Expert Review Of
Proposed Rating Methodology for APH Yield Exclusion

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Prepared for

Federal Crop Insurance Corporation
Risk Management Agency

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Executive Summary

RMA has proposed a methodology to make adjustments in the APH rates to cover a new option to exclude any recorded or appraised yield for any crop year in which the county yield is "at least 50 percent below the simple average during the previous 10 consecutive crop years." This new option was mandated in the 2014 Farm Bill.

As described in the example provided by RMA, the exclusion of one or more years' yields will artificially increase the APH and the effective coverage level will be increased in proportion to the ratio of the average yield with the exclusion to the ratio before the exclusion. In the illustration, the APH after the exclusion is 108 compared to 100 before the exclusion, thereby increasing a .75 coverage level to an effective level of .81 (.75 x 108/100). The actual expected (mean) yield for the producer, which underlies the rate per guarantee, remains at 100.

The RMA proposal to reflect this increase in the effective coverage level in the rates is to do a straight line interpolation of the existing coverage level relativities for effective coverage levels less than the current maximum (.85). For effective coverage levels greater than .85 the relativities will be extrapolated straight line by extending the slope between the current .85 and .80 out the appropriate intervals.

By employing our table of calculated loss costs by Coefficient of Variation (CV), which translates one-to-one into a loss cost, by coverage levels, we extended the table out to include the effective coverage levels of .95 and 1.05. For the most part, the straight line extrapolation procedure resulted in inadequate rates for these higher coverage levels. The higher the effective coverage level and/or the lower the CV, the more inadequate the extrapolated loss costs will be.

As an alternative to the straight line extrapolation procedure, we are suggesting using *Stirling's Interpolation Formula*, which is not overly complicated to implement and produces vastly more accurate results.

In conclusion, while the proposed Yield Exclusion program has a great deal of merit and should be welcomed by APH insureds, it is highly recommended that RMA rethink the extrapolation process for coverage level relativities for the resulting very high effective coverage levels, especially those with relatively low base rates.

Expert Review of the Proposed Rating Methodology for APH Yield Exclusion

I was engaged on December 22, 2014 by the Federal Crop Insurance Corporation (FCIC) of the U.S. Department of Agriculture (USDA) to prepare a review of a proposed methodology to adjust rates to address the option of producers to exclude yields of certain years in determining their Actual Production History (APH) guarantees for a prospective policy year. The 2014 Farm Bill directed the Risk Management Agency (RMA) to provide producers the option to exclude any recorded or appraised yield for any crop year in which the county yield is "at least 50 percent below the simple average during the previous 10 consecutive crop years." The Act further mandated that the premiums shall be adjusted to reflect the risk associated with the exclusion of any designated years' yields. RMA has proposed a methodology to make the necessary adjustments in the APH rates to cover this new option and a description of this proposed scheme has been provided its reviewers for an analysis and comments. I have concluded my review and I am pleased to present herein the results of my analysis.

Our Approach to this Review

Our approach to this review can essentially be broken down into five phases:

1. Review in some detail the recent report[1] to RMA providing a review of the proposed rating enhancements for the Yield Exclusion (YE) feature.

2. Review of the RMA-supplied monograph, *The Actual Production History Yield Exclusion: Overview of Premium Rating.* This document summarized the proposed scheme to account for expected loss cost increases attributable to the YE provision.

3. Construct a table of expected APH loss costs (per guarantee) by the Coefficient of Variation (CV) of the yield probability distribution, further subdivided by coverage levels. In addition to the customary coverage levels currently available (.50, .65, ..., .85), the table will include effective coverage levels in excess of the .85 level, the highest currently available.

4. Determine if the proposed straight line extrapolation of coverage level relativities greater than .85 will produce reasonable and adequate premiums.

5. If the answer to (4) is no – or at least doubtful – investigate alternative extrapolation schemes which would (a) result in reasonable rates for higher effective coverage levels and (b) not be overly complicated to implement..

[1] Coble, K.H.,Knight, T.O., Miller, M.F.,Barnett, B.J., *Review of Adjustment in Actual Production History to Establish Insurable Yields: Determination of Actuarially Sound Premium Rates*, 2014

The Proposed Premium Rating Methodology for YE

To illustrate how YE can affect APH, the RMA-supplied monograph described the proposed methodology with a hypothetical example of a corn producer's yield experience over a 10-year period, reproduced below. Both the 2011 and 2012 years are eligible for exclusion. The preliminary step in this procedure is, for years 2011-13, substituting 60% of the county T-yield (the "yield plug"). Then, the 10-year average yield, which becomes the approved yield, is 100 bushels. Then, after excluding the 2011 and 2012 years, the average yield after YE becomes 108.

Year	County T-yield	60% of T-yield	Grower APH	APH w/60%	APH w/ Excluded
2005	96	58	110	110	110
2006	104	62	100	100	100
2007	104	62	88	88	88
2008	104	62	118	118	118
2009	106	64	111	111	111
2010	106	64	110	110	110
2011	119	71	55	71	Excluded
2012	119	71	20	71	Excluded
2013	119	71	57	71	71
2014	119	71	153	153	153
Approved Yield			**92**	**100**	**108**

For a given coverage level selection by the producer – say .75 – the adjusted guarantee becomes 81 bushels (75 x 108/100). This in effect increases his effective coverage level to .81 from the original .75 in relation to the approved yield of 100. The appropriate premium rate would then be a function of an interpolated coverage level relativity for a .81 coverage level. The proposed methodology calls for a straight line interpolation between the relativities for the .80 and .85 coverage levels.

