LOSS ESTIMATION: THE EXPOSURE APPROACH

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Abstract

The estimation of ultimate losses for a particular year is consistently one of the most formidable tasks facing the actuary. Rather than focusing on and manipulating the data reported by the loss process, this paper presents a model of the loss process itself. Changes in claim counts, average values, and incurred losses are viewed as manifestations of changes in underlying characteristics of a book of business. The paper focuses on these underlying factors, describes a technique to measure them, and presents a framework to project their impact on ultimate losses.

INTRODUCTION

An insurance company's liability for outstanding claim payments has historically been the largest and most difficult to estimate. Loss reserves represent the ultimate value for a particular body of claims less paid amounts. Since the paid amounts are known, the difficulty in estimating reserve levels lies with estimating the ultimate value of the body of losses.

This paper describes a new approach to estimate ultimate losses on an accident year basis. "The Exposure Approach" focuses on the factors responsible for changes in losses from one year to the next, describes a technique to measure them, and presents a model to forecast their impact on losses. The method is not intended to replace any existing actuarial loss estimation techniques. It is presented as another tool to help actuaries in the challenge they face.

ANALYSIS OF THE COMPONENTS OF CHANGES IN ACCIDENT YEAR LOSSES

The traditional approach to estimating ultimate losses for a recent or current accident year with immature loss experience generally includes an analysis of reported incurred losses, claim counts, and average claim values. These data form loss development triangles which challenge the actuary to make judgments as to where the ultimate values will fall. Estimation of accident year losses using reported values for these data, however, can be subject to potentially unstable patterns of development. Moreover, for the immature or incomplete accident year, the judgment will have to be based on the few data points (or point) available.

Actuaries' abilities to make accurate projections of ultimate losses may depend not only on their technical skills, but also on their abilities to understand the data with which they are presented. Why do claim counts change from one year to the next? Why do average claim values change? Why do ultimate incurred losses change?

Why do losses change?

Ten factors which contribute to changes in accident year losses have been identified. They are listed below, each with a brief definition and its relationship to changes in claim counts, average values, and incurred losses. A summary is provided in Exhibit 1.

Number of Risks. As more risks are insured, claim counts and total losses can be expected to increase. There should not be any reason to expect average claim values to change as the result of a change in this factor alone.

Size of Risks. Generally speaking, the larger the risk, the greater the losses. For automobile insurance, insureds with multiple vehicles will tend to generate more claims than insureds with a single vehicle. For workers' compensation, an insured with $50,000,000 payroll will tend to have more losses than an insured with $100,000 payroll. It could be argued, too, that larger risks have the potential to experience larger claims than smaller risks.

Policy Limiting Factors. The profile of policy limits or deductibles has a significant effect on losses. Small claims disappear if higher deductibles are sold, and large losses capped at policy limits may rise if higher limits are sold. The particular policy coverage conditions and exclusions can also significantly affect accident year losses. Changes in these items could affect both claim counts and average values.

Class of business. A workers' compensation policyholder with an average class rate of $4 per $100 payroll can be expected to generate more dollars of loss than one with similar payroll and an average class rate of $1. The separate manifestations through claim counts and average values may be unclear, however. For automobile insurance, a young single male driving a sportscar can be expected to generate higher losses than a middle-aged woman driving a 4-door sedan. The territory or state of the insured may also be considered a type of classification. Shifts in a book of business from one state to another may produce changes in losses.

Reinsurance. Any reinsurance program can have a significant effect on net accident year losses. Net average claim values can be significantly affected.

Underwriting quality. This factor reflects the difference in inherent loss potential between two risks within the same rating classification. Certainly changes in this factor can affect ultimate losses, but the distinct effects on changes in claim counts and average values may be impossible to predict.

Inflation. The cost of goods and services which make up two identical insurance claims occurring a year apart may be different solely due to general inflation of the economy. This primarily affects average values, but could also affect claim counts to the extent inflation pushes claim values above deductibles.

Claim handling. A fundamental change in claim handling philosophy could have an impact on ultimate losses. For example, the introduction of a "get-tough" practice to eliminate small nuisance claims could reduce claim counts and ultimate losses. This new practice would also affect average claim values.

