the premium on current rates at the current TVI. P includes premium for miscellaneous coverages and endorsements, but does *not* include expense fees. Premium for endorsements added during the current term is restated as full-term premium on current rates.
2. Calculate P_1, the premium on *proposed* rates at the *current* TVI, for the standard policy coverages and only endorsements that are effective *before* the renewal date (in other words, on an "apples to apples" basis whereby premium for new additional coverages is not compared against current premium totals). P_1 also excludes expense fees.
3. The premium change factor is the ratio of the premium on proposed rates to premium on current rates less unity:

$$H = \frac{P_1}{P_0} - 1. \tag{16}$$

4. If the premium change factor exceeds M, the selected maximum premium increase, let transition factor

$$T_0 = \frac{M}{H}. \tag{17}$$

5. Multiply each peril partial base premium by T_0 in development of final policy premium. Store T_0 with policy

statistics. At the next renewal, update the transition factor by multiplying by the maximum premium increase, limiting it to unity:

$$T_1 = \mathrm{Min}(T_0 \times M, 1.00). \qquad (18)$$

6. Repeat the adjustment of base premium and storage of T_i for as many periods as necessary until it is 1.00.

It is straightforward to modify this algorithm to accommodate a transition plan that limits both premium increases and decreases for individual policyholders.

Steps 1 and 2 reflect the fact that there are many exposures such as endorsements and "inflation guard" (which provides automatic annual increases in TVI to keep pace with replacement cost inflation) of which the treatment should be carefully specified in designing any transition logic. Just as important is a cost-benefit analysis of the revenue loss expected from the transition plan, at least in the first year. Figure 5 should be reproduced to show the rate impacts net of the transition plan. A granular analysis of premiums on proposed rates, by policy, with and without the transition plan should be conducted to aggregate the revenue impact companywide and by territory. This is the only reliable way to assess the plan's impact.

Miscellaneous Rates, Endorsements, and Operational Impacts

Most miscellaneous coverages are rated using key premium as the base. Recall that this is the fair premium for the class and territory, but reflecting a given base coverage amount and deductible. Simply changing "key premium" to "total key premium" (the sum of the key premiums by peril) will allow migration of much of the rating logic for endorsements in a sound manner. However, rates per $1,000 of coverage and flat dollar charges should be thoroughly reviewed to assess their adequacy as the overall rate level and its distribution by peril shift under the modern rating plan.

The basic rating logic may be of primary concern to the actuary, but the policy services, programming, statistical reporting, and manual writing personnel will spend most of their time dealing with its effect on the adjustments to base premium and the miscellaneous rules for and endorsements available in the residential property program. The actuary should be prepared to invest significant time and effort in assisting these vital stakeholders in modifying the other processes downstream that are affected by the changes in basic rating logic.

12. CONCLUSION

Whether due to necessity or strategy, insurers can improve the stability and adequacy of overall rate level as well as the actuarial equity of individual policy rates by investing in a modern rating architecture for residential property insurance. Elements of the modern rating plan may include:

- Proper use of simulated losses for catastrophic perils in overall rate level, territory and class rating;
- A fair premium structure that is aligned with the need for appropriate consideration of expected losses, fixed and variable underwriting expenses, and costs of capital by peril;
- Base premiums divisible by peril and subject to distinct classification and territory rating plans;
- Refinement of corresponding territory definitions;
- Introduction of new class plans targeted to individual perils formerly not class rated;
- Coverage modification (amount of insurance, deductible and limit) factors that reflect differing loss distributions by peril and appropriate assumptions about the loss cost distribution for catastrophic events;

- Rating logic for adjustments to base premium and miscellaneous endorsement premiums that is targeted to the perils affected by such modifications of the policy and consistent with the logic for base premium determination.

In addition, many practical considerations apply as the modern rating architecture progresses from actuarial theory to operational reality within the organization and competitive reality in the outside market. The actuary should take an active role in addressing each issue.

REFERENCES

[1] American Academy of Actuaries, *Risk Classification Statement of Principles*, 1990.

[2] Applied Research Associates, Inc., *Development of Loss Relativities for Wind Resistive Features of Residential Structures*, Florida Department of Community Affairs (contract number 02-RC-11-14-00-22-003), 2001.

[3] Burger, George, Beth E. Fitzgerald, Jonathan White, and Patrick B. Woods, "Incorporating a Hurricane Model into Property Ratemaking," CAS *Forum*, Winter 1996, pp. 129–190.

[4] Casualty Actuarial Society, *Statement of Principles Regarding Property and Casualty Insurance Ratemaking*, as adopted May 1988, Casualty Actuarial Society Yearbook 2003, p. 335.

[5] Christopherson, Steven, and Debra L. Werland, "Using a Geographic Information System to Identify Territory Boundaries," CAS *Forum*, Winter 1996, pp. 191–211.

[6] Clark, Karen M., "A Formal Approach to Catastrophe Risk Assessment and Management," *PCAS* LXXIII, pp. 69–92.

[7] Cummins, J. D., et al., *Risk Classification in Life Insurance*, Kluwer Nijhoff, 1983, ch. 3.

[8] Hays, David H., and W. Scott Farris, "Pricing the Catastrophe Exposure in Homeowners Ratemaking," CAS Discussion Paper Program, 2, 1990, pp. 559–605.

[9] Hogg, Robert V., and Stuart A. Klugman, "Applications of Distributional Models," *Loss Distributions*, John Wiley and Sons, 1984, ch. 5.

[10] Homan, Mark J., "Homeowners Insurance Pricing," CAS Discussion Paper Program, May 1990, pp. 719–780.

[11] Homan, Mark J., "Reflecting Reinsurance Costs in Rate Indications for Homeowners Insurance," CAS *Forum*, Winter 1997, pp. 223–254.

[12] Insurance Services Office, Inc., Reference Filing #HO-2002-RLC1, filed with the Florida Office of Insurance Regulation, 2002.

[13] Kozlowski, Ronald T., and Stuart B. Mathewson, "Measuring and Managing Catastrophe Risk," CAS Discussion Paper Program, May 1995, pp. 81–110.