The validity of the above described rating methodology depends on a very critical assumption and to fully appreciate how critical this assumption is we need to go back to APH 101. For the producer in question there exists an implied expected (mean) yield for the season in question. There also exists a probability distribution around this mean. So, for this distribution we have a mean (the expected yield) and a coefficient of variation (CV), or the standard deviation divided by the mean. For a given coverage level, the CV dictates the loss cost per guarantee, which in turn translates to a gross rate. So, here is the critical assumption: even after excluding years in the yield-averaging process, *the expected yield and the mean of the distribution remains at 100 bushels*. The YE process simply artificially jacks up the guarantee to an elevated effective coverage level, requiring the calculation of a higher coverage level relativity, by interpolation. The rates for this particular commodity in this county are, after all, based on actual loss experience which includes those years which are artificially excluded in this YE program, so it is reasonable to assume that the expected yield (and CV) for any producer would remain the same as before the exclusion is applied.

APH Loss Costs by Coverage Level by Underlying CV

The example described above deals with an interpolated coverage level relativity between two existing coverage levels available to the producer (.80 and .85). I think it is safe to assume that, due to the proximity of the current available coverage levels (intervals of .05), a straight line interpolation formula would be reasonable to estimate relativities for coverage levels less than .85 that are not exact multiples of .05. It is entirely conceivable, however, that the YE procedure could lead to effective coverage levels well in excess of the .85, which is the highest now offered. Effective coverage levels even exceeding 1.00 would not be that unlikely, it would seem. In this event, the proposed procedure would simply use a straight line extrapolation of the coverage level relativities using the slope between the two highest levels offered (.80 and .85). The key question here, and the key focal point of this review, is whether or not this straight line extrapolation will result in adequate rates for the higher effective coverage levels.

At this point, it is informative to revisit the theoretical APH loss costs per guarantee by coverage level by CV, using a table and accompanying graph we have used for some previous studies. In Exhibit 1 we have tabulated loss costs by CV for a selected group of coverage levels. For this expanded table we have included coverage levels .95 and 1.05. The probability distribution we have used is the beta distribution. Even though there is no overwhelming consensus that this distribution is the most representative of reality, I have found in reviewing literature over the past 10 years that the beta is assumed to provide a better fit than either the normal or any other distribution, although corroborating data at the producer level seems to be hard to come by. The beta distribution requires parameters representing the maximum and minimum values and we have selected the mean plus two standard deviations as the max and zero as the min.

The loss cost data in Exhibit 1 is depicted graphically in Exhibit 2. We have used this graphical depiction in previous studies but for this review we have expanded it to include two higher coverage levels: .95 and 1.05. One might find it curious that for each of the coverage levels less than 1.00 the loss cost approaches zero as the CV approaches zero. A CV of zero (theoretically) means that whatever the expected (mean) yield is, it is a certainty, with no variability whatsoever. Therefore, no losses. With a coverage level of 1.05, however, with a CV of zero the loss cost will be .05/1.05 (.04762), recalling that the expected yield is 100 and we are indemnifying any result under 105. A CV of zero is, of course, a strictly theoretical exercise but it does help in understand how this graph – and the underlying process – works.

Extrapolated Relativities for Coverage Levels Greater than 0.85

In Exhibits 1 and 2 we have tabulated loss costs per guarantee rather than relativities, but it is clear that they are, by definition, proportional, as the relativities are simply the loss costs at a specific coverage level divided by the loss cost at the base (0.65) coverage level. In Exhibit 3 we have then compared the theoretical loss costs at coverage levels .95 and 1.05 with the loss cost estimates derived from the proposed straight line extrapolation. Columns (a) through (f) are the loss costs derived in Exhibit 1. The extrapolated values for coverage level .95 are shown in column (g). As shown in the notes, the extrapolation is accomplished using the difference between the loss costs at .85 and .80 coverage levels and extending that slope the appropriate number of intervals. Similarly, the extrapolated values for the 1.05 coverage level are shown in column (i). In columns (h) and (j) we calculated the ratio of the actual loss costs to the extrapolated values, and these ratios are shown in red. The pattern that emerges is that, as the CV's (which translate to loss costs and then to rates) decrease, the error increases and as the effective coverage level increases the error also increases. Only with CV's in excess of, say, .40, can one reasonably conclude that the errors are not material.