External factors. Given the same book of business over two years, losses could change due to external factors. These factors include higher or lower gasoline prices, affecting the intensity of use of the insured vehicles. Changes in statutory workers' compensation benefit levels will produce changes in losses. For property lines, this factor could be quite large, with the occurrence of hurricanes and other natural perils. For liability lines, social inflation (rising jury awards) and tort reform are examples of external factors. External factors can affect both claim counts and average values.

Randomness. This last item reflects the unexplained random nature of loss occurrence. This could be called good luck or bad luck. Its

effect on claim counts and average values is impossible to determine.

Changes in the ten factors above have complicated and interrelated effects on changes in claim counts, average values, and incurred losses.

Ceteris paribus, an increase in the average automobile liability policy limit will result in higher losses. Loss development triangles will ultimately reveal the increase. Claim counts should not change, but average values can be expected to increase by the increase in average increased limits factors. If only one of the ten factors changes from one year to the next, the actuary should be able to determine the effect on losses.

Unfortunately, the practicing actuary cannot rely on such an academic assumption as ceteris paribus. The actuary never has the opportunity to estimate losses when only one component changes. Everything changes. Therefore, a method which can measure changes in each of or combinations of the ten components should help the actuary in the challenge to estimate ultimate losses.

MEASURING CHANGES IN EXPOSURE

Definition of Exposure

The key in measuring several of the above ten components of changes in losses lies not in loss data, but in premium data. Premium should vary directly with the exposure to loss represented by a book of business. The phrase "exposure to loss" reflects the following characteristics of a book of business:

- the number of risks
- the average size of the risks
- the average policy limit, deductible, and conditions
- the rating classifications of the risks
- the underwriting quality of the risks.

These five items represent half of the list of ten components of changes in accident year losses. They also constitute this paper's definition of "exposure." Exposure is meant to be a measure of the real, not nominal, loss potential of a book of business. (This use of "exposure" must not be confused with the use of the term "exposure base" for rating, e.g., payroll, number of vehicles, etc.) Measuring changes in exposure should provide clues regarding subsequent changes in ultimate accident year losses.

Why do premiums change?

In order to measure changes in exposure, the components of changes in premiums need to be analyzed. Since premiums are charged for accepting exposure to loss, premiums can be viewed as a function of price per loss exposure and the level of loss exposure. Changes in premiums, therefore, can be split into changes in price and changes in exposure. Changes in

price include the combined effects of changes in filed rates, deviations, and rating factors (Rate), changes in schedule rating modifications or the use of deviated rate companies (Flex Price), and changes in premium bases (for instance, payroll) due to external economic inflationary effects (Inflation). Appendix I includes a more detailed discussion of the three components of changes in price. The ability to measure changes in the components of price, especially Flex Price, demands that companies have data systems which can capture such information. Once the information has been captured, actuarial staff should be able to determine the impacts of changes in these pricing factors.

Policy month premiums, not calendar month written or earned premiums, are the best data to use to measure exposure changes; they exclude accounting distortions and better reflect the exposure accepted by selling insurance policies.

Since changes in premium and price can be measured, simple algebra lets the actuary solve for the change in exposure.

$$\text{Premium} = \text{Price} \times \text{Exposure}$$

$$\text{Change in Premium} = \text{Change in Price} \times \text{Change in Exposure}$$

$$\text{Change in Exposure} = \text{Change in Premium} \div \text{Change in Price}$$

Example 1

Assume that the ABC Insurance Company sells workers' compensation policies. The universe of risks is divided into two homogeneous rating classifications, clerical office workers and road construction workers. The correct and manual rate for road workers is much higher than for clerical workers. In 1986, the payroll for the policies written is split evenly among the two classes. In 1987, total insured payroll does not change. The split between the two classes, however, has changed to 60% road workers, 40% clerical workers. Though the rating base, payroll, has not changed from 1986 to 1987, the real exposure to loss accepted by ABC has increased. The rating system, however, has also increased the premiums charged for accepting the exposure. With no change in price per exposure, the premium has increased by the increase in exposure.

Example 2

Assume that the XYZ Mutual Insurance Company writes five automobile insurance policies. Each policy insures one vehicle. The base rate is $100, the average rating factor is 1.00, and each purchases a $300,000 policy limit (Increased Limit Factor (ILF) = 1.62). Total premium, therefore, equals $810.