[14] McClenahan, Charles L., "Ratemaking," *Foundations of Casualty Actuarial Science*, Second Edition, Casualty Actuarial Society, 1990, ch. 2.

[15] Musulin, Rade T., and John W. Rollins, "Optimizing a Multi-Season Catastrophe Reinsurance Program with Private and Public Components," CAS *Forum*, Summer 2001, pp. 119–152.

[16] Robbin, Ira, *The Underwriting Profit Provision*, CAS Study Note, 1992.

[17] Rollins, John W., "Reflecting Catastrophe Risk Load in Property Rates: An Approach," Presented at 2003 CAS Ratemaking Seminar, Marco Island, Florida, Session PL-8.

[18] Walters, Michael A., and François Morin, "Homeowners Ratemaking Revisited (Use of Computer Models to Estimate Catastrophe Loss Costs)," *PCAS* LXXXIV, pp. 1–43.

EXHIBIT 1

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
OVERALL RATE LEVEL CHANGE

Accident Year	[1] Paid Loss +D&CC	[2] Loss Devel. Factor	[3] Ultimate Loss + D&CC	[4] Trend Factor	[5] Trended Loss + LAE Excl. CAT	[5a] De-trended Modeled CAT Loss
1998	10,754,022	1.014	10,904,579	1.461	17,748,250	9,198,579
1999	12,023,961	1.028	12,362,989	1.378	18,982,974	9,474,536
2000	13,774,286	1.043	14,360,943	1.300	20,799,291	9,759,563
2001	16,043,017	1.090	17,478,985	1.227	23,882,287	10,052,349
2002	11,999,482	1.454	17,453,154	1.157	22,497,164	10,353,920
Total	64,594,768		72,560,648		103,909,965	48,838,947

Calendar Year	[6] Direct Earned Premium	[7] On-Level Earned Premium	[8] Trend Factor	[9] Trended Earned Premium	[10] Experience Ratio	[11] Experience Weight
1998	40,100,324	37,606,910	1.000	37,606,910	71.7%	10%
1999	39,949,945	39,038,560	1.000	39,038,560	72.9%	15%
2000	41,122,889	41,122,889	1.000	41,122,889	74.3%	20%
2001	43,280,161	43,280,161	1.000	43,280,161	78.4%	25%
2002	46,105,811	46,105,811	1.000	46,105,811	71.3%	30%
Total	210,559,132	207,154,332		207,154,332	73.9%	100%

EXHIBIT 1

Continued

[A]	Weighted Average Experience Ratio	73.9%
[B]	Adjusting & Other Expense Load	11.4%
[C]	Fixed Underwriting Expenses	6.0%
[D]	Fixed Reinsurance Cost Provision	15.7%
[E]	Variable Underwriting Expenses	17.8%
[F]	(Variable) Profit and Contingency Factor	3.9%
[G]	Indicated Overall Rate Level Change	22.1%
[H]	Permissible Loss + LAE Ratio	56.6%

[1], [6], [7] from company data
[2] from loss devel. analysis (not shown)
[3] = [1] × [2]
[4], [8] from Exhibit 2
[5] = [3] × [4] × (1 + [B])
[5a] latest year from Exhibit 5; prior years detrended with factors from Exhibit 2
[9] = [7] × [8]
[10] = ([5] + [5a])/[9]
[11] selected by actuarial judgment

[A] = average of [10] weighted on [11]
[B], [C], [E] from Exhibit 3
[D] from Exhibit 4
[F] derived per regulatory rule (not shown)
[G] = ([A] + [C] + [D])/(1 − [E] − [F]) − 1
[H] = 1 − ([C] + [D] + [E] + [F])

EXHIBIT 2

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
TREND FACTORS

						Annual Moving Averages		
Calendar Quarter	[1] Earned House-Years	[2] Earned TVI ($000)	[3] Earned Premium excl. Fees	[4] Earned Expense Fees	[5] Paid Losses and D&CC	[6] Earned Rate	[7] Earned Exposure	[8] Loss Cost*
1997Q1	12,835	2,165,308	8,427,043	721,389	2,245,436			
1997Q2	13,120	2,226,806	8,798,473	755,941	2,699,437			
1997Q3	13,426	2,290,692	8,921,938	776,210	3,279,226			
1997Q4	13,604	2,333,822	8,965,026	786,669	2,598,940	720	52,985	204
1998Q1	13,926	2,403,000	9,100,200	802,749	2,287,484	719	54,076	201
1998Q2	14,033	2,447,804	9,157,679	811,602	2,626,653	715	54,989	196
1998Q3	14,276	2,514,409	9,285,824	825,854	2,918,068	712	55,839	187
1998Q4	14,430	2,561,319	9,279,669	833,661	2,518,275	708	56,665	183
1999Q1	14,536	2,599,823	9,210,946	840,193	2,602,927	703	57,274	186
1999Q2	14,654	2,632,956	9,132,242	848,042	3,073,424	695	57,895	192
1999Q3	14,767	2,671,008	9,078,897	856,347	4,293,516	686	58,386	214
1999Q4	14,937	2,721,972	9,115,905	864,260	2,270,183	678	58,893	208
2000Q1	15,048	2,765,971	9,202,260	869,833	2,522,362	673	59,406	205
2000Q2	15,143	2,809,975	9,314,807	876,294	3,089,474	671	59,895	203
2000Q3	15,298	2,866,477	9,477,229	886,071	3,596,407	672	60,426	190
2000Q4	15,395	2,916,663	9,602,072	891,242	3,327,800	675	60,883	206
2001Q1	15,493	2,967,175	9,714,748	895,251	3,007,986	679	61,328	212
2001Q2	15,503	3,007,891	9,829,334	897,285	3,412,061	684	61,688	216
2001Q3	15,609	3,068,204	10,004,985	904,487	4,860,321	689	62,000	236
2001Q4	15,679	3,111,541	10,122,235	908,852	3,570,750	695	62,284	238