Alternative Extrapolation Methods

Given what appears to be an inadequacy in the extrapolated loss cost relativities for higher effective coverage levels, we have investigated alternative methods of extrapolation. One promising candidate is the *Stirling Interpolation Formula,* which has fairly wide use and does not appear to be that challenging to implement. It can be described as follows:

Define the following three points:

(a) (x_{i-1}, y_{i-1})

(b) (x_i, y_i)

(c) (x_{i+1}, y_{i+1})

The x's represent the coverage levels and the y's represent the corresponding coverage level relativities. Also:

Let

$h = x_i - x_{i-1} = x_{i+1} - x_i \qquad [h = .05]$

and

$x =$ coverage level in question for which interpolated or extrapolated relativity y_x is to be determined

and

$$u = \frac{x - x_i}{h}$$

then

$$y_x = y_i + \frac{u}{2}(y_{i+1} - y_{i-1}) + \frac{u^2}{2}(y_{i+1} - 2y_i + y_{i-1})$$

Example (using actual loss costs for CV=.20 instead of relativities):

(a) (.75, 0.01907)

(b) (.80, 0.02684)

(c) (.85, 0.03673)

then find extrapolated loss cost (y_x) for coverage level (x) = 1.02

$h = .05$

$$u = \frac{x - x_i}{h} = \frac{1.02 - .80}{.05} = 4.4$$

$$y_x = .02684 + \frac{4.4}{2}(.03673 - .01907) + \frac{4.4^2}{2}(.03673 - 2 \cdot 0.02684 + .01907)$$

$y_x = .08621$

In columns (k) through (p) in Exhibit 3 we have calculated the extrapolated loss costs using Stirling’s formula and the results are much closer to actual loss costs than the straight line extrapolation. For the very low CV’s (say, less than .15) there is still a fairly significant error, but it is much less than the results with the straight line extrapolation. I am pretty sure, though, that CV’s less than .15 are rare.

Questions and Answers Prescribed by RMA

(Note: the "Procedure for the Submission and Review of New and Revised Crop Insurance Policies" includes topics which address Protection of Producers' Interests, Administrative Burden, Marketability, and Other Review Areas, in addition to Actuarial Soundness. For this review, however, the only item called upon to be reviewed is Actuarial Soundness)

(1) Actuarial soundness.

(A) Are adequate, credible, and reliable rate-making data available? Is it likely that the data will continue to be available? Is the data vulnerable to tampering if the proposed rate methodology is approved?

Obviously, there currently exists no actual loss data for effective coverage levels greater than 0.85. Coverage Level relativities have been calculated and promulgated for coverage levels up to .85. The relativities are a function of (a) the base rate at the .65 coverage level and (b) the coverage level itself. If the loss costs in Exhibit 1 were translated to relativities (dividing each by its respective loss cost at the .65 level) then the resulting pattern would closely resemble the relativity tables as modified about four years ago. Accordingly, expanding my table in Exhibit 1 to higher coverage levels should provide a reasonable estimate of the associated loss costs at these levels. So, the absence of actual loss experience at these higher levels should not be a deal breaker. If I am writing automobile collision coverage with $250 and $500 deductible options and wish to add a $1,000 deductible option, I would have the underlying data from which to properly price the $1,000 deductible coverage. With this in mind, adequate data is currently available and will continue to be available for this program embellishment. Vulnerability to tampering would be, at most, a remote possibility.

(B) Are the explicit and implicit assumptions used in the rating process reasonable?

The key assumption is, again, that the *expected (mean*) yield for the producer remains the same as before the excluded years, and I believe this is a reasonable assumption..

(C) Are the technical analyses (e.g., stochastic and other simulations) correct and recognized as appropriate? Do they provide credible, relevant results?

Not applicable.

(D) Is the data used for the analyses appropriate, reliable, and the best available?

Not applicable.

(F) Are the proposed premium rates likely to cover anticipated losses and a reasonable reserve?

Using the proposed straight line extrapolation, there is a clear inadequacy in the resulting rate relativities as you increase the effective coverage level and as you decrease the underlying base rate. See Exhibit 3.

(G) Is the actuarial methodology appropriate for the insured risks?

As detailed in Exhibit 3, the straight line extrapolation falls short for the higher effective coverage levels. Using Stirling's Interpolation Formula gives much better results.

Conclusion

While the proposed Yield Exclusion program has a great deal of merit and should be welcomed by APH insureds, it is highly recommended that RMA rethink the extrapolation process for coverage level relativities for the resulting very high effective coverage levels, especially those with relatively low base rates.

CURRICULUM VITAE

Name of Reviewer: David R. Bickerstaff, FCAS, MAAA

Name of Firm: BICKERSTAFF, WHATLEY, RYAN & BURKHALTER, INC.
Richardson, Texas

Profession: Consulting Actuary

Membership in Professional Societies:
- Fellow, Casualty Actuarial Society
- American Academy of Actuaries

Education: University of Mississippi – 1960 – B.A. Mathematics

Key Qualifications:

Mr. Bickerstaff's experience in crop insurance ratemaking dates back more than 30 years. In the early 1970's, as Vice-President and Actuary at Southern Farm Bureau Casualty Insurance Company in Jackson, Mississippi, he performed periodic studies on crop hail programs underwritten in Texas (cotton, soybeans) and South Carolina (tobacco). In 1983, as a Principal with Milliman & Robertson (Pasadena, California, office), he was one of four co-authors of a comprehensive analysis and review of the procedures used by the Federal Crop Insurance Corporation (FCIC) of Kansas City, Missouri. Mr. Bickerstaff was the principal author of two of the nine separate reports resulting from that engagement: "Analyzing the Effects of Unitizing on Loss Costs and Related Issues" and "Analysis of Procedures to Determine Rating Areas and Classifications." He was also a major contributor to a third report in that series, "Analysis of Area Average Yield and Individual Yield Programs."