A year later, each policy renews its coverage with XYZ. The current base rate, however, has increased to $120. Each risk selects a higher policy limit of $500,000 (ILF = 1.77). Total renewal premium equals $1062, an increase of 31.1% over the expiring premium. The increase in premium was produced by not only the higher base rate, but also the selection of the higher policy limit. The price component of the premium increase is 20%,

since the base rate increased from $100 to $120. The remaining increase in premium, 9.3% (1.311/1.200), represents the increase in exposure.

In this example, although the number of autos and policies remained the same, the exposure to loss increased because of the higher policy limit. Specifically, the increase in exposure is equal to the increase in the ILF's (1.77/1.62 = 1.093). (This example, as well as any measurement of exposure change, must assume that the relationship among class rating or increased limit factors represent the true relative loss exposure among the classes or limits.)

Example 3

Assume that the Solid Insurance Company sells one line of insurance. Premiums for policies issued during January, 1987, were $43.5 million. One year later, January, 1988, policies produce $50.0 million premium. The underlying number of risks, their average size, average policy limit or deductible, and average class are not known. The company's actuaries, however, have carefully measured changes in price. Rate has increased 10.5%, Flex Price added 1.5%, while Inflation generated an increase of 4.5% on the rating base. Therefore, total Price has increased 17.2%. Since the premium change is +14.9%, exposure has changed by -2.0%.

ESTIMATION OF ACCIDENT YEAR LOSSES

Components of the Exposure Approach

The exposure approach to estimating changes in accident year losses assumes that policy month changes in exposure can be measured. For the purposes of this paper, assume that changes in the Flex Price component of Price reflect purely competitive considerations, not changes in underwriting quality. Therefore, measured exposure changes exclude changes in underwriting quality. If the measured exposure changes include the effect of reinsurance (by using net instead of direct premiums), then the measured exposure changes include five of the ten components of changes in losses.

Therefore, the ten factors contributing to changes in losses can be consolidated to six factors:

1) exposure
2) quality
3) inflation
4) claim handling
5) external factors
6) randomness.

(It is important to note that the impact of inflation on losses is not necessarily the same as its impact on premium bases. For general liability, inflation's impact on premium through sales is not the same as its impact on losses through medical costs.)

Estimates for the non-exposure parameters of the model are generated from a variety of sources. A company may have a sophisticated monitoring system to evaluate the underwriting quality of new business or renewal policies.

Inflation may be estimated by changes in the Consumer Price Index for medical costs, repair costs, or other appropriate items. Changes in claim handling procedures will have to be based on a company's assessment of this factor. External factors may be objectively or subjectively measured. Changes in statutory workers' compensation benefit levels can be measured. On the other hand, the effect of changes in gasoline prices may be less scientifically measured. As used to forecast losses, randomness may be incorporated as either optimism or conservatism.

Timing of Effects

The timing of the six factors' effects is not the same, however. Exposure changes are on a policy month basis. Changes in underwriting quality should affect losses on a policy month basis, since policies are issued according to the underwriting guidelines in effect during policy issuance. The other factors generally affect losses on a calendar/accident year basis. Inflation's effect on a claim should be more related to accident date than policy effective date (it may be more related to the report date than the accident date). A change in claim handling policy would tend to affect all claims occuring after a given date. External factors, too, should affect the occurrence of losses independent of policy effective date.

The changes in policy month written exposure and quality must be converted to a calendar/accident year basis. They must be "earned." The exposure measurement method should generate the changes in exposure from January, 1985 to January, 1986, and from February, 1985 to February, 1986. In order to average the exposure changes over a calendar period, the

relationship of January's change to February's change is needed. A base period exposure index is needed, consisting of twelve consecutive policy months' relative exposure levels.

Since premiums vary proportionately with the exposure, the distribution of policy month premiums in an initial period should give the exposure relationships needed. The base period premiums, however, must be adjusted to a common pricing basis, thereby determining a base period written exposure index. Exhibit 2 illustrates the derivation of the initial exposure indices.

Assume that the current month is May, 1988, and that an insurance company experiences the exposure changes from Exhibit 3. The company has projected 0% exposure growth for the rest of 1988. Using these data and the base index from Exhibit 2, Exhibit 4 shows the calculation of earned changes in exposure.

Changes in earned exposure are measured by changes in the average calendar period exposure indices. To demonstrate, the average calendar exposure index for January, 1986 (0.507, Exhibit 4, Column 7) is the average of the written exposure indices (Column 5) for policy months February, 1985, through January, 1986. All policies are assumed to be written on the first day of each month. The change in earned exposure (Column 9) is measured by the change in the earned index (Column 7). Similarly, the earned indices and changes can be determined on an annual basis.

