UNEARNED PREMIUM RESERVES -- CHANGE IS IN THE WIND

by

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Biography

Roger is a Fellow of the Casualty Actuarial Society, a Member of the American Academy of Actuaries, and Consulting Actuary in the Pasadena, California office of Milliman & Robertson, Inc. with over twenty-one years of casualty actuarial consulting experience. Roger is a frequent speaker on reserve and Dynamic Financial Analysis-related topics and has authored several papers dealing with considerations and estimates of uncertainty in reserve projections. Roger is currently the chair of the CAS Research Policy and Management Committee and has served as chair of both the CAS Committee on Theory of Risk and the CAS/AAA Joint Committee on the Casualty Loss Reserve Seminar.

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Abstract

In the past few years, the National Association of Insurance Commissioners (NAIC) has changed the required practices and procedures used to calculate unearned premium reserves. For the first time, the instructions to the 1998 statutory annual statements carried the requirement that the statement of actuarial opinion on loss reserves also cover certain unearned premium reserves in some situations.

This paper looks at the new requirements as they pertain to long term contracts (using the NAIC's definition). The calculations can be somewhat complex and attempt to simultaneously accomplish goals that sometimes conflict. We carry through with examples showing the calculations for three different contracts with different characteristics but which should be somewhat representative of the types of contracts most likely to be encountered in practice.

UNEARNED PREMIUM RESERVES -- CHANGE IS IN THE WIND

1. Introduction

> *Unearned premium reserves are substantial liabilities on the financial statements of property-liability insurance companies. However, they represent one liability that should be easily determined in amount, without subjectivity and based on the system and method the company elects to use.*[1]

Oh, how simple life once was. In that 1994 chapter on unearned premium reserves (UEPR) we do not find any reference to extended reporting coverage options or of contracts with terms longer than thirteen months and only passing reference to warranty insurance. Most of the discussion in that chapter considers pro-rata earning of premium over the life of a policy. In less than two pages, the author discusses other methods for ocean marine, surety, and the "reverse rule of 78's" for automobile service contracts.

A reading of Chapter 12 of the 1997 version of the *Accounting Practices and Procedures Manual For Property/Casualty Insurance Companies* (which we will call the *Accounting Manual)* of the National Association of Insurance Commissioners (NAIC) paints a far different picture. Although that section starts out with the usual "pro-rata" approach, it quickly mentions other situations and particular coverages that require different treatment. Specifically identified are:

1.   Claims made extended reporting coverage options related to death, disability and retirement,

2.   Warranty insurance, and

3. Single or fixed premium policies with coverage periods in excess of thirteen months.[2]

In each of these three situations, the NAIC's instructions move away from the mechanical "pro-rata" approach and inject substantial judgment, subjectivity, and analysis into estimating unearned premium reserves. The new instructions are quite different from Mr. Morgan's unearned premium reserves that are "easily determined in amount, without subjectivity and based on the system and method the company elects to use."

In addition, the instructions for year-end 1998 statutory annual statements have expanded the scope of the statement of actuarial opinion to include the unearned premium reserve, at least in some instances.

The second and third types of coverage listed above, warranty insurance and long-term policies, can be somewhat related and are generally different than extended reporting options for death, disability and retirement. In this paper, we will focus only on the prescribed procedures and some implications of these new rules on carriers who write warranty or other qualifying long-term coverages. The considerations involved in analyzing liabilities for extended reporting options are sufficiently different, and potentially involved, to warrant a paper on their own.

2. Service Contract Background

Since the focus of this paper will be on warranties and similar products, possibly a brief description of the contract is in order. Although there are a variety of different contracts and approaches, most service contracts or extended warranties follow the same general

pattern. For (usually) a single premium, one party (the obligor) takes on the obligation to provide a specified service to a contract-holder if a covered part fails for specified reasons. The coverage could be on a new item (refrigerator, television, car or house) or a used one, and the contract could be of limited term (three or six months) or much longer (ten years or more for some new home warranties).

Product warranties are usually outside the scope of state insurance regulation. State laws often allow manufacturers or sellers of products to warrant that if a product fails for particular reasons during a particular term, the seller or manufacturer will repair or replace the product. The cost for such a warranty may be included in the cost of the product itself, or the seller (or manufacturer) may offer extensions for a fee. These extensions, or other promises to provide service, go under several names; extended warranties, service contracts, mechanical breakdown coverage to name a few.

