TITLE: BANK ACCOUNTS AS A TOOL FOR RETROSPECTIVE ANALYSIS OF EXPERIENCE ON LONG-TAIL COVERAGES

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ABSTRACT: This paper presents a model for the retrospective analysis of experience on long-tail coverages. The model chosen is a "bank account" model which considers separately the profitability of each exposure period. The model treats premium income and interest earnings as bank account deposits, and loss payments, expense payments and interest charges as withdrawals.

The exposure period results are calculated on three different bases: traditional underwriting profit/loss, net operating result at current value, and net operating result at exposure period value. Results are also displayed graphically for an effective presentation of the profitability/unprofitability of the exposure period.

A model of this type is a valuable tool for communicating financial results to management and others in an effective and straightforward manner. It is particularly helpful in the evaluation of long-tail lines of business.

BANK ACCOUNTS AS A TOOL FOR RETROSPECTIVE ANALYSIS OF EXPERIENCE ON LONG-TAIL COVERAGES

As interest rates have risen and claim settlement patterns have lengthened, actuaries have increasingly been called upon to take the time value of money into account when evaluating profitability. When analyzing historic results, this sometimes requires assumed rates of return and payment patterns, because actual historic data is not readily available. Where the data is available, however, it is possible to produce an analysis which can be communicated to management and other interested parties in an effective and straightforward manner.

The model chosen is a "bank account". It considers each exposure period as a separate bank account. The account receives an initial deposit (premiums collected less expenses) which is reduced by withdrawals (loss and loss expense payments), increased by interest earned and reduced by interest charges when the balance goes negative.

The model will seem straightforward, even simple, to anyone who has mastered compound interest. It is presented here only because of its utility in communicating results, particularly to important but less experienced audiences.

By looking at each exposure period separately, the model enables us to estimate profit or loss individually by exposure period. It provides a hindsight look at what an appropriate rate level would have been in each exposure period. The bank account model is particularly helpful

in evaluating long tail lines. The attached exhibits show the application of the model to the medical malpractice line of business.

In long tail lines such as medical malpractice, investment income is a crucial variable in the ultimate profitability or unprofitability of the insurance enterprise. Care should be taken in the selection of interest rates for the bank account model. The over or understatement of investment income can obviously have a distortive effect on the exposure period results. In the example which is attached, we have used actual portfolio average rates of return for those calendar years in which this information was available to us (1974 through 1983) and one-year Treasury Bill rates as a reasonable approximation of available rates of return for the earlier years (1959 through 1973).

Although real world considerations introduce complexities to this simple illustration, the basic concepts are still applicable. Expenses include unallocated loss adjustment expenses in addition to taxes, underwriting and acquisition expenses, if any. No Federal income tax implications have been considered. However, consideration has been given to the interest charge which is made when the exposure period or report period account balance turns negative. This charge represents interest income lost because the particular exposure period account is overdrawn and "borrowing from the bank." In the case of a multi-line/state company, the bank represents one of three sources of funds: surplus, profits from other states or lines of business, or future policy years (i.e., other "bank accounts"). For a one-line, one-state company, there are only two sources of funds: surplus and future

income. Obviously, the borrowing of funds from the future to pay the losses of the past implies both that those funds will not be available to pay future losses and that the expected interest return on those funds (which may be anticipated in the premium structure) will not be collected.

Beneath the account's annual transactions is shown a Summary of Results. This summary consolidates the transactions over time and also includes the unpaid loss liability for the account, both reported and estimated unreported.

In the Summary of Results table, results are shown on three different bases. The first is traditional underwriting profit/loss, which is simply the amount of funds available for losses, less loss and allocated loss adjustment expenses paid and remaining to be paid. This measure does not consider any investment income.

The second measure reflects imputed investment income received through the evaluation date (including the charge for borrowing if the balance is negative), as well as discount on unpaid losses and loss expenses at some assumed rate and payment pattern. This is shown as the net operating result at 12/31/83 value.