Using virtually the same approach, earned changes in underwriting quality can be determined. Exhibit 5 shows the calculation of the earned impact of changes in quality, using the policy month quality changes found in Exhibit 3. Earning changes in quality, however, requires one other set of indices: the relative underwriting quality within the base period. For this paper, underwriting quality is assumed to be constant within the base period. Therefore, the base period index (Column 2) is the same as that for determining the earned impact of changes in exposure.

Calculating Changes in Accident Year Losses

Once the earned changes in exposure and quality have been determined, the calculation of the overall changes in accident year losses is rather straightforward, by directly including the other factors of the model. In order to determine accident year losses, the overall changes must be applied to the loss base of a mature accident year. Immature, current, and future accident years' losses can be estimated using this technique. Table I shows the calculation using the assumptions found in Exhibit 3.

TABLE I

Estimating Accident Year Losses

Loss Change Component	1986	1987	1988
Earned Exposure	-	17.9%	3.9%
Earned Quality	-	3.1	0.0
Inflation	-	6.0	5.0
Claim	-	0.0	0.0
External	-	2.0	2.0
Randomness	-	0.0	0.0
Total	-	31.4%	11.3%
Acc Yr Losses	$300.0	394.2	438.7

Advantages

The primary advantage of the exposure approach is the reliance on information directly corresponding with the factors producing changes in accident year losses. The method does not require individual selections of changes in ultimate claim counts, average claim values, and incurred losses using data reported at a particular loss valuation. Early development patterns for these reported data can be unstable, and their ultimate values very difficult to predict. The exposure approach gives the actuary a new perspective on such reported data.

Therefore, used in conjunction with other actuarial reserving techniques, this method may help accident year loss estimates converge to their ultimate levels earlier. Consequently, reserves for IBNR claims and development on known claims may be better estimated, too.

From another point of view, consider the amount of information about an accident year available at a given time using traditional loss development methods and the exposure approach. In July, 1987, when reported losses may be available for the first half of accident year 1987, the amount of information about the accident year is illustrated in Figure 1 of Exhibit 6. Loss development methods would rely on data regarding claims occurring in the first half of the year and reported by mid-year.

On the other hand, with the exposure approach, the amount of information regarding accident year 1987 (Figure 2) is much greater. As of July, 1987, the exposure approach would have measured exposure changes through policy month June, 1987. The majority of losses occurring during the latter half of the year are associated with policies effective prior to July. Therefore, better loss estimates regarding the full accident year, and consequently strategic decisions, could be made earlier, rather than waiting for the reported data to arrive.

AVENUES OF FURTHER RESEARCH

Frequency and Severity by Class

One avenue of research to which the loss exposure approach leads regards claim frequency and severity by class of business. If accurate measures of the propensity of particular classes to have claims, and of the average values of those claims once they occur, can be made, then shifts in the mix of business could be converted to changes in claim counts and average values. Projected changes in claim counts could be important in projecting the claim department staffing levels needed to adequately handle future arising claims.

Financial Solidity Standards

The analysis of the price and exposure components of premium can lead to a discussion of financial solidity standards. In particular, a premium to surplus ratio of 3 to 1 may be used by regulators as a standard of financial solidity. Premium to surplus ratios higher than that standard may indicate a company overextending itself. But, if higher premiums can be generated due solely to increases in price, with the same level of exposure, an insurer should be allowed to maintain a higher ratio. This suggests that an exposure to surplus ratio should be considered as a measure of financial solidity. The challenge to develop an absolute measure of exposure would have to be met.

SUMMARY

The exposure approach to estimating accident year losses represents a new method of evaluating a company's liability for outstanding losses. Instead of focusing on the data produced by the loss process, the approach focuses on the loss process itself. Identifying and quantifying the parameters of the process not only lead to a better understanding of the process, but also to better estimates of the process' results.

At the May, 1987 CAS convention in Orlando, Florida, Pat Choate, director of policy analysis at TRW, Inc., referred to actuaries as the "most sophisticated futurists in America." Unfortunately, one of the premises underlying many actuarial techniques is that the past is a good predictor of the future. The industry may be better served by actuaries who, instead of only reacting to data, understand what caused the past, monitor the present, and thereby predict the future.