Often, the obligor may want to limit the risk assumed under the contract, or is required to limit such risk by law. In such situations, the obligor may purchase a contractual liability insurance policy, sometimes referred to as a service contract reimbursement policy, from an insurer and pays the insurer based on the types and terms of contracts covered.

Sometimes the insurer takes on the role of direct obligor without another party in the middle. Some states only allow such direct policies between the contract holders receiving the service and the insurer. This direct coverage is sometimes called mechanical breakdown insurance, to distinguish it from service contracts or service contract reimbursement insurance.

The multiple-layered structure in most states can be significant to an actuary having to opine on unearned premium reserves for such carriers. Since the only insurance

transaction is between the obligor and the insurer, what the ultimate contract-holder actually pays may not enter into the calculations at all. Rather, only the amounts actually remitted to the insurer as premium are at issue.

In addition to these three parties (the contract-holder, the obligor, and the insurer), many service contract programs have a fourth party, an administrator. The administrator may be responsible for most aspects of the program including sales, policy administration, relations with obligors, and claims settlement, and may transfer only the risk of loss to the insurer. The administrator may charge for these services by adding a fee to the obligor's costs. In effect, then, the obligor remits two payments, one to the administrator for the administrator's services, and the other an insurance premium to the insurer providing the reimbursement coverage. Only this latter amount is actually premium on the insurer's own books.

Complicating matters even further, many service contract programs have profit participation in some form. As with a number of different administrative structures, there are different contingent fee arrangements. Some are simple, while others are complex. Though specific structures are beyond the scope of this paper, they do affect the calculation of the unearned premium reserves for these contracts.

As if these features are not enough, service contracts and many long-term contracts will not have losses and expenses emerge uniformly during the life of the contracts. Service contracts on new items, whether they are automobiles, refrigerators, computers, or houses, are usually secondary to the manufacturer's own warranty. Although there may be items not covered under the manufacturer's warranty that are covered under service contracts (such as trip interruption for automobiles), we would expect very little in terms of losses in the early stages of such contracts, with increasing losses later.   Many

vehicle service contracts also have limitations on mileage. Such limitations will tend to limit losses late in the contract term.

Service contracts on used products, especially used cars with mileage limitations, often exhibit the opposite pattern. Here, more losses tend to occur early in the contract term with mileage limitations reducing losses later in the term.

3. The NAIC Rules As They Stand

It is interesting that the NAIC's *Accounting Manual* has two separate sections appearing to deal with warranties or service contracts. One deals with "warranty insurance … defined as insurance covering mechanical breakdown, service contract agreements or maintenance agreements." The other deals with

> "… all direct and assumed contracts or policies (contracts), excluding financial guaranty contracts, mortgage guaranty policies, and surety contracts that fulfill both of the following conditions:
>
> 1. The contract term is greater than or equal to 13 months,
>
> 2. The insurer can neither cancel the contract, nor increase the premium during the policy or contract term."[3]

It appears that multiple-year service contracts and mechanical breakdown coverages fall into both categories. As we will see, the requirements for long-term (in excess of thirteen months) contracts are more stringent than those for simple warranty contracts so treating multiple-year warranty contracts as long term will fulfill both requirements.

For warranty policies, the calculation is fairly simple: the UEPR "shall equal the gross premium (after proportional reinsurance) multiplied by the ratio of expected future losses and expenses from the unexpired term of the contract to the total expected losses and expenses under the contract."[4] It would appear from the instructions, then, that this is the only calculation necessary for contracts with terms less than thirteen months.

The calculation for qualifying longer term contracts is much more involved. Basically, the NAIC rules require the calculation of three amounts or "tests" for each policy year:

1. The best estimate of the amounts refundable to the contract-holders at the reporting date,

2. The gross premium multiplied by the ratio of (a) over (b), where:

    (a) equals the projected future gross losses and expenses to be incurred during the unexpired term of the contracts; and

    (b) equals the projected total gross loses and expenses under the contracts.

3. The present value of the projected future gross losses and expenses to be incurred during the unexpired term of the contracts as adjusted below, reduced by the present value of the future guaranteed gross premiums, if any.[5]

For each of the most recent three policy years, the UEPR must be at least as large as each of these three tests. The UEPR for older policy years in the aggregate must be at least as large as each of the following amounts: the total for all older policy years for

Test 1, the total for all older policy years for Test 2, and the total for all older policy years for Test 3.

It is interesting to note that terms such as "best estimate" and "projected" appear in the above definitions. This is in contrast to the general rule "to establish a pro rata portion" on the first page of the chapter of the *Accounting Manual For Property/Casualty Insurers.* The former implies estimation and judgment while the latter is a fixed mechanical calculation.