EXHIBIT 2

Continued

						Annual Moving Averages		
Calendar Quarter	[1] Earned House-Years	[2] Earned TVI ($000)	[3] Earned Premium excl. Fees	[4] Earned Expense Fees	[5] Paid Losses and D&CC	[6] Earned Rate	[7] Earned Exposure	[8] Loss Cost*
2002Q1	15,778	3,168,506	10,261,147	913,362	4,103,676	701	62,569	255
2002Q2	15,852	3,229,286	10,462,594	920,065	4,045,259	707	62,918	264
2002Q3	15,967	3,310,911	10,707,226	928,750	6,391,492	715	63,277	286

Calendar Year	[9] Trend Period	[10] Premium Factor	[11] Loss Cost Factor	[12] Cat Loss De-Trend
1998	6.507	1.000	1.461	0.888
1999	5.507	1.000	1.378	0.915
2000	4.504	1.000	1.300	0.943
2001	3.504	1.000	1.227	0.971
2002	2.504	1.000	1.157	1.000

	Fitted Annual Changes:		
5 years	–0.56%	3.57%	7.00%
4 years	0.39%	2.95%	10.33%
3 years	2.21%	2.58%	13.31%
2 years	3.28%	2.14%	20.35%
Selected	0.0%	3.0%	6.0%
	[A]	[B]	[C]

*Loss costs are paid losses and D&CC per earned house-year.

[1]...[5] from company data.

[9] = # of years between one year after effective date and midpoint of experience year.

[10] = (1 + [A])^[9].

[11] = (1 + [C])^[9].

[12] = (1 + [B])^ – (2002-Year)

EXHIBIT 3

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
UNDERWRITING AND LOSS ADJUSTING EXPENSES

		Calendar Year			
Item	2000	2001	2002	3-year Total	Selected
Direct Written Premium	56,788,429	57,553,000	62,936,260	177,277,689	
Direct Paid Loss + D&CC ex-Cat	17,158,203	21,167,830	24,114,351	62,440,384	
Commission & Brokerage	7,140,183	7,534,182	7,936,740	22,611,105	
Ratio to DWP	12.6%	13.1%	12.6%	12.8%	12.8%
General Expenses	1,392,835	1,317,561	1,453,641	4,164,037	
Ratio to DWP	2.5%	2.3%	2.3%	2.3%	2.4%
Other Acquisition	4,141,156	4,587,674	4,157,582	12,886,413	
Ratio to DWP	7.3%	8.0%	6.6%	7.3%	7.2%
Premium Taxes	663,829	547,425	614,602	1,825,856	
Ratio to DWP	1.2%	1.0%	1.0%	1.0%	1.0%
Other Taxes, Licenses, & Fees	438,182	233,723	211,106	883,011	
Ratio to DWP	0.8%	0.4%	0.3%	0.5%	0.4%
Paid A&OE ex-Cat	2,050,848	2,386,143	2,756,391	7,193,381	
Ratio to Paid Loss + D&CC	12.0%	11.3%	11.4%	11.5%	11.4%
Item	Selected	Fixed %	[A] Fixed	[B] Variable	
Commission & Brokerage	12.8%	0.0%	0.0%	12.8%	
General Expenses	2.4%	100.0%	2.4%	0.0%	
Other Acquisition	7.2%	50.0%	3.6%	3.6%	
Premium Taxes	1.0%	0.0%	0.0%	1.0%	
Other Taxes, Licenses, & Fees	0.4%	0.0%	0.0%	0.4%	
Total Underwriting Expenses			6.0%	17.8%	

EXHIBIT 4

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
FIXED REINSURANCE COST PROVISION

Item	Source	Description	Amount
[1]	Exhibit 5	Direct Earned Premium	46,105,811
[2]	Exhibit 5	Private Cat Subject Premium	40,573,114
[3]	Exhibit 5	Modeled Hurricane Gross Annual Losses	10,353,920
[4]	Exhibit 5	Private Cat Reinsurance Premium	9,385,801
[5]	Exhibit 5	Public Cat Reinsurance Premium	3,820,128
[6]	accounting	Private Cat Retention % SMP	10%
[7]	accounting	Private Cat Layer Coverage Level	95%
[8]	([3] – [6] × [2]) × [7]	Reinsured Portion of Loss Cost	5,981,778
[9]	[4] + [5] – [8]	Implied Reinsurance Expenses	7,224,150
[10]	[9]/[1]	Provision for Fixed Reinsurance Costs	15.7%
[11]	[9]/[3]	Risk Load as % of Gross Loss Cost	69.8%

EXHIBIT 5

A-Florida Insurance Company
Homeowners Rates Effective 1/1/2004
Allocation of Ceded Cat Reinsurance Premiums

Program	[1] Direct Earned Premium	[2] Property Portion	[3] [1] × [2] Subject Earned Premium	[4] Modeled Expected Hurr. Loss	[5] [5T] × [4]/[4T] Allocated Private Cat Premium	[6] Public Cat Premium
Homeowners	46,105,811	88%	40,573,114	10,353,920	9,385,801	3,820,128
Mobile Homeowners	6,978,546	88%	6,141,120	1,063,477	964,039	201,902
Dwelling EC	2,104,790	100%	2,104,790	1,037,755	940,722	246,155
Businessowners	1,302,042	80%	1,041,634	68,180	61,805	8,058
Inland Marine	81,759	100%	81,759	2,122	1,924	0
Total [T]	56,572,949		49,942,418	12,525,454	11,354,291	4,276,243

[1], [5T], [6] from accounting data
[2] convention assumed in reinsurance contracts
[4] from catastrophe simulation model

EXHIBIT 6

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
BASE RATES FOR MODELED PERILS

[A] Var. U/W Expense Ratio: 21.7%

Allocation of Reinsurance Costs to Policy Form—Hurricane

Policy Form	[1] Base Value Insured	[2] CY 2002 House-Yrs.	[3] 2002 Base Earned TVI	[4] 2002 Alloc. Re. Expense	[5] Indicated Reins. Load
HO2/3/9	100,000	72,765	7,276,499	7,191,638	98.83
HO4/6	10,000	3,290	32,896	32,512	9.88
Total		76,055	7,309,394	7,224,150	

Modeled Base Rates for Hurricane and Other Wind

Form	[6] Hurricane Loss Cost	[7] Reinsurance Fixed Load	[8] Indicated Base Rate	[9] Other Wind Loss Cost	[10] Indicated Base Rate
HO2/3/9	135.24	98.83	298.95	33.64	42.96
HO4/6*	9.02	9.88	24.14	2.24	2.86