The third measure is the net operating result at the middle of the initial exposure period. If negative, it is the additional amount which, if it had been in the account at the time that premiums were collected, would have resulted in no net gain or loss after all claims

were paid. If the account is profitable, it represents the "profit at issue".

In order to clarify how the bank account analogy works, we can review Exhibit I, which shows the 1964 policy year account for Employers Insurance of Wausau physicians and surgeons professional liability business in New York. The initial deposit (premium paid) in 1964 was $4,325,000. This was reduced for expenses of $700,000, resulting in the initial balance of $3,625,000. It should be noted that, although this amount is shown as the balance at January 1, 1964, the interest calculation in the initial calendar year assumes that this amount is not available until July 1.

Withdrawals (loss and allocated expense payments) for calendar year 1964 were $31,000, while interest income on the average fund at the rate of 3.89% yielded $69,000. In subsequent years, withdrawals (loss and allocated expense payments) increase sharply, exceeding the interest income earned and reducing the account balance dramatically. In 1971 the withdrawal exceeds the account balance making the balance as of January 1, 1972 $-282,000. From this point on, the account is charged, rather than credited, with interest. In calendar years 1972-1983, loss and expense payments total $4,643,000 and imputed interest charged is $3,312,000, creating an account balance of $-8,237,000 on January 1, 1984.

The Summary of Results shows an underwriting loss of $6,836,000, which is $4,325,000 of premium income, less $700,000 of expense, $9,615,000 of paid loss and allocated expense, and $846,000 of unpaid loss and

allocated expense (of which $676,000 is reported and $171,000 is unreported). The net operating result valued at 12/31/83 is a loss of $8,862,000. This reflects discount, at the rate of 12%, on the unpaid loss and allocated loss expense, in the amount of $221,000. The net operating result at 1964 value is a loss of $2,851,000, which is to say that Employers needed $2,851,000 of additional funds at the time that premiums were being collected in 1964 in order to come out with a breakeven result when the last claim is paid.

The bank account information can also be shown in graphical format, as displayed on Exhibit II. The solid line shown as "Available Funds" represents premium income, reduced by expenses, then augmented by interest income. The dashed line represents paid losses and allocated loss adjustment expenses, while the dotted line shows reported losses and allocated expenses (paid plus case basis reserves). The available funds line stops at the point at which paid losses and allocated loss adjustment expenses exceed available funds. We have included a "dollars per doctor" scale on the right-hand side of the graph, as well as reported loss and allocated expense information (not included in the bank account on Exhibit I), to enhance the value of the graph as a communications tool.

Where a good series of historical data is available, it is possible to prepare separate accounts for each exposure period. Accident years or policy years can be used, with appropriate adjustments in the computation of interest earned in the initial year. If the experience has been consistently profitable or unprofitable, the cumulative communi-

cative impact of a series of graphs can be quite effective. It is also easy to produce exhibits which account for an entire period of years to illustrate the cumulative experience. Exhibit III shows the cumulative experience of fifteen and one-half years of medical malpractice writings and Exhibit IV shows the same experience graphically. In Exhibits III and IV, no interest was charged on the cumulative balance after it turned negative. (Interested readers can obtain the complete set of bank accounts and graphs which underlie these cumulative exhibits from the authors.)

There are a number of simplifications in the present model, as described earlier, which could be removed for a more in-depth analysis. Expenses could be spread over time rather than charged to the initial calendar year. Consideration could be given to Federal income taxes. Finally, there are numerous adjustments that could be made to the method of allocating investment income. Investment year methods, for example, could keep track of funds by year originally received, and could reflect the actual term structure and reinvestment results. In this regard, our life insurance colleagues have already investigated several methodologies for handling the complex accounting and allocation procedures. Consistency in the choice of either new money yields or embedded yields is obviously desirable.