The NAIC recognized this and requires that "[t]he projected future losses and expenses are to be re-estimated for each reporting date, and the most recent estimate of these projected losses and expenses to be used in these Tests."[6] Thus, far from the mechanical nature of UEPR Morgan describes, the UEPR for long term coverages requires estimation and judgment. And, also in contrast to the pre-determined emergence of premium implied by the rigid pro-rata or "reverse rule of 78's," the current procedures require re-estimating the expected emergence patterns, so the amount of premiums to be earned in a particular future year could change from one valuation to the next.

 The third test talks of "present values." In this case the estimated future losses and expenses may be discounted from the date the losses or expenses are incurred, and <u>not</u> from the date of payment. The interest rate that is to be used in the calculation cannot exceed the smaller of the following two amounts:

     1.   current yield to maturity of five-year U.S. Treasury debt instruments or

2. the company's own future yield to maturity on statutory invested assets (from

Schedule D) minus an "actuarial provision for adverse deviations" of 1.5%.[7]

These calculations are in terms of gross premiums and losses. The insurer is to appropriately reflect reserve credit for reinsurance ceded in the annual statement. The projected losses and expenses can be reduced for anticipated salvage and subrogation but not for anticipated deductible recoveries unless such deductible recoveries are secured by a letter of credit.

4. Some Observations

The specified UEPR tests seem to take three different views of the purpose of the UEPR. The first test assures the UEPR can provide for return of premium in the event of cancellation of all contracts. This seems to follow liquidation accounting that flavors much of statutory accounting and recognizes the company's obligations in the event it stops business on the valuation date. Many service contracts provide for pro rata refund of premium on cancellation, thus this calculation often simply reflects pro rata earning of total premiums.

The second test seems to use the UEPR as an income flow device, since it releases portions of gross premium written into income over the life of a contract. All other things being equal, earning premiums using this method alone will result in uniform loss ratios over the life of a contract and provides the best match between income and expenses over the life of the contract. This is very close to the UEPR calculation for non-warranty one-year contracts with one significant exception. The second test eliminates the "growth penalty" inherent in the usual UEPR.

For most lines of insurance, one calculates the UEPR based as a percentage of total premiums written, the percentage being determined solely on the portion of the policy term still unexpired. Thus a policy written on the last day of the year will have virtually all its premium posted in the UEPR, and yet the insurer still must pay its expenses in writing the business. Thus, if an insurer is growing, usual statutory accounting rules put a drain on statutory surplus in the amount of expenses to acquire the policy.

The second calculation for long-term contracts avoids this "growth penalty." We noted above that the second test multiplies the percentage of losses and expenses to be incurred in the unexpired term of the contracts by the premium written. Thus, if 10% of the total losses and expenses are incurred in writing the business, the second calculation will give 90% of the written premium for contracts written on the last day of the year as one UEPR calculation. If the contract is priced to a combined loss and expense ratio of no more than 100%, then there will be no "growth penalty" in this test.

Also of note is the requirement that estimates upon which the second and third test are based use the most recent experience available. Compare this with the UEPR for "normal" policies. For most contracts, an insurer can precisely calculate the amount of premiums it will earn until contract expiration. An insurer has no such guarantee for long-term contracts. Since the evaluation of ultimate losses and expenses could potentially change every year, the rate at which premiums flow into income can also change over the life of a contract.

The third test, at least to our understanding, does not appear to have a counterpart in the UEPR for other casualty coverages. To our knowledge it is the only provision in statutory accounting that may require an insurer to have more in the UEPR than the total premium written for the policy. The third test effectively ignores the premium written (the

focus of the first two tests) and calculates the expected net outflows from the contract (future losses and expenses less guaranteed future premiums). As we will see later, if a contract is significantly underpriced, this calculation could exceed the total written premium.

It is not too difficult to see that the "crossover" (when Test 3 is larger than Test 2) with a 0% interest rate would be a combined ratio greater than 1. What may not be as clear is that, in this situation, Test 3 will always dominate the second, since they both "earn" the various amounts at the same rate (as losses and expenses emerge) and the third test starts at a higher level.