[A] from Exhibit 1, includes profit load
[1], [2] from company data
[3] = [1] × [2]
[4] total = [9] from Exhibit 4, then allocated on [3]
[5] = [4]/[2]
[6], [9] from cat model for HO 2,3,9; scaled by ratio of base coverage amounts for HO 4,6
[7] = [5]
[8] = ([6] + [7])/(1 − [A])
[10] = [9]/(1 − [A])

*Ratio of base coverage amounts reflects Cov. A + B + C + D

EXHIBIT 7

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
BASE RATES FOR NON-MODELED PERILS

[A] Var. U/W Expense Ratio: 21.7%

	Fire						
Form	[1] Average Underlying Covg. A/C	[2] Average Underlying Key Factor	[3] Average Underlying Const/Prot	[4] Earned House-Yrs.	[5] 5 CY Paid Loss + D&CC	[6] Loss Cost	[7] Indicated Base Rate
HO2	56,704	0.819	0.735	3,477	194,354	55.89	118.53
HO3	103,536	1.008	0.548	315,958	20,807,086	65.85	152.22
HO4	29,256	1.963	0.488	12,060	159,155	13.20	17.61
HO6	37,341	2.367	0.342	7,811	86,899	11.12	17.55
HO9	137,183	1.103	0.371	64,341	2,955,761	45.94	143.40

[A] from Exhibit 1, includes profit load
[1]…[5] from company data
[6] = [5]/[4]
[7] = [6]/((1 − [A]) × [2] × [3])

EXHIBIT 8

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
PROPOSED EXPENSE FEES

[A] Variable Expense Ratio: 21.7%
[B] Fixed Expense Ratio: 6.0%

Form	[1] CY 2002 EP incl. Fees	[2] CY 2002 House-Years	[3] Indicated Expense Fee
HO2,3	38,277,064	60,174	48.74
HO9	6,867,503	12,591	41.79
HO4	506,870	1,895	20.50
HO6	454,375	1,395	24.96

[A], [B] from Exhibit 1, includes profit load
[1], [2] from company data
[3] = [1]/[2] × [B]/(1 – [A])

EXHIBIT 9

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
TERRITORY FACTORS—HURRICANE

Ki: 0.103

Proposed Territory	[1] Exposure Weight	[2] Modeled Hurricane Loss Cost	[3] Modeled Standard Deviation	[4] Allocated Risk Load	[5] Total Cost Relative to State Avg.	[6] Tempering Ratio	[7] Tempered Territory Factor	[8] Balanced Tempered Factor
011	418	72.43	441.17	45.52	0.723	1.000	0.723	0.744
012	533	62.97	383.20	39.54	0.628	1.000	0.628	0.646
020	611	47.46	309.94	31.98	0.487	1.000	0.487	0.501
031	184	300.03	2,256.26	232.81	3.266	0.800	2.813	2.893
032	138	162.63	1,182.12	121.98	1.744	1.000	1.744	1.794
033	520	121.66	860.37	88.78	1.290	1.000	1.290	1.326
671	551	95.16	610.25	62.97	0.969	1.000	0.969	0.997
672	61	60.03	326.68	33.71	0.575	1.000	0.575	0.591
[T] All	3,016	96.10	750.00	67.05	1.000	1.000	0.972	1.000

[A] Risk Load as % of Modeled Loss Cost: 69.8%
[B] Indicated Dollar Risk Load: 67.05
Difference [4T]–[B]: 0

[1], [2], [3] from cat model
[2T] = avg [2] wtd on [1]
[4] = [Ki] × [3]
[4T] = avg [4] wtd on [1]
[5] = ([2] + [4])/([2T] + [4T])
[6] selected

[7] = [5] × [6] + (1 − [6])
[7T] = avg of [7] wtd on [1]
[8] = [7]/[7T]
[A] from Exhibit 4
[B] = [A] × [2T]
[Ki] chosen to make [4T] equal to [B]

EXHIBIT 10

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
TERRITORY FACTORS—ALL OTHER PERILS

[Z] Full Credibility ETVI: 5,000,000

Column:	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Source:	data	data	data	[3]/[2]	[4]/[4T]	([2]/[Z])^.5	[5] × [6] + (1 − [6])	selected	[8]/[8T]
County	Earned House-Years	Earned TVI ($000)	Paid Loss + D&CC	Paid Loss Cost per $TVI	Relative Loss Cost to State Avg	Credibility	Z-Wtd Relative Loss Cost	Selected Territory Factor	Balanced Territory Factor
Alachua	20,317	3,538,662	2,067,554	0.584	1.106	84.1%	1.089	1.08	1.05
Baker	4,903	694,043	208,870	0.301	0.570	37.3%	0.840	0.84	0.82
Bay	7,469	1,093,334	571,762	0.523	0.990	46.8%	0.995	1.00	0.97
Washington	3,400	427,166	190,492	0.446	0.844	29.2%	0.954	0.95	0.93
Total [T]	36,089	5,753,205	3,038,677	0.528	1.000	100.0%	1.000	1.03	1.00

[8T] = avg of [8] wtd on [2]

EXHIBIT 11

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
CLASS FACTORS—HURRICANE MITIGATION

				Terrain B				Terrain C			
				Roof Shape				Roof Shape			
				Other		Hip		Other		Hip	
Roof Cover	Roof Deck Attachment	Roof-Wall Connection	Opening Protection	No SWR	SWR	No SWR	SWR	No SWR	SWR	No SWR	SWR
Non-FBC Equivalent	A (6d@6″/12″)	Toe Nails	None	1.00	0.97	0.77	0.75	1.00	0.97	0.86	0.84
			Basic—Windows or All	0.82	0.79	0.69	0.68	0.85	0.81	0.72	0.69
			Hurricane—Windows or All	0.78	0.74	0.67	0.65	0.81	0.76	0.68	0.64
		Clips	None	0.83	0.79	0.69	0.67	0.91	0.87	0.78	0.75
			Basic—Windows or All	0.77	0.73	0.66	0.64	0.81	0.76	0.68	0.64
			Hurricane—Windows or All	0.75	0.71	0.65	0.63	0.78	0.73	0.66	0.62
		Single Wraps	None	0.82	0.78	0.69	0.67	0.90	0.86	0.78	0.74
			Basic—Windows or All	0.76	0.73	0.66	0.64	0.80	0.75	0.68	0.64
			Hurricane—Windows or All	0.75	0.71	0.65	0.63	0.78	0.73	0.66	0.62
		Double Wraps	None	0.82	0.78	0.69	0.67	0.90	0.86	0.78	0.74
			Basic—Windows or All	0.76	0.73	0.66	0.64	0.80	0.75	0.68	0.64
			Hurricane—Windows or All	0.75	0.71	0.65	0.63	0.78	0.73	0.66	0.62