The advantages of the bank account model for presenting exposure period experience are mainly in the area of better communication. It provides an effective way of looking at past underwriting results which is particularly helpful when explaining results to non-actuaries or the non-

financially sophisticated. We have found it particularly useful in the medical malpractice field, where specialty companies formed in the middle 1970's are cash rich but still need regular rate increases because of the long term trend in pure premiums on the order of 20% per annum. These rate increases must be decided upon by boards of directors composed primarily of medical professionals with little insurance or financial expertise. It has also been useful in dealing with arguments advanced by the plaintiff's bar, generally to the effect that investment income has been inadequately taken into account.

The bank account model is not without its disadvantages as well. Although it is a valuable tool in explaining financial results to the non-sophisticated, it should not be used in place of actuarial analysis. It can in fact be a dangerous weapon in the hands of someone unfamiliar with its limitations. Chief among its limitations is the fact that the bank account model can not be used to make rates prospectively, nor to set adequate reserves. It is, however, a very useful method for analyzing and communicating financial results by exposure period.

We have programmed the model in APL, but it could be easily undertaken in spreadsheet software as well. Contributions to the development of the model were also made by Jim Hurley, Dean Anderson, and Terry Biscoglia. The data used in the attached exhibits was provided by Employers Insurance of Wausau.

NEW YORK PHYSICIANS AND SURGEONS

EMPLOYERS INSURANCE OF WAUSAU

1964 POLICY YEAR

($000)

PREMIUM INCOME = $ 4325
LESS EXPENSES(A) = 700

AVAILABLE FOR LOSSES(B) = $ 3625

CALENDAR YEAR	BALANCE AT JAN. 1(C)	WITH-DRAWALS (PMTS)(B)	RATE OF RETURN(D)	INTEREST INCOME(E)
(1)	(2)	(3)	(4)	(5)
1964	$ 3625	$ 31	3.89 %	$ 69
1965	3663	61	4.23	157
1966	3759	211	5.34	200
1967	3748	568	4.94	175
1968	3355	671	5.78	180
1969	2863	916	7.28	182
1970	2130	1654	6.94	95
1971	571	860	4.90	7
1972	-282	1176	5.01	-44
1973	-1503	478	7.54	-136
1974	-2117	319	5.47	-128
1975	-2563	679	5.68	-169
1976	-3411	266	5.53	-201
1977	-3879	119	5.63	-228
1978	-4226	213	5.72	-255
1979	-4693	75	5.88	-286
1980	-5054	134	6.55	-346
1981	-5534	72	6.89	-397
1982	-6003	738	7.36	-485
1983	-7227	374	8.26	-637
1984	-8237			
TOTAL		$ 9615		$ -2247

SUMMARY OF RESULTS

FUNDS AVAILABLE FOR LOSSES		$ 3625
PAID LOSS AND ALLOCATED LAE		9615
UNPAID LOSS AND ALLOCATED LAE		846
REPORTED	$ 676	
UNREPORTED(F)	171	
UNPAID LOSS AND ALAE DISCOUNTED AT 12%		625
UNDERWRITING PROFIT/LOSS		-6836
INTEREST INCOME/LOSS		-2247
NET OPERATING RESULT AT 12/31/83 VALUE		-8862
NET OPERATING RESULT AT 1964 VALUE		-2851

Notes to Exhibit I, Sheet 1

(a) Expenses include administrative and unallocated loss adjustment expenses. Employers Insurance of Wausau figures have been extracted from figures they have provided to the New York Insurance Department (Exhibit IA).

(b) Includes allocated loss adjustment expense.

(c) In the initial year, the balance is only available for a half-year.

(d) Yields for calendar years 1959-1973 are based on one-year Treasury bill yield rates. Yields for subsequent years are the actual calendar year yields achieved by Employers Insurance of Wausau, as defined by net investment gain or loss (including realized capital gain or loss) divided by mean total assets.

(e) Assumes all transactions occur uniformly throughout the year.

(f) Provision for unreported losses is based on the projected ultimate pure premiums developed in Part I of the Medical Malpractice Insurance Association of New York June 1984 physicians and surgeons professional liability rate filing.