The specifics for the third test are very clear that the discounting is from the valuation date to the date the claim is <u>incurred</u> and <u>not</u> to the date the claim is paid. The rule specifically excludes discounting of loss or expense reserves for incurred claims, whether reported or not. In addition, the test only allows discounting to the extent that there are invested assets available to support the liability. If not, the rules specify a reduction in the amount of discount allowable in the calculation.[8]

The three specified tests are applied to gross premiums. Reductions for amounts ceded are taken afterwards. As we noted above, the estimated losses and expense can be reduced for salvage and subrogation recoveries, but <u>not</u> for anticipated deductible recoveries unless the deductibles are secured by letters of credit or similar securities. This latter restriction could be quite onerous and difficult to measure for warranty insurers in many instances.

Most automobile service contracts carry some level of deductible. Many programs offer various deductible options with few having $0 or "disappearing" deductibles. This latter

option may waive the deductible if the vehicle is returned to the automobile dealer selling the service contract. It is possible that the provision disallowing the deductible is targeted primarily at larger programs with high deductibles and/or self-insured retentions. Since a service contract reimbursement policy covers the guarantor and not the original purchaser of a service contract, the "retail" level deductibles may not be an issue for an insurer. A technical reading of the procedures, though, may make deductibles an issue for insurers who sell service contracts directly to the public.

As alluded to in the prior paragraph, there are many different types of service contract programs, particularly in the automobile area. As with most commercial lines, the variations look to increasing the insured's loss consciousness, and thus giving incentive for loss control. Often, the arrangements are set up as contingent commission or profit sharing agreements with the attempt to mimic the insurer's cash flows.

A portion of the obligor's premiums (often referred to as "reserves") is put into a "trust" account. The trust account is then credited for interest (usually at a pre-determined rate) and loss payments are made from the account. When all policies have expired, the obligor takes a portion (or all) of what is left over. Sometimes the trusts are set up on an on-going basis with the insurer only being called upon to pay losses if all trust funds have been exhausted.

The actuary should understand the structure and extent of any contingent commission program. Although such issues would not enter unearned premium reserves for most one-year policies, it does enter into the calculations for specified long-term contracts. The reason for this is that the second and third tests require the estimate of losses and expenses to be incurred after the valuation date. The procedures specify that "expenses" shall include all incurred and anticipated expenses related to the issuance

and maintenance of the policy, including loss adjustment expenses, policy issuance and maintenance expenses, commissions, and premium taxes. Thus, when expenses (and commissions) are incurred enters into Tests 2 and 3.

This brings up an interesting question: how does one treat the incurring of contingent commissions for a trust agreement as described above? Some of these agreements allow the obligor to receive interim payments if experience appears to be "good." Well designed plans will have rather conservative interim payments relative to the expected experience. Often, commission payments are made based on a comparison of losses to "earned reserves" where the earning pattern used is intentionally slowed (or thought to be slowed). Obviously, this adds substantial complication to estimating the amount and timing of future expenses and hence the analysis involved in setting the UEPR.

It is also interesting to note that the procedures allow expected salvage and subrogation to offset estimated future losses and expenses. However they require that "[p]rojected salvage and subrogation recoveries (net of associated expenses) shall be established based on company experience, if credible; otherwise based on industry experience."[9] We know of no statistical agency that maintains an industry database on warranty or extended service contract data. Since these coverages are not separately reported in statutory annual statements, there does not appear to be publicly-available sources for this "industry experience."

5. Some Examples

For illustration we will consider three different contracts, the first a five-year limited mileage contract on a new car, second a two-year limited mileage contract on a used car, and the third a six-year service contract on a new product limited only by time. This

latter contract could be for a refrigerator, a personal watercraft, computer, or other product. In each case we consider exposure over a policy year, assuming uniform writing of policies through the year. That is why there are losses and expenses incurred in the following table that extend beyond the apparent expiration date of the contracts. We also caution that these amounts are only for illustrative purposes. Although they may approximate the emergence of losses and expenses in some contracts any resemblance to actual contracts is coincidental.

Table 1
ASSUMED POLICY YEAR LOSSES
AND EXPENSES

	Contract 1	Contract 2	Contract 3
Policy Issue	15.0%	15.0%	15.0%
First Year	$ 0.77	$ 26.64	$ 0.23
Second Year	7.88	42.45	2.44
Third Year	20.22	10.91	7.48
Fourth Year	24.57		14.10
Fifth Year	19.16		19.46
Sixth Year	7.41		23.44
Seventh Year			12.86

The total losses and expenses incurred after policy issue are $80.00 for each of the three sample contracts and in each case we assume that expenses incurred when the policy is written total 15% of written premium. Thus if we charge $100.00 for each policy we will have an expected underwriting profit of $5.00 or 5%. Tables 2, 3, and 4 give the unearned premiums if these were the only policies written, and assuming the NAIC procedures. We have arbitrarily assumed an interest rate of 5.0% for use in Test 3.