EXHIBIT 11

Continued

				Terrain B				Terrain C			
				Roof Shape				Roof Shape			
				Other		Hip		Other		Hip	
Roof Cover	Roof Deck Attachment	Roof-Wall Connection	Opening Protection	No SWR	SWR	No SWR	SWR	No SWR	SWR	No SWR	SWR
Non-FBC Equivalent	B (8d@6″/12″)	Toe Nails	None	0.96	0.93	0.76	0.74	0.96	0.93	0.85	0.83
			Basic—Windows or All	0.77	0.75	0.69	0.67	0.78	0.75	0.70	0.68
			Hurricane—Windows or All	0.72	0.69	0.66	0.64	0.73	0.69	0.66	0.63
		Clips	None	0.71	0.68	0.66	0.64	0.81	0.78	0.72	0.68
			Basic—Windows or All	0.68	0.65	0.64	0.62	0.69	0.65	0.63	0.60
			Hurricane—Windows or All	0.67	0.64	0.63	0.62	0.65	0.61	0.62	0.59
		Single Wraps	None	0.70	0.66	0.66	0.64	0.76	0.71	0.70	0.65
			Basic—Windows or All	0.67	0.64	0.64	0.62	0.67	0.62	0.63	0.59
			Hurricane—Windows or All	0.66	0.63	0.63	0.62	0.65	0.60	0.62	0.59
		Double Wraps	None	0.70	0.66	0.66	0.64	0.75	0.68	0.70	0.64
			Basic—Windows or All	0.67	0.63	0.64	0.62	0.66	0.61	0.63	0.59
			Hurricane—Windows or All	0.66	0.63	0.63	0.62	0.65	0.60	0.62	0.58

Non-FBC Equivalent	C (8d@6″/6″) and D (8d@6″/6″) Dimensional Lumber Deck	Toe Nails	None	0.95	0.93	0.76	0.74	0.95	0.93	0.85	0.83
			Basic—Windows or All	0.77	0.74	0.69	0.67	0.78	0.75	0.70	0.68
			Hurricane—Windows or All	0.72	0.69	0.66	0.64	0.72	0.69	0.66	0.63
		Clips	None	0.71	0.67	0.66	0.64	0.81	0.78	0.72	0.68
			Basic—Windows or All	0.67	0.65	0.64	0.62	0.68	0.64	0.63	0.60
			Hurricane—Windows or All	0.66	0.64	0.63	0.62	0.64	0.61	0.62	0.59
		Single Wraps	None	0.69	0.65	0.66	0.63	0.75	0.70	0.70	0.64
			Basic—Windows or All	0.66	0.63	0.64	0.62	0.65	0.61	0.63	0.59
			Hurricane—Windows or All	0.66	0.63	0.63	0.62	0.63	0.59	0.62	0.58
		Double Wraps	None	0.69	0.65	0.66	0.63	0.73	0.65	0.69	0.63
			Basic—Windows or All	0.66	0.63	0.64	0.62	0.64	0.59	0.62	0.58
			Hurricane—Windows or All	0.66	0.63	0.63	0.61	0.63	0.59	0.62	0.58
FBC Equivalent	A (6d@6″/12″)	Toe Nails	None	0.95	0.93	0.73	0.72	0.97	0.95	0.83	0.82
			Basic—Windows or All	0.77	0.76	0.65	0.65	0.80	0.79	0.68	0.68
			Hurricane—Windows or All	0.72	0.71	0.62	0.62	0.75	0.74	0.63	0.63
		Clips	None	0.76	0.75	0.64	0.64	0.86	0.85	0.73	0.73
			Basic—Windows or All	0.70	0.69	0.61	0.61	0.75	0.74	0.63	0.62
			Hurricane—Windows or All	0.69	0.68	0.60	0.60	0.72	0.71	0.61	0.60
		Single Wraps	None	0.76	0.75	0.64	0.64	0.85	0.84	0.73	0.73
			Basic—Windows or All	0.70	0.69	0.61	0.61	0.75	0.73	0.63	0.62
			Hurricane—Windows or All	0.68	0.68	0.60	0.60	0.72	0.71	0.61	0.60
		Double Wraps	None	0.76	0.75	0.64	0.64	0.85	0.84	0.73	0.73
			Basic—Windows or All	0.70	0.69	0.61	0.61	0.74	0.73	0.63	0.62
			Hurricane—Windows or All	0.68	0.68	0.60	0.60	0.72	0.71	0.61	0.60

EXHIBIT 11

Continued

				Terrain B				Terrain C			
				Roof Shape				Roof Shape			
				Other		Hip		Other		Hip	
Roof Cover	Roof Deck Attachment	Roof-Wall Connection	Opening Protection	No SWR	SWR	No SWR	SWR	No SWR	SWR	No SWR	SWR
FBC Equivalent	B (8d@6″/12″)	Toe Nails	None	0.91	0.90	0.72	0.71	0.93	0.91	0.83	0.82
			Basic—Windows or All	0.72	0.72	0.65	0.64	0.74	0.73	0.67	0.67
			Hurricane—Windows or All	0.67	0.66	0.62	0.62	0.69	0.68	0.62	0.61
		Clips	None	0.65	0.65	0.61	0.61	0.77	0.76	0.67	0.66
			Basic—Windows or All	0.62	0.62	0.59	0.59	0.64	0.63	0.60	0.59
			Hurricane—Windows or All	0.61	0.61	0.59	0.59	0.61	0.59	0.58	0.57
		Single Wraps	None	0.64	0.63	0.61	0.61	0.71	0.70	0.64	0.63
			Basic—Windows or All	0.61	0.60	0.59	0.59	0.62	0.60	0.59	0.58
			Hurricane—Windows or All	0.61	0.60	0.59	0.59	0.60	0.58	0.58	0.57
		Double Wraps	None	0.64	0.63	0.61	0.61	0.69	0.67	0.64	0.62
			Basic—Windows or All	0.61	0.60	0.59	0.59	0.61	0.59	0.58	0.57
			Hurricane—Windows or All	0.61	0.60	0.59	0.59	0.60	0.58	0.58	0.57