APPENDIX I

THE COMPONENTS OF PRICE CHANGE

Rate

The Rate component of Price change is the impact of changes in filed rates or rating factors. Rate includes the impact of changes in manual base rates, increased limit factors, classification plan rating factors, company deviations, or experience rating plans. For example, a change in deviation from -10% to -5% produces a 5.5% Rate increase.

Flex Price

Commercial insurance pricing practices contain a variety of judgmental modifications. Schedule rating plans allow the underwriter to credit or debit an account's premium due to a judgmental evaluation of special characteristics, for example, a loss prevention program. The decision to use a deviated company or not may be within the underwriter's authority. (Note that a change in deviation is a Rate action, while the decision to use or not use a deviated company is a Flex Price action.) The use of any pricing factor not represented by the manual price is a Flex Price action.

Note on Underwriting Quality

If judgmental modifications are an accurate reflection of underwriting quality, then changes in Flex Price should not be included as part of changes in Price. Consequently, the measured exposure changes would include changes in quality. On the other hand, if these modifications are used solely due to competitive considerations, then changes in Flex Price should be included in changes in Price. Consequently, the measured exposure changes do not reflect changes in underwriting quality.

Inflation

The Inflation component of Price reflects the impact of general economic inflation on the premium rating base. For example, a workers' compensation risk's premium may increase by 5% over the prior year's premium due solely to a 5% nominal increase in the payroll base. In this case, the real loss exposure has not changed. Therefore, inflation's impact on premium bases should be included in Price to measure changes in real loss exposure. Inflation's separate effect on nominal losses is reflected by the inflation component of the loss exposure method.

At times, it may be unclear whether a particular component of premium change is a component of Price or exposure. One rule of thumb to use is this: if the set of risks insured does not change from one year to the next, then the measured exposure change should be zero.

APPENDIX II

ESTIMATING POLICY YEAR LOSSES FROM ACCIDENT YEAR LOSSES

As the loss exposure method developed as a tool to estimate accident year losses, it was discovered that it could also estimate policy year losses from accident year losses. This may be valuable for existing years where the loss data may not be retained in policy year detail, or for future policy years where no loss data yet exist.

Exhibit 7 shows the method.

Since a measure (a written index) of the amount of loss potential (exposure) by policy month is known, and the pattern by which that loss exposure (written index) becomes earned is known, then, based on each policy month's contribution to an accident year's earned exposure index, an accident year's losses can be "allocated" to the policy years in effect during the accident year. In other words, an accident year's losses can be distributed to the in-effect policy years based on each policy year's relative contribution, in terms of both exposure index and length of time "exposed" in the accident year, to the accident year's earned exposure index.

Exhibit 7 shows that policy year 1986 contributed 38.3% of the earned exposure to loss of accident year 1987. Therefore, of the $394.2 accident year 1987 losses, $151.0 "belong" to policy year 1986 and $243.2 to policy year 1987. The loss estimate for complete policy year 1986 would be the sum of its losses allocated from accident years 1986 and 1987.

APPENDIX III

EVALUATION OF CHANGES IN UNDERWRITING QUALITY

Changes in loss exposure should ultimately be manifested through changes in claim counts, average values, and total losses. After enough time has elapsed, and the reported values for these data are fully mature, reliance should be placed fully on the actual data. The loss estimates produced by the exposure approach, however, may not balance exactly with the actual data. Any difference could be found in any or all of three places.

First, the assumptions for the components of the exposure approach may have been inaccurate. The exposure changes may have been improperly measured, as a consequence of imprecisely measured premium changes or price impacts. Also, inaccurate estimates for inflation, claim handling, and external factors may produce a loss estimate different from the actual data.

Or, the immeasurable component of the model, randomness, may be the source of any difference between the model's estimate and the true ultimate value. Changes in randomness can be interpreted as good or bad luck. For small insurers, this could have a significant impact. Intuitively based on the law of large numbers, its impact for large insurers should be minimal. Unfortunately, its impact may be impossible to measure.

Finally, assuming that estimates for exposure, inflation, claim handling, and external factors are accurate, and that the effect of randomness is nil, the exposure approach's estimates may still be inconsistent with fully mature data. The remaining component, the impact of changes in

underwriting quality, may be the source of the difference. Estimates regarding trends in the underwriting quality of the insured risks may have been too optimistic or pessimistic.