Table 2
CONTRACT 1, $100.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 100.00	$ 84.21	$ 67.73	$ 100.00
1	90.00	83.40	70.33	90.00
2	70.00	75.11	65.77	75.11
3	50.00	53.83	48.34	53.83
4	30.00	27.97	25.59	30.00
5	10.00	7.80	7.23	10.00

Table 3
CONTRACT 2, $100.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 100.00	$ 84.21	$ 75.11	$ 100.00
1	75.00	56.17	51.57	75.00
2	25.00	11.48	10.64	25.00

Table 4
CONTRACT 3, $100.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 100.00	$ 84.21	$ 63.90	$ 100.00
1	91.67	83.97	66.86	91.67
2	75.00	81.40	67.71	81.40
3	58.33	73.52	63.43	73.52
4	41.67	58.68	52.15	58.68
5	25.00	38.20	34.82	38.20
6	8.33	13.53	12.55	13.53

The results in the above tables should not be surprising. Since losses and expenses for the two-year contract 2 are "front loaded," the pro-rata emergence in Test 1 is more conservative than the other two, and hence Test 1 dominates for this contract. Converesly, losses for contract 3 are "back loaded," occurring mainly at later ages. Thus we would expect Test 2 to be dominant. Finally, with contract 1, there is a decrease in losses in the fifth and sixth year (due primarily to mileage limitations). Hence, though

Test 2 dominates in the middle years, Test 1 regains strength in the tail. Since we assumed an underwriting profit, we would not expect Test 3 to enter any of the calculations, and it did not.

Of course, Test 3 may prevail if there is an underwriting loss. Tables 5, 6, and 7 keep the same assumptions but assume that the premium is $85.00 rather than $100.00 as in the above tables. In this case, the insurer will experience a modest underwriting loss with a combined ratio of 109.1% (15% of the $85.00 premium gives $12.75 in expenses incurred at policy issue, plus $80.00 in losses and expenses after that point for a total loss and expense of $92.75 against $85.00 premium).

Table 5
CONTRACT 1, $85.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ **85.00**	$ 73.32	$ 67.73	$ 85.00
1	**76.50**	72.61	70.33	76.50
2	59.50	65.39	**65.77**	65.77
3	42.50	46.86	**48.34**	48.34
4	25.50	24.35	**25.59**	25.59
5	**8.50**	6.79	7.23	8.50

Table 6
CONTRACT 2, $85.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ **85.00**	$ 73.32	$ 75.11	$ 85.00
1	**63.75**	48.90	51.57	63.75
2	**21.25**	9.99	10.64	21.25

Table 7
CONTRACT 3, $85.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ **85.00**	$ 73.32	$ 63.90	$ 85.00
1	**77.92**	73.10	66.86	77.92
2	63.75	**70.87**	67.71	70.87
3	49.58	**64.01**	63.43	64.01
4	35.42	51.09	**52.15**	52.15
5	21.25	33.26	**34.82**	34.82
6	7.08	11.78	**12.55**	12.55

Here, we see that even with a modest underwriting loss, Test 3 comes into play in the later years of contract 3 and in the middle years of contract 1. The conservatism of Test 1 relative to the "front loaded" contract 2 leaves the result for contract 2 unchanged.

Now let us consider a fairly large underwriting loss, though still well within the realm of possibility. Here we will assume that the insurer only charged $60.00 in premium. This results in a combined ratio of 148.3%. Tables 8, 9, and 10 show the calculated UEPR in this situation.

Table 8
CONTRACT 1, $60.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 60.00	$ 53.93	$ **67.73**	$ 67.73
1	54.00	53.42	**70.33**	70.33
2	42.00	48.11	**65.77**	65.77
3	30.00	34.47	**48.34**	48.34
4	18.00	17.91	**25.59**	25.59
5	6.00	5.00	**7.23**	7.23

Table 9
CONTRACT 2, $60.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 60.00	$ 53.93	**$ 75.11**	$ 75.11
1	45.00	35.97	**51.57**	51.57
2	**15.00**	7.35	10.64	15.00