FBC Equivalent	C (8d@6″/6″) and D (8d@6″/6″) Dimensional Lumber Deck	Toe Nails	None	0.91	0.90	0.72	0.71	0.93	0.91	0.83	0.82
			Basic—Windows or All	0.72	0.72	0.65	0.64	0.74	0.73	0.67	0.67
			Hurricane—Windows or All	0.67	0.66	0.62	0.62	0.68	0.68	0.62	0.61
		Clips	None	0.65	0.64	0.61	0.61	0.77	0.76	0.67	0.66
			Basic—Windows or All	0.62	0.62	0.59	0.59	0.64	0.63	0.59	0.58
			Hurricane—Windows or All	0.61	0.61	0.59	0.59	0.60	0.59	0.58	0.57
		Single Wraps	None	0.63	0.62	0.61	0.60	0.70	0.68	0.64	0.62
			Basic—Windows or All	0.61	0.60	0.59	0.59	0.61	0.60	0.58	0.57
			Hurricane—Windows or All	0.60	0.60	0.59	0.59	0.59	0.58	0.58	0.57
		Double Wraps	None	0.63	0.62	0.61	0.60	0.66	0.63	0.63	0.61
			Basic—Windows or All	0.61	0.60	0.59	0.59	0.59	0.58	0.58	0.57
			Hurricane—Windows or All	0.60	0.60	0.59	0.59	0.59	0.57	0.58	0.57
Reinforced Concrete Roof Deck			None				0.59				0.60
			Basic—Windows or All				0.58				0.56
			Hurricane—Windows or All				0.58				0.56

EXHIBIT 12

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
KEY FACTORS—FIRE, FORM HO-3

Break: 5,000

	Covg A Range		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Group	Low	High	Current Avg Factor	Adj. Earned House-Yrs	Paid Loss Fire	Exposure	Cumulative Paid Loss	Loss Cost	Selected Loss Cost	Implied Inc. Loss Cost	Interp. Key Factor	Marginal Key Factor
1	5,000	9,999	n/a	0	0	0	0	n/a				
2	10,000	14,999	0.363	1	0	1	0	0			0.630	
3	15,000	19,999	0.388	3	0	4	0	0			0.650	0.020
4	20,000	24,999	0.415	11	0	16	0	0			0.670	0.020
5	25,000	29,999	0.445	48	1,250	63	1,250	19.71	80.00	80.000	0.690	0.020
6	30,000	34,999	0.475	217	8,521	280	9,771	34.85			0.706	0.016
7	35,000	39,999	0.505	1,140	113,072	1,420	122,843	86.49			0.721	0.015
8	40,000	44,999	0.545	3,734	254,721	5,154	377,564	73.25			0.737	0.016
9	45,000	49,999	0.595	4,625	337,706	9,779	715,270	73.14			0.752	0.015
10	50,000	54,999	0.643	6,681	754,930	16,460	1,470,200	89.32	89.00	89.035	0.768	0.016
11	55,000	59,999	0.688	6,264	750,172	22,724	2,220,372	97.71			0.806	0.038
12	60,000	64,999	0.733	8,377	1,256,725	31,101	3,477,097	111.80			0.844	0.038
13	65,000	69,999	0.778	8,775	712,445	39,877	4,189,542	105.06			0.883	0.039
14	70,000	74,999	0.815	9,397	1,691,670	49,274	5,881,212	119.36			0.921	0.038
15	75,000	79,999	0.845	9,607	995,686	58,880	6,876,898	116.79	105.00	111.208	0.959	0.038
16	80,000	84,999	0.875	10,477	762,228	69,358	7,639,126	110.14			0.967	0.008
17	85,000	89,999	0.905	10,063	1,601,942	79,421	9,241,068	116.36			0.975	0.008
18	90,000	94,999	0.940	10,439	1,311,610	89,860	10,552,678	117.44			0.984	0.009
19	95,000	99,999	0.980	8,997	676,689	98,856	11,229,367	113.59			0.992	0.008
20	100,000	104,999	1.024	9,587	866,301	108,444	12,095,668	111.54	110.00	115.940	1.000	0.008
21	105,000	109,999	1.072	7,529	388,984	115,973	12,484,652	107.65			1.012	0.012