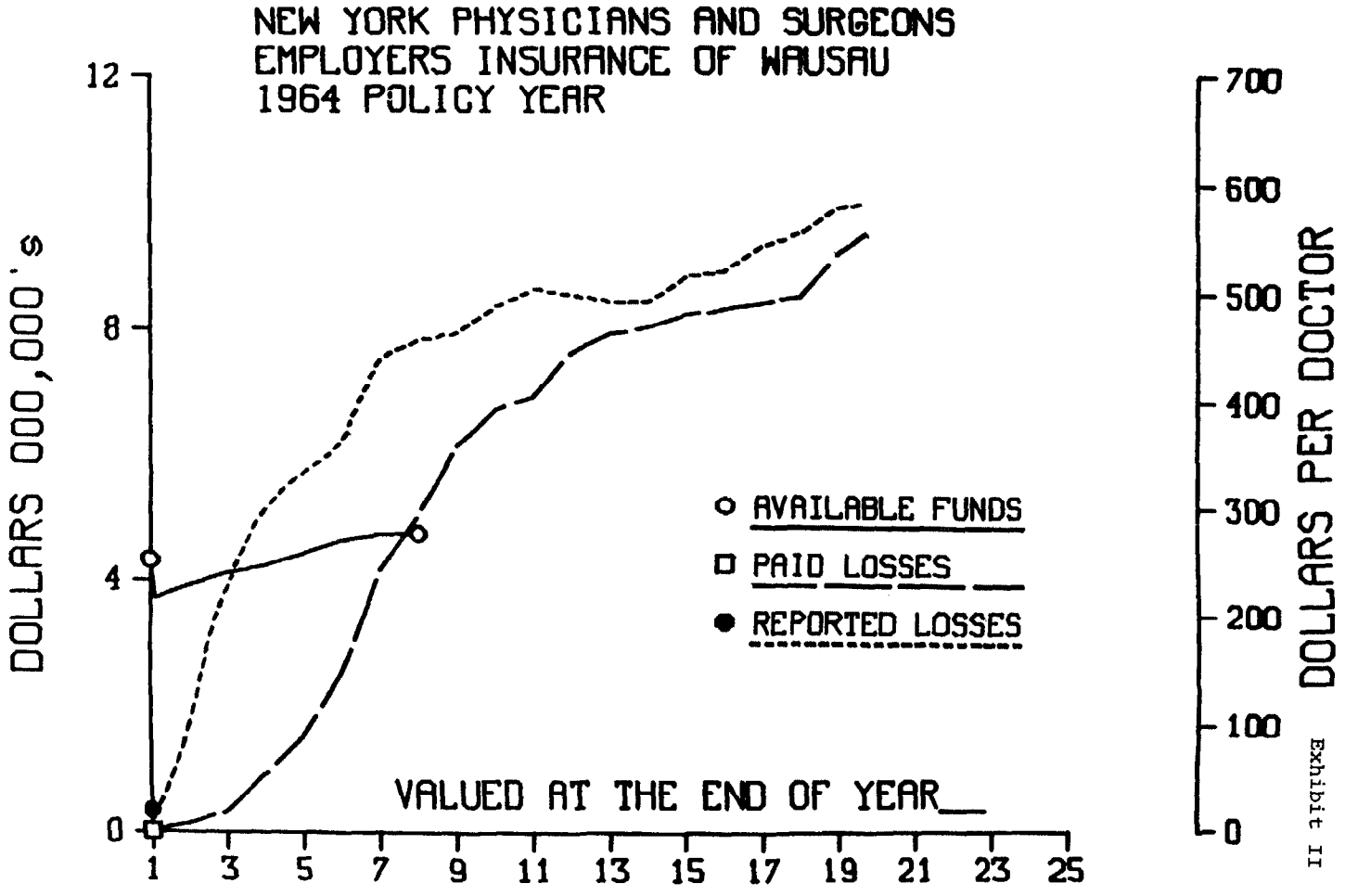
NEW YORK PHYSICIANS AND SURGEONS
EMPLOYERS INSURANCE OF WAUSAU
1964 POLICY YEAR
DOLLARS 000,000's
12
8
4
0
1
3
5
7
9
11
13
15
17
19
21
23
25
VALUED AT THE END OF YEAR
AVAILABLE FUNDS
PAID LOSSES
REPORTED LOSSES
700
600
500
400
300
200
100
0
DOLLARS PER DOCTOR