Table 10
CONTRACT 3, $60.00 RATE

Year	Test 1	Test 2	Test 3	UEPR
0	$ 60.00	$ 53.93	**$ 63.90**	$ 63.90
1	55.00	53.78	**66.86**	66.86
2	45.00	52.13	**67.71**	67.71
3	35.00	47.09	**63.43**	63.43
4	25.00	37.58	**52.15**	52.15
5	15.00	24.47	**34.82**	34.82
6	5.00	8.67	**12.55**	12.55

Not surprisingly, the UEPR equals the results of Test 3 in all but the second year of contract 2. Also of note in the above is that the required UEPR exceeds the total written premium in some cases -- through the first two years of contracts 1 and 3 and when contract 2 is first written. It is also interesting that the UEPR for contract 3 actually increases through the end of the second year, in effect giving earned premiums that are negative. Such a situation would produce a severe the "growth penalty."

Tables 11 through 13 show the earned premiums (defined as total written minus the UEPR), both cumulative (through the end of the given year) and incremental (earned during the given year). In the case of a $60.00 rate, we see several negatives, both on a cumulative and an incremental basis.

Table 11
CONTRACT 1 EARNED PREMIUM

			Rate			
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
0	$ -	$ -	$ -	$ -	$ (7.73)	$ (7.73)
1	10.00	10.00	8.50	8.50	(10.33)	(2.60)
2	24.89	14.89	19.23	10.73	(5.77)	4.56
3	46.17	21.28	36.66	17.43	11.66	17.43
4	70.00	23.83	59.41	22.75	34.41	22.75
5	90.00	20.00	76.50	17.09	52.77	18.35
6	100.00	10.00	85.00	8.50	60.00	7.23

Table 12
CONTRACT 2 EARNED PREMIUM

			Rate			
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
0	$ -	$ -	$ -	$ -	$ (15.11)	$ (15.11)
1	25.00	25.00	21.25	21.25	8.43	23.54
2	75.00	50.00	63.75	42.50	45.00	36.57
3	100.00	25.00	85.00	21.25	60.00	15.00

Table 13
CONTRACT 3 EARNED PREMIUM

			Rate			
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
0	$ -	$ -	$ -	$ -	$ (3.90)	$ (3.90)
1	8.33	8.33	7.08	7.08	(6.86)	(2.96)
2	18.60	10.26	14.13	7.05	(7.71)	(0.85)
3	26.48	7.88	20.99	6.86	(3.43)	4.28
4	41.32	14.84	32.85	11.86	7.85	11.28
5	61.80	20.48	50.18	17.33	25.18	17.33
6	86.47	24.67	72.45	22.28	47.45	22.28
7	100.00	13.53	85.00	12.55	60.00	12.55

As can be seen from these tables, the earned premiums that result from the requried calculations are not always smooth even if the underlying expected loss and expense emergence are. For example losses and expenses for contract 3 emerge smoothly over time, with ever-increasing amounts each year. However, the incremental earned premium at the $100.00 rate shows a decrease between the second and third years. This anomaly follows from the maximum choice feature of the NAIC's prescribed procedures.

Of course, if premiums do not match loss emergence, one could expect unstable loss ratios over the life of the contracts. Tables 14, 15, and 16 show the indicated cumulative and incremental loss ratios that result from these example contracts. In reviewing these tables, we should be aware that estimates of future losses and expenses in our examples do not change over time, nor from one assumed rate to another. The amount and timing of those losses and expenses are assumed to be completely known at policy issue.

Table 14
CONTRACT 1 COMBINED LOSS AND EXPENSE RATIOS

	Rate					
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
1	157.7%	157.7%	159.0%	159.0%	-94.6%	-94.6%
2	95.0%	52.9%	111.3%	73.4%	-305.7%	172.9%
3	95.0%	95.0%	113.5%	116.0%	324.8%	116.0%
4	97.8%	103.1%	111.4%	108.0%	181.4%	108.0%
5	97.3%	95.8%	111.6%	112.1%	154.6%	104.4%
6	95.0%	74.1%	109.1%	87.2%	148.3%	102.5%

Table 15
CONTRACT 2 COMBINED LOSS AND EXPENSE RATIOS

	Rate					
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
1	166.6%	166.6%	185.4%	185.4%	422.6%	422.6%
2	112.1%	84.9%	128.4%	99.9%	173.5%	116.1%
3	95.0%	43.6%	109.1%	51.3%	148.3%	72.7%