Therefore, a way to measure the impact of changes in underwriting quality would be to compare the loss estimates produced by the model assuming no changes in quality and the fully mature loss data.

Exhibit 1

RELATIONSHIP OF THE TEN UNDERLYING COMPONENTS OF CHANGES IN LOSSES

TO CHANGES IN AVERAGE VALUES AND CLAIM COUNTS

Underlying Component of Changes in Losses	Impact On Average Values	Impact On Claim Counts
Number of Risks	No	Yes
Size of Risks	Yes?	Yes
Policy Limiting Factors	Yes	Yes
Class of Business	Yes	Yes
Reinsurance	Yes	No
Underwriting quality	Yes	Yes
Inflation	Yes	Yes
Claim handling	Yes	Yes
External factors	Yes	Yes
Randomness	Yes	Yes

Exhibit 2

DERIVATION OF BASE PERIOD WRITTEN EXPOSURE INDEX

Policy Month	Premium	Rate* Index	Flex** Price Index	Inflation Index***	Total Price Index	Adjusted Premium	Exposure Index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Jan-85	67.6	1.000	1.000	1.000	1.000	67.6	1.000
Feb-85	26.1	1.012	1.000	1.004	1.016	25.7	0.380
Mar-85	30.6	1.015	1.000	1.008	1.023	29.9	0.442
Apr-85	42.3	1.020	0.990	1.012	1.022	41.4	0.612
May-85	32.5	1.016	0.990	1.016	1.022	31.8	0.470
Jun-85	30.6	1.035	0.990	1.021	1.046	29.3	0.433
Jul-85	48.0	1.040	0.980	1.025	1.044	46.0	0.680
Aug-85	28.4	1.044	0.980	1.029	1.053	27.0	0.399
Sep-85	31.1	1.055	0.980	1.033	1.068	29.1	0.430
Oct-85	34.2	1.062	1.010	1.037	1.113	30.7	0.454
Nov-85	26.7	1.060	1.010	1.041	1.115	23.9	0.354
Dec-85	27.0	1.067	1.010	1.046	1.127	24.0	0.355

* For example, the average level of filed rates and rating factors in July is 4.0% higher than the average in January.

** The relationship between average modifications is needed. For example, the average modification in the second quarter is 1% less than the average in the first quarter.

*** Annual rate equals 5%

Col (6) = Product of Cols (3), (4), & (5).

Col (7) = Col (2) / Col (6)

Col (8) = Col (7) / (Jan-85 Adjusted Premium)

Exhibit 3

LOSS EXPOSURE APPROACH - DATA & ASSUMPTIONS*

Policy Month			Accident Year Change in . . .			
Month	Exposure Change	Quality Change**	Inflation	Claim	External	Randomness
1 86	7	1				
2 86	9	1				
3 86	11	1				
4 86	12	3				
5 86	14	3				
6 86	17	3				
7 86	22	4				
8 86	20	4				
9 86	25	4				
10 86	26	5				
11 86	26	5				
12 86	24	5				
1 87	20	4				
2 87	22	4				
3 87	19	4				
4 87	18	2				
5 87	15	2				
6 87	13	2				
7 87	10	1				
8 87	10	1				
9 87	7	1				
10 87	8	0				
11 87	4	0				
12 87	3	0	6	0	2	0
1 88	4	0				
2 88	2	0				
3 88	0	0				
4 88	-3	0				
5 88	-1	0				
6 88	0	0				
7 88	0	-2				
8 88	0	-2				
9 88	0	-2				
10 88	0	-3				
11 88	0	-3				
12 88	0	-3	5	0	2	0

* All changes in percentages.

** Positive value for quality change indicates deterioration in quality (increase in loss exposure) over prior year's policy month; negative value indicates improvement in quality.