Since 2002, Mr. Bickerstaff has been engaged by the Risk Management Agency (RMA), the operational wing of FCIC, to perform actuarial reviews of proposed new crop insurance products. In 2002-2003 he reviewed a Livestock Risk Protection product. In 2005, he reviewed the Pasture, Rangeland, and Forage Rainfall Index and NDVI Index pilot programs. In 2006, he reviewed the Experience Based Producer Discount Program. In 2007, reviews were performed for the Apiculture Vegetation Index and the Apiculture Rainfall Index programs. In 2008, he reviewed three other proposals, one involving a Crop Technology Discount Program, another dealing with Trout and Catfish farms, and a third involving a new Named Peril Weather Program. In 2009 he reviewed an Actual Revenue History program for navel oranges and a Maximum Indemnity Factor amendment to the existing Apiculture program. In 2010 he contributed to the report "Feasibility Research Report for Insuring Honey Bees", prepared for RMA by AgForce of Perryton, Texas. Then, in later 2010, he prepared a review of a proposed County ACRE program. In 2011 Mr. Bickerstaff provided a review for a proposed APH product for Camelina. In 2012 he prepared reviews for a Pulse Crop program and a proposed Downed Rice Endorsement. In 2013 he prepared a review for a proposed ARPI program for rice. In 2014 he was part of the AgForce, Inc., team to prepare the rating for a new Drought Monitor Endorsement to the existing Pasture, Rangeland, and Forage Rain Index program.

In 2001, Mr. Bickerstaff was engaged by Agriservices, LLC, of Blackfoot, Idaho, to provide the actuarial input for a proposed Whole Farm Revenue Protection plan. The plan will be proposed as a pilot in a selected group of counties in Idaho. The model simulates (a) the yields for various crops produced at the grower level and (b) the harvest prices for these crops, incorporating the correlation of both the yields and the prices among the crops at the grower level. To determine the Whole Farm loss cost and the whole farm premium, the model samples 100,000 random scenarios.

Mr. Bickerstaff was a speaker at the November 2006 CAS Meeting in San Francisco on the subject of GRP programs.

Employment Record:

<u>1990 – present</u> **Bickerstaff, Whatley, Ryan & Burkhalter, Inc.,** Indian Wells, California and Richardson, TX (since 2009). Former names: *Bickerstaff & Associates; Bickerstaff & Whatley, Inc.*

Position: Chairman

Types of Activities: Wide assortment of medical professional liability engagements, having served physician and hospital clients in every area of the U.S. Has also had extensive experience in personal lines pricing and loss reserves, and in the development of risk models and actuarial information systems. Clients have included insurance companies, managing general agents, captives, self-insurance trusts, risk retention groups, trade associations, law firms, and regulatory bodies. Highlights of other past assignments include:

- Actuarial expert reviewer for Risk Management Agency/Federal Crop Insurance Corporation/U.S. Department of Agriculture

- Actuarial advisor for northwest USA carrier covering agri-business risks, assisting in that carrier's exclusive design of a whole-farm revenue protection policy for selected crops.

- Participant in major study of Federal Crop Insurance Corporation in mid-80's

- Extensive Expert Testimony in insurance-related litigation and rate hearings

- Consultant to the Insurance Council of Texas (formerly Texas Automobile Insurance Service Office and Texas Insurance Organization) since 1989, annually preparing proposals for private passenger benchmark rates.

- Consultant to large workers' compensation self insurance trust for restaurant owners in California

- Designed pricing models for vehicle service contract and GAP products for carrier in western states

- Developed Surety Bond product for one of the largest bail bondsman in Nevada

- Assisted in the development of a Patent Infringement Liability product

- Consultant to General Accounting Office (U.S. Government) for Medical Malpractice study

- Designed and implemented Actuarial Information System for major Southeastern personal lines carrier

- Consultant to major HMO in Southern California

- Extensive Workers' Compensation studies for large Midwestern state insurance department

- Consultant in 1980’s to nation's largest extended automobile warranty carrier

1974 – 1990 **Milliman & Robertson, Inc.**, Pasadena, California (now known as Milliman USA)
Position: Consulting Actuary; Principal

1965 – 1974 **Southern Farm Bureau Casualty Insurance Company**, Jackson, MS
Position: Vice President and Actuary

1963 – 1965 **State Farm Mutual Insurance Company**, Bloomington, IL
Position: Senior Actuarial Assistant

1960 – 1963 **United States Navy**
Rank: Lieutenant Junior Grade

Awards and Publications:

Mr. Bickerstaff has served on the Board of Directors of the Casualty Actuarial Society (1975-78). In 1972 he received the Woodward-Fondiller Prize for his paper in the Society's Proceedings. He has also made frequent contributions to the C.A.S. Call Paper program and the annual loss reserve and ratemaking seminars sponsored by the Society.