Table 16
CONTRACT 3 COMBINED LOSS AND EXPENSE RATIOS

	Rate					
	$100.00		$85.00		$60.00	
	Cumul-	Incre-	Cumul-	Incre-	Cumul-	Incre-
Year	ative	mental	ative	mental	ative	mental
1	182.8%	182.8%	183.3%	183.3%	-134.5%	-134.5%
2	95.0%	23.7%	109.1%	34.6%	-151.4%	-287.7%
3	95.0%	95.0%	109.1%	109.1%	-559.0%	174.7%
4	95.0%	95.0%	112.6%	118.9%	423.6%	125.0%
5	95.0%	95.0%	112.5%	112.3%	209.3%	112.3%
6	95.0%	95.0%	110.3%	105.2%	160.5%	105.2%
7	95.0%	95.0%	109.1%	102.5%	148.3%	102.5%

With a few exceptions, the above tables show fairly volatile loss ratios over the life of each of the contracts. We can readily conclude that the use of the NAIC's prescribed formula in monitoring calendar year (or even inception-to-date experience) can lead to significantly misleading conclusions. Some of the situations will generally be unavoidable.

In particular, service contracts that include mileage limitations and are written on used cars will generally show an improving loss ratio over the contract term if the NAIC formula is used to calculate earned premiums. These contracts typically incur relatively more losses earlier in the policy term than would be indicated by time alone. Therefore,

it is likely that Test 1 (usually pro rata earning) will dominate the UEPR calculation slowing the recognition of income relative to losses. Thus we would expect higher loss ratios for more immature policies with the loss ratios declining as the contracts mature.

Contract 3 at the $100 rate shows a rather stable pattern for both cumulative and incremental loss ratios after the first year. This too should not be surprising. The UEPR for contract 3 is the result of Test 2 for all but the first year. Thus, after that year, premiums match the emergence of losses and expenses. However, even with the mild inadequacy in the $85.00 rate, the presence of Test 3 in some years changes the picture and introduces volatility into both the cumulative (inception-to-date) and incremental (calendar year) loss and expense ratios.

All of these examples assume that the estimates of loss and expense emergence over the life of the contract are unchanged over the contract's life. The earning patterns from the formula could significantly change if these estimates change.   Such changes introduce increased volatility into loss ratios based on premiums earned derived from the NAIC formula.

6.   Deriving The Estimates

The distinction that the NAIC procedures make between the time claims are incurred and the time they are paid implies that the actuary analyzing experience on these long term contracts will need to consider loss emergence separately from loss payment. Hayne[10] deals with this issue and provides methods to derive such estimates.

The primary approach discussed in Hayne's paper begins with current payment data sorted first by policy period and then by occurrence period within each policy period.

The result appears to be the "usual" triangle of incremental payments by policy year, but with one significant difference. The "diagonals" represent claims occurring in a particular period not the amounts paid in that period. Thus the most recent diagonal is the least mature (relating to accidents occurring in the most recent period), the second-to-last diagonal is one age more mature, and so forth. Using aggregate development by accident period, similar to that used in analyzing losses in a "usual" reserve analysis, one could develop diagonals to their estimated ultimate value. The result, then, will be a triangle of estimated ultimate losses by policy year, aged as the losses emerge.

Once the actuary has this triangle of cumulative losses incurred through the valuation date he or she can use a variety of actuarial forecasting methods to estimate the ultimate losses yet to emerge during the unexpired portion of the various policy periods. Based on these forecasts, he or she can then derive estimates of the timing of those losses. Sometimes the actuary will need to augment the emergence patterns based on historical data, due, possibly to either a lack of experience on mature contracts or to some change in the underlying exposure that would make early history a poor indicator of expected future experience. Since the author knows of no source of industry aggregate experience for these contracts, the actuary may need to model that future emergence based on reasonable assumptions regarding the underlying risk.

As with any reserve analysis, however, there are events that can affect expected loss emergence. When analyzing experience on contracts covering new products, changes in the manufacturer's warranty could have an impact as can substantial changes in product quality over time. Another factor that can affect emergence is the opportunity in some programs to purchase service contract coverage after the purchase of the covered item. Here, there may be an increased risk of adverse selection against the insurer.

After all, someone who is already experiencing problems with a product under the manufacturer's warranty may be more willing to purchase a service contract to cover repairs after the warranty expires.

This opportunity to purchase after the "point of sale" is sometimes referred to as "extended eligibility." Obviously, it is the most common type of sale made in direct mail type programs. In many cases, particularly for automobiles, the extended eligibility contracts are written so that the time and mileage limits in the policy act as if the policy was written when the vehicle was initially put into service (the "in-service date"). For example, a 6 years/100,000 miles contract purchased on a two-year old car with 24,000 miles will provide the buyer with four years or 76,000 miles of coverage (whichever comes first).