Exhibit 4

DERIVATION OF CHANGE IN EARNED EXPOSURE

Month	Base Index	Exposure Change Month	Exposure Change Year	Written Index Month	Written Index Year	Earned Index Month	Earned Index Year	Earned Change Month	Earned Change Year
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Jan-85	1.000			1.000					
Feb-85	0.380			0.380					
Mar-85	0.442			0.442					
Apr-85	0.612			0.612					
May-85	0.470			0.470					
Jun-85	0.433			0.433					
Jul-85	0.680			0.680					
Aug-85	0.399			0.399					
Sep-85	0.430			0.430					
Oct-85	0.454			0.454					
Nov-85	0.354			0.354					
Dec-85	0.355			0.355	0.501	0.501			
Jan-86		7%		1.070		0.507			
Feb-86		9%		0.414		0.509			
Mar-86		11%		0.491		0.514			
Apr-86		12%		0.685		0.520			
May-86		14%		0.536		0.525			
Jun-86		17%		0.507		0.531			
Jul-86		22%		0.830		0.544			
Aug-86		20%		0.479		0.550			
Sep-86		25%		0.538		0.559			
Oct-86		26%		0.572		0.569			
Nov-86		26%		0.446		0.577			
Dec-86		24%	16.6%	0.440	0.584	0.584	0.541		
Jan-87		20%		1.284		0.602		18.7%	
Feb-87		22%		0.505		0.609		19.6%	
Mar-87		19%		0.584		0.617		20.0%	
Apr-87		18%		0.808		0.627		20.6%	
May-87		15%		0.616		0.634		20.8%	
Jun-87		13%		0.573		0.640		20.5%	
Jul-87		10%		0.913		0.647		18.9%	
Aug-87		10%		0.527		0.651		18.4%	
Sep-87		7%		0.576		0.654		17.0%	
Oct-87		8%		0.618		0.658		15.6%	
Nov-87		4%		0.464		0.659		14.2%	
Dec-87		3%	13.0%	0.453	0.660	0.660	0.638	13.0%	17.9%
Jan-88		4%		1.335		0.664		10.3%	
Feb-88		2%		0.515		0.665		9.2%	
Mar-88		0%		0.584		0.665		7.8%	
Apr-88		-3%		0.784		0.663		5.7%	
May-88		-1%		0.610		0.663		4.6%	
Jun-88		0%		0.573		0.663		3.6%	
Jul-88		0%		0.913		0.663		2.5%	
Aug-88		0%		0.527		0.663		1.3%	
Sep-88		0%		0.576		0.663		1.4%	
Oct-88		0%		0.618		0.663		0.3%	
Nov-88		0%		0.464		0.663		0.6%	
Dec-88		0%	0.5%	0.453	0.663	0.663	0.663	0.5%	3.9%

Exhibit 5

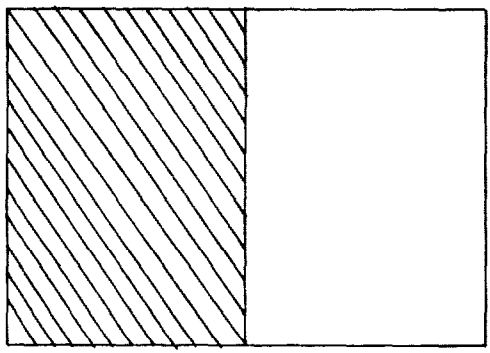
DERIVATION OF CHANGE IN EARNED QUALITY

Month	Base Index	Quality Change Month	Quality Change Year	Written Index Month	Written Index Year	Earned Index Month	Earned Index Year	Earned Change Month	Earned Change Year
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Jan-85	1.000			1.000					
Feb-85	0.380			0.380					
Mar-85	0.442			0.442					
Apr-85	0.612			0.612					
May-85	0.470			0.470					
Jun-85	0.433			0.433					
Jul-85	0.680			0.680					
Aug-85	0.399			0.399					
Sep-85	0.430			0.430					
Oct-85	0.454			0.454					
Nov-85	0.354			0.354					
Dec-85	0.355			0.355	0.501	0.501			
Jan-86		1%		1.010		0.502			
Feb-86		1%		0.384		0.502			
Mar-86		1%		0.446		0.502			
Apr-86		3%		0.630		0.504			
May-86		3%		0.484		0.505			
Jun-86		3%		0.446		0.506			
Jul-86		4%		0.707		0.508			
Aug-86		4%		0.415		0.510			
Sep-86		4%		0.447		0.511			
Oct-86		5%		0.477		0.513			
Nov-86		5%		0.372		0.514			
Dec-86		5%	3.0%	0.373	0.516	0.516	0.508		
Jan-87		4%		1.050		0.519		3.4%	
Feb-87		4%		0.399		0.521		3.8%	
Mar-87		4%		0.464		0.522		4.0%	
Apr-87		2%		0.643		0.523		3.8%	
May-87		2%		0.494		0.524		3.8%	
Jun-87		2%		0.455		0.525		3.8%	
Jul-87		1%		0.714		0.525		3.3%	
Aug-87		1%		0.419		0.526		3.1%	
Sep-87		1%		0.451		0.526		2.9%	
Oct-87		0%		0.477		0.526		2.5%	
Nov-87		0%		0.372		0.526		2.3%	
Dec-87		0%	1.9%	0.373	0.526	0.526	0.524	1.9%	3.1%
Jan-88		0%		1.050		0.526		1.3%	
Feb-88		0%		0.399		0.526		1.0%	
Mar-88		0%		0.464		0.526		0.8%	
Apr-88		0%		0.643		0.526		0.6%	
May-88		0%		0.494		0.526		0.4%	
Jun-88		0%		0.455		0.526		0.2%	
Jul-88		-2%		0.700		0.525		0.0%	
Aug-88		-2%		0.411		0.524		-0.4%	
Sep-88		-2%		0.442		0.523		-0.6%	
Oct-88		-3%		0.463		0.522		-0.8%	
Nov-88		-3%		0.361		0.521		-1.0%	
Dec-88		-3%	-1.1%	0.362	0.520	0.520	0.524	-1.1%	0.0%