He is the author of the following published papers:

"Automobile Collision Deductibles and Repair Cost Groups: The Lognormal Model" in *Proceedings of the Casualty Actuarial Society*, 1972.

"Hospital Self-Insurance Funding: A Monte Carlo Approach", *Casualty Actuarial Society Forum,* Fall 1989.

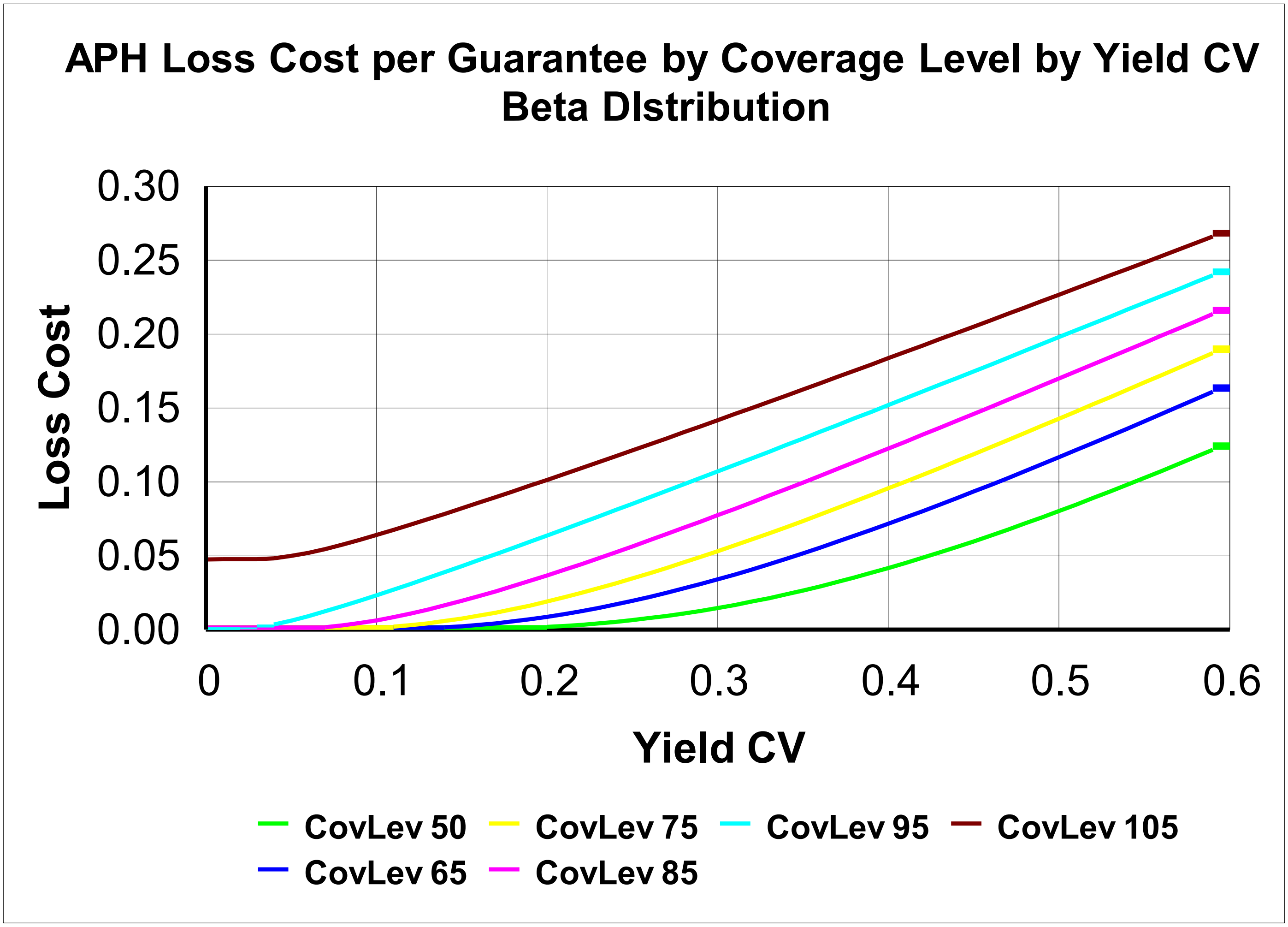
"Evaluating Contingent Premium Liabilities for Excess-of-Loss Swing Plans", *C.A.S. Discussion Paper Program*, 1988.

"How Your Free Tail Liability Policy is Funded," *Medical Practice Management*, September/October, 2000.