There are also programs where extended eligibility contracts continue for the number of years after the date of contract purchase, but will expire if the odometer miles exceed the limit in the contract. In our example above, the contract would provide coverage for six years but would expire if the odometer mileage reached 100,000 (76,000 miles from time of contract purchase). Others may have both the time and mileage run from time of contract purchase.

The existence of extended eligibility contracts can substantially affect the analysis of service contract experience. If the insurer follows a strict interpretation of policy period, then the contract in the above example written in 1998 would be treated as a 1998 policy. However, it would experience future losses (if it is the first type of contract) as if it were written in 1996. Faced with this situation, many service contract writers will record this as a 1996 policy. This allows analysis of experience and estimation of loss emergence to be done on a more consistent basis. However, the presence of such

contracts, as well as the possibility of cancellations of existing contracts, means that both premiums and contract counts for a policy year can develop, both upwards and downwards, during the term of the contracts under review.

A more difficult situation arises when extended eligibility contracts begin at the time of contract issue. Here, treating the 1998 contract on a two-year-old vehicle as a 1996 contract would then move the "tail" of the distribution further out. Rather than being able to assume that all contracts will expire by the end of their stated term (six years in our example), there is the potential of some continuing past this date. Allocating such contracts to the year in which they are written will overcome this problem, but introduces inconsistencies in loss emergence that are exacerbated when there is a change in the proportion of such contracts in an entire book. Needless to say, the actuary should recognize the presence of such contracts and take steps to assure that their effects are appropriately reflected in the analysis.

These discussions have focused on losses. The actuary should not lose sight of the requirement that tests 2 and 3 consider the emergence of losses _and expenses_. Certain costs, such as some acquisition expense, are incurred when the policy is written. Other expenses, such as loss adjustment expenses, probably emerge over the policy terms at the same rate as losses emerge. Still others, such as contingent commissions, may have yet different emergence patterns.

7.   Conclusions and Beginnings?

Hopefully, from the above, the reader has a flavor of the extent of change the new procedures bring to the calculation of the UEPR and in requirements for the statement of actuarial opinion. Some of the changes are obvious and some are less so. To some

extent an insurer can take credit for prepaid expenses in the UEPR for the first time under the new rules.   Also, for the first time there is the requirement to consider expected future losses and expenses in calculating the UEPR.   Finally, the procedures move away from a strictly formula approach to calculating the UEPR and introduce judgment.

Now that the NAIC requires actuaries to opine on the UEPR for long-term contracts, will that requirement be extended to the remaining UEPR?   If so, what does it mean that the UEPR makes "reasonable provision" for a company's liabilities?   The actuary could fairly easily opine, after review, that the UEPR conforms to the calculations specified in the manual.   Does this necessarily make them reasonable?   For example, suppose the insurer significantly underprices its general liability business.   If it calculates the UEPR as set out in the rules, the UEPR would alone be insufficient to support the claims yet to emerge under the contracts.   Is this calculation, conforming to the rules, reasonable? Should the UEPR be increased to reflect the pricing shortfall?   Should the insurer post a separate premium deficiency reserve (as we understand is required in generally accepted accounting principles, GAAP)?   If so, where in statutory accounting would such a reserve be established?   The author is unaware of any provision in statutory accounting that allows, much less requires, such an additional reserve.

We do not claim to have the answers to these questions, but actuaries will likely face them in the future.

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[1] Morgan, James L., *Property-Casualty Insurance Accounting*, Insurance Accounting and Systems Association, Inc., Sixth Edition, July 1994, p. 5-16.

[2] National Association of Insurance Commissioners, *Accounting Practices and Procedures Manual For Property/Casualty Insurance Companies*, Chapter 12, "Unearned Premiums."

[3] NAIC, *Accounting Practices and Procedures Manual For Property/Casualty Insurance Companies*, 12/97 revision, p. 12-4.

[4] NAIC, Ibid, p. 12-3.

[5] NAIC, Ibid, p. 12-4.

[6] NAIC, Ibid., p. 12-5.

[7] See, NAIC, Ibid., p. 12-4

[8] NAIC, Ibid., pp. 12-4 & 12-5

[9] NAIC, Ibid. p. 12-4.

[10] Hayne, R.M., "Extended Service Contracts," *Proceedings of the Casualty Actuarial Society*, v. LXXXI, 1994, pp. 243-302.