Exhibit 6

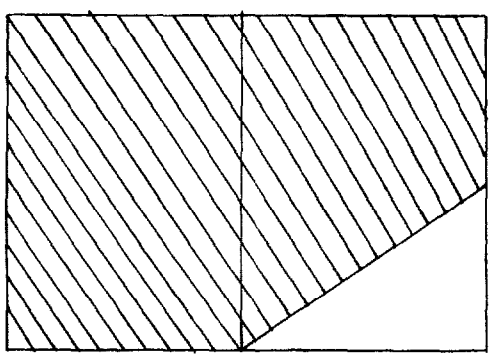
INFORMATION REGARDING ACCIDENT YEAR 1987 AT MIDYEAR

Figure 1



Information with reported data

Figure 2



Information with the exposure approach

Exhibit 7

ALLOCATION OF ACCIDENT YEAR LOSSES TO POLICY YEAR

Policy Month	Written Exposure Index	Earned in '87 Ratio	Portion Earned in '87	Share of '87 Earned Exposure Index: Policy Month	Share of '87 Earned Exposure Index: Policy Year	Pol Yr Share of Accident Year Losses
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Jan-86	1.070	0.000	0.000	0.0%		
Feb-86	0.414	0.083	0.035	0.5%		
Mar-86	0.491	0.167	0.082	1.1%		
Apr-86	0.685	0.250	0.171	2.2%		
May-86	0.536	0.333	0.179	2.3%		
Jun-86	0.507	0.417	0.211	2.8%		
Jul-86	0.830	0.500	0.415	5.4%		
Aug-86	0.479	0.583	0.279	3.6%		
Sep-86	0.538	0.667	0.359	4.7%		
Oct-86	0.572	0.750	0.429	5.6%		
Nov-86	0.446	0.833	0.372	4.9%		
Dec-86	0.440	0.917	0.403	5.3%	38.3%	151.0
Jan-87	1.284	1.000	1.284	16.8%		
Feb-87	0.505	0.917	0.463	6.0%		
Mar-87	0.584	0.833	0.487	6.4%		
Apr-87	0.808	0.750	0.606	7.9%		
May-87	0.616	0.667	0.411	5.4%		
Jun-87	0.573	0.583	0.334	4.4%		
Jul-87	0.913	0.500	0.457	6.0%		
Aug-87	0.527	0.417	0.220	2.9%		
Sep-87	0.576	0.333	0.192	2.5%		
Oct-87	0.618	0.250	0.155	2.0%		
Nov-87	0.464	0.167	0.077	1.0%		
Dec-87	0.453	0.083	0.038	0.5%	61.7%	243.2
Total		12.000	7.659	100.0%	100.0%	394.2 *
'87 Earned Exposure Index			0.638			

'87 Earned Exposure Index = Total Col (4) / Total Col (3)

Col (2) is from Exhibit 4, Col (5).
Col (3) assumes policies written on the first day of each month.
Col (4) = Col (2) x Col (3)
Col (5) = Col (4) / Total Col (4)
Col (6) = Col (5) summed by policy year.
Col (7) = Col (6) x Total Col (7)

* From Table 1.