APH Loss Cost per Guarantee by Coverage Level by Yield CV
Beta Distribution (max = mean + 2 standard deviations, min = 0)

Yield	Coverage Level					
CV	0.50	0.65	0.75	0.85	0.95	1.05
0.00	0.00000	0.00000	0.00000	0.00000	0.00000	0.04762
0.01	0.00000	0.00000	0.00000	0.00000	0.00001	0.04766
0.02	0.00000	0.00000	0.00000	0.00000	0.00035	0.04770
0.03	0.00000	0.00000	0.00000	0.00001	0.00157	0.04774
0.04	0.00000	0.00000	0.00000	0.00007	0.00359	0.04836
0.05	0.00000	0.00000	0.00001	0.00032	0.00618	0.04985
0.06	0.00000	0.00000	0.00004	0.00084	0.00918	0.05201
0.07	0.00000	0.00001	0.00014	0.00170	0.01245	0.05464
0.08	0.00000	0.00003	0.00036	0.00291	0.01592	0.05757
0.09	0.00000	0.00008	0.00073	0.00447	0.01953	0.06074
0.10	0.00000	0.00019	0.00129	0.00635	0.02326	0.06407
0.11	0.00001	0.00037	0.00207	0.00852	0.02708	0.06752
0.12	0.00003	0.00067	0.00308	0.01094	0.03097	0.07106
0.13	0.00008	0.00109	0.00433	0.01360	0.03493	0.07469
0.14	0.00015	0.00165	0.00580	0.01645	0.03893	0.07837
0.15	0.00026	0.00238	0.00751	0.01949	0.04299	0.08211
0.16	0.00043	0.00329	0.00943	0.02268	0.04708	0.08590
0.17	0.00068	0.00437	0.01156	0.02602	0.05121	0.08972
0.18	0.00100	0.00564	0.01388	0.02948	0.05537	0.09358
0.19	0.00142	0.00709	0.01639	0.03305	0.05956	0.09747
0.20	0.00195	0.00872	0.01907	0.03673	0.06378	0.10139
0.21	0.00260	0.01054	0.02191	0.04050	0.06803	0.10534
0.22	0.00337	0.01253	0.02490	0.04435	0.07229	0.10931
0.23	0.00428	0.01469	0.02803	0.04828	0.07658	0.11330
0.24	0.00533	0.01701	0.03129	0.05229	0.08089	0.11731
0.25	0.00652	0.01950	0.03467	0.05635	0.08522	0.12135
0.26	0.00786	0.02213	0.03816	0.06047	0.08957	0.12540
0.27	0.00935	0.02492	0.04176	0.06465	0.09393	0.12947
0.28	0.01099	0.02784	0.04546	0.06888	0.09832	0.13356
0.29	0.01278	0.03090	0.04925	0.07316	0.10272	0.13766
0.30	0.01471	0.03408	0.05313	0.07748	0.10713	0.14178
0.31	0.01680	0.03739	0.05709	0.08184	0.11156	0.14592
0.32	0.01903	0.04081	0.06113	0.08624	0.11601	0.15007
0.33	0.02140	0.04433	0.06524	0.09067	0.12047	0.15423
0.34	0.02392	0.04797	0.06941	0.09514	0.12494	0.15841
0.35	0.02657	0.05170	0.07365	0.09964	0.12942	0.16260
0.36	0.02935	0.05553	0.07795	0.10417	0.13392	0.16680
0.37	0.03226	0.05944	0.08230	0.10873	0.13843	0.17102
0.38	0.03531	0.06344	0.08671	0.11331	0.14296	0.17524
0.39	0.03847	0.06752	0.09116	0.11792	0.14749	0.17948
0.40	0.04176	0.07168	0.09567	0.12256	0.15203	0.18373
0.41	0.04515	0.07591	0.10021	0.12721	0.15659	0.18799
0.42	0.04866	0.08022	0.10480	0.13189	0.16115	0.19226
0.43	0.05228	0.08458	0.10943	0.13658	0.16573	0.19654
0.44	0.05600	0.08901	0.11410	0.14130	0.17031	0.20083
0.45	0.05982	0.09350	0.11880	0.14603	0.17490	0.20513
0.46	0.06374	0.09804	0.12353	0.15078	0.17950	0.20944
0.47	0.06775	0.10264	0.12830	0.15555	0.18411	0.21375
0.48	0.07185	0.10729	0.13309	0.16032	0.18873	0.21808
0.49	0.07604	0.11198	0.13792	0.16512	0.19335	0.22241
0.50	0.08030	0.11672	0.14277	0.16992	0.19798	0.22674
0.51	0.08464	0.12151	0.14764	0.17474	0.20262	0.23109
0.52	0.08906	0.12633	0.15253	0.17957	0.20726	0.23544
0.53	0.09355	0.13119	0.15745	0.18441	0.21190	0.23980
0.54	0.09811	0.13609	0.16238	0.18925	0.21655	0.24416
0.55	0.10273	0.14102	0.16734	0.19411	0.22121	0.24852
0.56	0.10741	0.14598	0.17231	0.19897	0.22587	0.25289
0.57	0.11215	0.15097	0.17729	0.20384	0.23053	0.25727
0.58	0.11695	0.15599	0.18229	0.20872	0.23519	0.26164
0.59	0.12180	0.16103	0.18731	0.21360	0.23986	0.26602
0.60	0.12669	0.16609	0.19233	0.21848	0.24452	0.27040

Exhibit 2



APH Loss Cost per Guarantee by Coverage Level by Yield CV
Beta DIstribution
Loss Cost
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0
0.1
0.2
0.3
0.4
0.5
0.6
Yield CV
CovLev 50
CovLev 75
CovLev 95
CovLev 105
CovLev 65
CovLev 85