22	110,000	114,999	1.119	7,107	698,291	123,080	13,182,943	107.11			1.024	0.012
23	115,000	119,999	1.167	6,185	1,213,427	129,265	14,396,370	111.37			1.037	0.013
24	120,000	124,999	1.214	6,031	734,987	135,296	15,131,357	111.84			1.049	0.012
25	125,000	129,999	1.262	5,680	754,843	140,976	15,886,200	112.69	113.00	123.000	1.061	0.012
26	130,000	134,999	1.309	5,081	438,875	146,057	16,325,075	111.77			1.078	0.017
27	135,000	139,999	1.357	4,236	410,158	150,293	16,735,234	111.35			1.095	0.017
28	140,000	144,999	1.404	3,895	185,363	154,188	16,920,597	109.74			1.113	0.018
29	145,000	149,999	1.452	3,158	421,333	157,346	17,341,930	110.22			1.130	0.017
30	150,000	154,999	1.499	3,772	748,756	161,118	18,090,686	112.28	115.50	132.998	1.147	0.017
31	155,000	159,999	1.547	2,693	849,466	163,811	18,940,152	115.62			1.173	0.026
32	160,000	164,999	1.589	2,463	676,881	166,274	19,617,033	117.98			1.199	0.026
33	165,000	169,999	1.627	1,996	431,865	168,270	20,048,897	119.15			1.226	0.027
34	170,000	174,999	1.669	1,747	393,824	170,017	20,442,721	120.24			1.252	0.026
35	175,000	179,999	1.713	1,594	87,091	171,610	20,529,812	119.63	117.50	148.212	1.278	0.026
36	180,000	184,999	1.757	1,456	328,610	173,066	20,858,422	120.52			1.305	0.027
37	185,000	189,999	1.801	1,168	676,463	174,234	21,534,885	123.60			1.332	0.027
38	190,000	194,999	1.846	1,057	58,931	175,291	21,593,816	123.19			1.360	0.028
39	195,000	199,999	1.890	853	27,860	176,144	21,621,675	122.75			1.387	0.027
40	200,000	204,999	1.935	1,199	53,960	177,342	21,675,636	122.22	119.00	163.910	1.414	0.027
41	205,000	209,999	1.979	837	359,670	178,179	22,035,306	123.67			1.433	0.019
42	210,000	214,999	2.023	743	9,286	178,923	22,044,592	123.21			1.451	0.018
43	215,000	219,999	2.067	587	195,540	179,510	22,240,133	123.89			1.470	0.019
44	220,000	224,999	2.112	504	0	180,014	22,240,133	123.55			1.488	0.018
45	225,000	229,999	2.156	567	15,870	180,581	22,256,003	123.25	120.00	174.760	1.507	0.019
46	230,000	234,999	2.201	450	39,775	181,031	22,295,778	123.16			1.538	0.031
47	235,000	239,999	2.245	380	2,250	181,411	22,298,028	122.91			1.569	0.031
48	240,000	244,999	2.290	337	21,253	181,747	22,319,281	122.80			1.599	0.030
49	245,000	249,999	2.334	287	0	182,034	22,319,281	122.61			1.630	0.031
50	250,000		2.378	433	40,848	182,467	22,360,130	122.54	120.75	192.542	1.661	0.031
									Each Additional $5,000:		0.031	

[1], [3] from company data
[2] from data, adjusted to base class (PPC 9, Frame)
[4] = accumulation of [2] up to current TVI group
[5] = accumulation of [3] up to current TVI group
[6] = [5]/[4]
[7] selected from [6] with smoothing
[8] = (([4] × [7]current group) − ([4] × [7]previous group))/(sum[2]current group)
[9] = [8]/([8] at base limit) or linear interpolation
[10] = [9] − ([9] at previous limit)

EXHIBIT 13

A-Florida Insurance Company
Homeowners Rates Effective 1/1/2004
Deductible Factors—Non-Modeled Perils

All Other Perils—All Forms

	[1] Loss Elimination Ratios				[2] Indicated Factors ($500 Base)				[3] Selected Deductible Factors			
Cov. A/C Amount	$250	$500	$1,000	$2,500	$250	$500	$1,000	$2,500	$250	$500	$1,000	$2,500
Less than $75,000	12.6%	25.0%	40.4%	64.7%	1.165	1.000	0.795	0.470	1.17	1.00	0.80	0.47
$75,000 to $149,999	10.3%	20.4%	33.9%	55.8%	1.128	1.000	0.831	0.556	1.13	1.00	0.83	0.56
$150,000 to $224,999	9.0%	17.8%	30.2%	52.1%	1.108	1.000	0.849	0.583	1.11	1.00	0.85	0.58
$225,000 and Over	7.4%	14.7%	25.3%	45.1%	1.086	1.000	0.875	0.643	1.09	1.00	0.88	0.64

Fire—All Forms

	[1] Loss Elimination Ratios				[2] Indicated Factors ($500 Base)				[3] Selected Deductible Factors			
Cov. A/C Amount	$250	$500	$1,000	$2,500	$250	$500	$1,000	$2,500	$250	$500	$1,000	$2,500
Less than $75,000	1.4%	2.7%	5.0%	10.9%	1.014	1.000	0.976	0.916	1.01	1.00	0.98	0.92
$75,000 to $149,999	1.3%	2.7%	5.0%	10.8%	1.014	1.000	0.976	0.916	1.01	1.00	0.98	0.92
$150,000 to $224,999	0.7%	1.4%	2.6%	5.6%	1.007	1.000	0.987	0.957	1.01	1.00	0.99	0.96
$225,000 and Over	0.8%	1.6%	2.9%	6.3%	1.008	1.000	0.987	0.952	1.01	1.00	0.99	0.96

[1] from company data, losses grossed up by actual policy deductible then truncated at each deductible amount.
[2] = (1 – [1])/(1 – [1] for $500)
[3] selected with smoothing

EXHIBIT 14

A-Florida Insurance Company
Homeowners Rates Effective 1/1/2004
Deductible Factors—Hurricane

Hurricane Loss Cost	[1] Modeled Losses at $100,000 Cov A				Modeled
Group	0.5%	1%	2% [B]	5%	# of Units
Low	7,774,635	7,165,936	6,333,953	5,091,801	54,005
Medium	420,339	394,885	356,583	288,122	856
High	825,763	784,311	719,737	594,485	1,031
Xtreme	47,001	45,049	42,006	35,780	38

Hurricane Loss Cost	[2] Relative Modeled Losses			
Group	0.5%	1%	2% [B]	5%
Low	1.227	1.131	1.000	0.804
Medium	1.179	1.107	1.000	0.808
High	1.147	1.090	1.000	0.826
Xtreme	1.119	1.072	1.000	0.852

Hurricane Loss Cost	[3] Selected Deductible Factors			
Group	0.5%	1%	2% [B]	5%
Low	1.23	1.13	1.00	0.80
Medium	1.18	1.11	1.00	0.81
High	1.15	1.09	1.00	0.83
Xtreme	1.12	1.07	1.00	0.85

EXHIBIT 14

Continued

AOP $500 Deductible Data

Cov. A/C Range	[4] Relative Loss Cost	[5] Selected Adjustment	[6] Adjusted $500 Deductible Factors by Group Low	Medium	High	Xtreme
Less than $75,000	0.943	0.95	1.17	1.12	1.09	1.09
$75,000 to $149,999	1.000	1.00	1.23	1.18	1.15	1.12
$150,000 to $224,999	1.033	1.03	1.27	1.22	1.18	1.15
$225,000 and Over	1.072	1.07	1.32	1.26	1.23	1.20