Exhibit 3

Actual Loss costs for APH Effective coverage levels Greater that .85 Compared to Extrapolations

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(m)	(n)	(p)
										Stirling Interpolation Formula			
	actual loss costs by coverage level (beta)					extrapolated	error	extrapolated	error	.95 coverage level		1.05 coverage level	
CV	0.75	0.80	0.85	0.95	1.05	cov lev .95	actual/extrap	cov lev 1.05	actual/extrap	u	loss cost	u	loss cost
0.00	0.00000	0.00000	0.00000	0.00000	0.04762								
0.01	0.00000	0.00000	0.00000	0.00001	0.04766								
0.02	0.00000	0.00000	0.00000	0.00035	0.04770								
0.03	0.00000	0.00000	0.00001	0.00157	0.04774								
0.04	0.00000	0.00001	0.00007	0.00359	0.04836								
0.05	0.00001	0.00005	0.00032	0.00618	0.04985								
0.06	0.00004	0.00020	0.00084	0.00918	0.05201								
0.07	0.00014	0.00052	0.00170	0.01245	0.05464								
0.08	0.00036	0.00107	0.00291	0.01592	0.05757								
0.09	0.00073	0.00189	0.00447	0.01953	0.06074								
0.10	0.00129	0.00298	0.00635	0.02326	0.06407	0.01310	1.775	0.01986	3.227	3.00	0.01817	5.00	0.03676
0.11	0.00207	0.00435	0.00852	0.02708	0.06752	0.01687	1.605	0.02522	2.678	3.00	0.02256	5.00	0.04420
0.12	0.00308	0.00598	0.01094	0.03097	0.07106	0.02086	1.485	0.03078	2.309	3.00	0.02702	5.00	0.05133
0.13	0.00433	0.00788	0.01360	0.03493	0.07469	0.02503	1.395	0.03647	2.048	3.00	0.03153	5.00	0.05811
0.14	0.00580	0.01001	0.01645	0.03893	0.07837	0.02933	1.327	0.04221	1.857	3.00	0.03603	5.00	0.06454
0.15	0.00751	0.01237	0.01949	0.04299	0.08211	0.03373	1.274	0.04797	1.712	3.00	0.04053	5.00	0.07064
0.16	0.00943	0.01492	0.02268	0.04708	0.08590	0.03820	1.233	0.05372	1.599	3.00	0.04502	5.00	0.07645
0.17	0.01156	0.01766	0.02602	0.05121	0.08972	0.04273	1.199	0.05944	1.510	3.00	0.04949	5.00	0.08199
0.18	0.01388	0.02057	0.02948	0.05537	0.09358	0.04729	1.171	0.06510	1.438	3.00	0.05395	5.00	0.08731
0.19	0.01639	0.02364	0.03305	0.05956	0.09747	0.05189	1.148	0.07072	1.378	3.00	0.05840	5.00	0.09244
0.20	0.01907	0.02684	0.03673	0.06378	0.10139	0.05650	1.129	0.07627	1.329	3.00	0.06284	5.00	0.09739
0.21	0.02191	0.03018	0.04050	0.06803	0.10534	0.06114	1.113	0.08178	1.288	3.00	0.06728	5.00	0.10225
0.22	0.02490	0.03364	0.04435	0.07229	0.10931	0.06578	1.099	0.08721	1.253	3.00	0.07169	5.00	0.10691
0.23	0.02803	0.03721	0.04828	0.07658	0.11330	0.07044	1.087	0.09259	1.224	3.00	0.07613	5.00	0.11156
0.24	0.03129	0.04088	0.05229	0.08089	0.11731	0.07510	1.077	0.09792	1.198	3.00	0.08055	5.00	0.11609
0.25	0.03467	0.04464	0.05635	0.08522	0.12135	0.07977	1.068	0.10318	1.176	3.00	0.08497	5.00	0.12053
0.26	0.03816	0.04849	0.06047	0.08957	0.12540	0.08444	1.061	0.10841	1.157	3.00	0.08942	5.00	0.12499
0.27	0.04176	0.05242	0.06465	0.09393	0.12947	0.08912	1.054	0.11358	1.140	3.00	0.09384	5.00	0.12933
0.28	0.04546	0.05642	0.06888	0.09832	0.13356	0.09380	1.048	0.11871	1.125	3.00	0.09828	5.00	0.13364
0.29	0.04925	0.06050	0.07316	0.10272	0.13766	0.09848	1.043	0.12380	1.112	3.00	0.10274	5.00	0.13799
0.30	0.05313	0.06464	0.07748	0.10713	0.14178	0.10316	1.038	0.12885	1.100	3.00	0.10718	5.00	0.14224
0.31	0.05709	0.06883	0.08184	0.11156	0.14592	0.10785	1.034	0.13386	1.090	3.00	0.11164	5.00	0.14649
0.32	0.06113	0.07309	0.08624	0.11601	0.15007	0.11254	1.031	0.13885	1.081	3.00	0.11612	5.00	0.15077