[1] from AIR CLASIC/2™ v. 5.1 and experimental data
[2] = [1]/[1B]
[3] selected on [2]
[4] = (1 – [1] from Exh. 13@TVI)/(1 – [1] from Exh. 13@75–149K)
[5] selected on [4]
[6] = ([3] at 0.5%)∗[5]

EXHIBIT 15

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
ADJUSTED BASE PREMIUM CHARGES AND CREDITS

	Earned	Base Rate Distribution by Peril						
Form	House-Yrs.	AOP	Fire	Liability	Medical	Hurricane	Wind	Total
HO2	3,477	136	119	28	2	299	43	627
HO3	315,958	151	152	31	2	299	43	678
HO4	12,060	14	18	3	2	24	3	64
HO6	7,811	11	18	2	2	24	3	60
HO9	64,341	120	143	29	2	299	43	636
HO Avg.	403,648	139	144	29	2	285	41	641

Protective Devices (AOP + Fire base)
Premium Base: 44.2%

Code	Current	Implied	Selected
1	−5.0%	−11.3%	−11.0%
2	−5.0%	−11.3%	−11.0%
3	−5.0%	−11.3%	−11.0%
4	−5.0%	−11.3%	−11.0%
5	−5.0%	−11.3%	−11.0%
6	−2.0%	−4.5%	−4.0%
7	−2.0%	−4.5%	−4.0%
8	−10.0%	−22.6%	−22.0%
9	−10.0%	−22.6%	−22.0%
10	−4.0%	−9.1%	−9.0%
11	−7.0%	−15.8%	−15.0%
12	−7.0%	−15.8%	−15.0%
13	−7.0%	−15.8%	−15.0%

EXHIBIT 16

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
COMPETITIVE ANALYSIS

Preferred HO-3, $75,000 Frame Risk

County	A-Florida Current Rate	A-Florida Proposed Rate	Top 20 Competitor Current Avg.	Residual Market Rate	A-Florida Change	Difference from Competition
Alachua	429	492	466	737	14.7%	5.7%
Baker	459	435	517	750	–5.2%	–15.9%
Bay	530	791	724	1,097	49.2%	9.3%
Washington	483	515	552	753	6.6%	–6.7%

Preferred HO-3, $150,000 Masonry Risk

County	A-Florida Current Rate	A-Florida Proposed Rate	Top 20 Competitor Current Avg.	Residual Market Rate	A-Florida Change	Difference from Competition
Alachua	527	716	673	1,031	35.9%	6.5%
Baker	617	617	750	1,048	0.0%	–17.7%
Bay	718	1,182	1,054	1,535	64.7%	12.2%
Washington	653	741	798	1,053	13.5%	–7.2%

EXHIBIT 17

A-FLORIDA INSURANCE COMPANY
HOMEOWNERS RATES EFFECTIVE 1/1/2004
RATING LOGIC FOR CALCULATION OF ADJUSTED BASE PREMIUM

Calculation of Total Base Premium

Op.	Value	Premium	Description
	163	163	Fire Base Rate (by Form)
×	1.00	0	Fire Territory Factor
×	1.00	0	Fire Construction/Protection Class Factor (by Form)
=		163	Fire Key Premium
×	1.006	1	Fire Key (amount of insurance) Factor (by Form)
×	1.00	0	Fire Deductible Factor (by AOI)
=		164	Fire Base Premium
	282	282	Hurricane Base Rate (by Form)
×	0.57	(121)	Hurricane Territory Factor
×	0.73	(76)	Hurricane Mitigation Factor
=		85	Hurricane Key Premium
×	1.025	2	Hurricane Key Factor (by Form)
×	1.00	0	Hurricane Deductible Factor (by Zone, & AOI if flat $500)
=		87	Hurricane Base Premium
	46	46	Other Wind Base Rate (by Form)
×	1.09	4	Other Wind Territory Factor
=		50	Other Wind Key Premium
×	1.025	1	Other Wind Key Factor (by Form)
×	1.00	0	Other Wind Deductible Factor (by AOI)
=		51	Other Wind Base Premium
	31	31	Liability Base Rate (by Form)
×	1.00	0	Liability Increased Limits Factor
×	0.92	(2)	Liability Territory (group) Factor
+	2	2	Medical Payments Base Rate
+	0	0	Medical Limit Charge/Credit
=		31	Liability/Medical Base Premium
	151	151	All Other Perils Base Rate (by Form)
×	1.01	2	AOP Territory Factor
=		153	AOP Key Premium
×	1.022	3	AOP Key Factor (by Form)
×	1.00	0	AOP Deductible Factor (by AOI)
=		156	AOP Base Premium
		488	Total Base Premium

EXHIBIT 17

Continued

Calculation of Adjusted Base Premium

Op.	Value	$ Impact	Description
−	(0.05)	(24)	Claim Free Credit (to Total)
−	(0.11)	(35)	Protective Device Credit (to AOP + Fire)
+	0	0	Seasonal Occupancy modifier (to AOP + Fire + Liab)
−	0	0	Wind Exclusion Credit (to Hurr + Other Wind)
+	0	0	Screen Enclosure Charge (flat charge)
−	(0.04)	(13)	Age of Home Credit (to AOP + Fire)—HO
+	0	0	Multi-Unit or Town/Rowhouse mod (to AOP + Fire)—HO
+	0.16	73	Replacement Cost Provisions mod (to non-Liab)—HO
−	0	0	Law/Ordinance Exclusion Credit (to non-Liab)—HO
−	0	0	In-Construction Credit (to Total)—HO
−	(0.06)	(8)	BCEGS Credit (to Hurr + Other Wind)—HO
+/−	0	0	Loss Settlement Options mod (to non-Liab)—MH
−	0	0	ANSI/ASCE Credit (to non-Liab)—MH
=		481	Adjusted Base Premium
+		55	Expense Fee
=		536	Total Policy Premium