0.33	0.06524	0.07739	0.09067	0.12047	0.15423	0.11723	1.028	0.14379	1.073	3.00	0.12060	5.00	0.15501
0.34	0.06941	0.08175	0.09514	0.12494	0.15841	0.12192	1.025	0.14871	1.065	3.00	0.12508	5.00	0.15921
0.35	0.07365	0.08615	0.09964	0.12942	0.16260	0.12662	1.022	0.15360	1.059	3.00	0.12958	5.00	0.16345
0.36	0.07795	0.09060	0.10417	0.13392	0.16680	0.13132	1.020	0.15847	1.053	3.00	0.13409	5.00	0.16770
0.37	0.08230	0.09509	0.10873	0.13843	0.17102	0.13602	1.018	0.16331	1.047	3.00	0.13860	5.00	0.17191
0.38	0.08671	0.09961	0.11331	0.14296	0.17524	0.14072	1.016	0.16813	1.042	3.00	0.14312	5.00	0.17612
0.39	0.09116	0.10417	0.11792	0.14749	0.17948	0.14543	1.014	0.17293	1.038	3.00	0.14766	5.00	0.18037
0.40	0.09567	0.10877	0.12256	0.15203	0.18373	0.15014	1.013	0.17772	1.034	3.00	0.15221	5.00	0.18461
0.41	0.10021	0.11340	0.12721	0.15659	0.18799	0.15485	1.011	0.18248	1.030	3.00	0.15675	5.00	0.18883
0.42	0.10480	0.11805	0.13189	0.16115	0.19226	0.15956	1.010	0.18723	1.027	3.00	0.16131	5.00	0.19307
0.43	0.10943	0.12274	0.13658	0.16573	0.19654	0.16427	1.009	0.19196	1.024	3.00	0.16588	5.00	0.19733
0.44	0.11410	0.12745	0.14130	0.17031	0.20083	0.16899	1.008	0.19668	1.021	3.00	0.17046	5.00	0.20159
0.45	0.11880	0.13219	0.14603	0.17490	0.20513	0.17371	1.007	0.20139	1.019	3.00	0.17505	5.00	0.20585
0.46	0.12353	0.13696	0.15078	0.17950	0.20944	0.17843	1.006	0.20608	1.016	3.00	0.17964	5.00	0.21011
0.47	0.12830	0.14174	0.15555	0.18411	0.21375	0.18315	1.005	0.21076	1.014	3.00	0.18424	5.00	0.21439
0.48	0.13309	0.14655	0.16032	0.18873	0.21808	0.18788	1.005	0.21543	1.012	3.00	0.18885	5.00	0.21867
0.49	0.13792	0.15137	0.16512	0.19335	0.22241	0.19260	1.004	0.22009	1.011	3.00	0.19346	5.00	0.22296
0.50	0.14277	0.15622	0.16992	0.19798	0.22674	0.19733	1.003	0.22474	1.009	3.00	0.19808	5.00	0.22725
0.51	0.14764	0.16108	0.17474	0.20262	0.23109	0.20206	1.003	0.22938	1.007	3.00	0.20271	5.00	0.23155
0.52	0.15253	0.16596	0.17957	0.20726	0.23544	0.20679	1.002	0.23401	1.006	3.00	0.20734	5.00	0.23586
0.53	0.15745	0.17085	0.18441	0.21190	0.23980	0.21152	1.002	0.23863	1.005	3.00	0.21198	5.00	0.24017
0.54	0.16238	0.17576	0.18925	0.21655	0.24416	0.21625	1.001	0.24324	1.004	3.00	0.21662	5.00	0.24449
0.55	0.16734	0.18068	0.19411	0.22121	0.24852	0.22098	1.001	0.24785	1.003	3.00	0.22127	5.00	0.24881
0.56	0.17231	0.18561	0.19897	0.22587	0.25289	0.22571	1.001	0.25244	1.002	3.00	0.22592	5.00	0.25314
0.57	0.17729	0.19055	0.20384	0.23053	0.25727	0.23044	1.000	0.25703	1.001	3.00	0.23057	5.00	0.25747
0.58	0.18229	0.19550	0.20872	0.23519	0.26164	0.23517	1.000	0.26161	1.000	3.00	0.23522	5.00	0.26181
0.59	0.18731	0.20045	0.21360	0.23986	0.26602	0.23989	1.000	0.26618	0.999	3.00	0.23988	5.00	0.26615
0.60	0.19233	0.20542	0.21848	0.24452	0.27040	0.24462	1.000	0.27075	0.999	3.00	0.24454	5.00	0.27049

Notes:

(a)	Coefficient of Variation of yield distribution, on which loss cost is based.	
(b) - (f)	Loss cost per guarantee at various coverage levels, based on beta distribution	
(g)	straight line extrapolation: (g) = (d) + 2 * [(d) - (c)]	
(h)	= (e) / (g)	
(i)	straight line extrapolation: (i) = (d) + 4 * [(d) - (c)]	
(j)	= (f) / (i)	
(k)	u = (.95 - .80) / .05	
(m)	= (c) + (u/2) * [(d) - (b)] + (u^2/2) * [(d) + (b) - 2*(c)]	
(n)	u = (1.05 - .80)/.05	
(p)	= (c) + (u/2) * [(d) - (b)] + (u^2/2) * [(d) + (b) - 2*(c)]	