Exhibit II

NEW YORK PHYSICIANS AND SURGEONS

Employers Insurance of Wausau
Financial Results for Policy Years 1959 - 1974(a)
at 12/31/83
($000)

Calendar Year (1)	Premium Income (2)	Expenses(b) (3)	Loss and ALAE Paid(c) (4)	Insurance Cash Flow(d) (5)	Interest Yield(e) (6)	Interest Income(f) (7)	Funds at Year-End (8)
1959	$ 2,442	$ 544	$ 76	$ 1,822	4.71%	$ 42	$ 1,864
1960	2,895	642	183	2,070	3.55	104	4,038
1961	3,269	610	499	2,160	2.89	149	6,347
1962	3,790	655	633	2,502	3.10	238	9,087
1963	4,121	671	825	2,625	3.41	359	12,071
1964	4,325	700	1,491	2,134	3.89	519	14,724
1965	4,428	701	1,884	1,843	4.23	674	17,241
1966	5,004	769	3,385	850	5.34	966	19,057
1967	5,906	910	3,547	1,449	4.94	997	21,503
1968	8,948	1,359	4,306	3,283	5.78	1,370	26,156
1969	11,939	1,657	4,778	5,504	7.28	2,164	33,824
1970	18,964	2,297	8,204	8,463	6.94	2,707	44,994
1971	33,256	3,060	7,130	23,066	4.90	2,811	70,871
1972	38,760	3,989	13,410	21,361	5.01	4,160	96,392
1973	36,903	4,157	19,297	13,449	7.54	8,008	117,849
1974	18,594	3,524	25,108	(10,038)	5.47	6,536	114,347
1975	-	-	30,162	(30,162)	5.68	5,810	89,995
1976	-	-	25,990	(25,990)	5.53	4,385	68,390
1977	-	-	30,976	(30,976)	5.63	3,073	40,487
1978	-	-	42,904	(42,904)	5.72	1,137	(1,280)
1979	-	-	51,930	(51,930)	5.88	0	(53,210)
1980	-	-	48,044	(48,044)	6.55	0	(101,254)
1981	-	-	39,460	(39,460)	6.89	0	(140,714)
1982	-	-	37,372	(37,372)	7.36	0	(178,086)
1983	-	-	30,383	(30,383)	8.26	0	(208,469)

Loss and ALAE Case Reserve @ 12/31/83	$ 76,583
Loss and ALAE IBNR @ 12/31/83 (g)	109,894
Total Unpaid Loss and ALAE @ 12/31/83	$186,477
Unpaid Loss and ALAE Discounted at 12%	$101,997

Notes to Exhibit III, Sheet 1

(a) Based on Employers' experience for policy years 1959-1974. Policy year 1974 is a partial policy year, reflecting writings from 1/1/74 - 6/30/74.

(b) Expenses include administrative and unallocated loss adjustment expenses. Employers' figures have been extracted from figures they have provided to the New York Insurance Department (Exhibit 1a).

(c) Includes allocated loss adjustment expense.

(d) Insurance Cash Flow [Column (5) = Columns (2)-(3)-(4)].

(e) Yields for calendar years 1959-1973 are based on one-year Treasury bill yield rates. Yields for subsequent years are the actual calendar year yields achieved by Employers, as defined by net investment gain or loss (including realized capital gain or loss) divided by mean total assets.

(f) Assumes all transactions occur uniformly throughout the year.

(g) Provision for unreported losses is based on the projected ultimate pure premiums developed in Part I of the Medical Malpractice Insurance Association of New York June 1984 physicians and surgeons professional liability rate filing.

NEW YORK PHYSICIANS AND SURGEONS
EMPLOYERS INSURANCE OF WAUSAU
POLICY YEARS 1959-1974 COMBINED

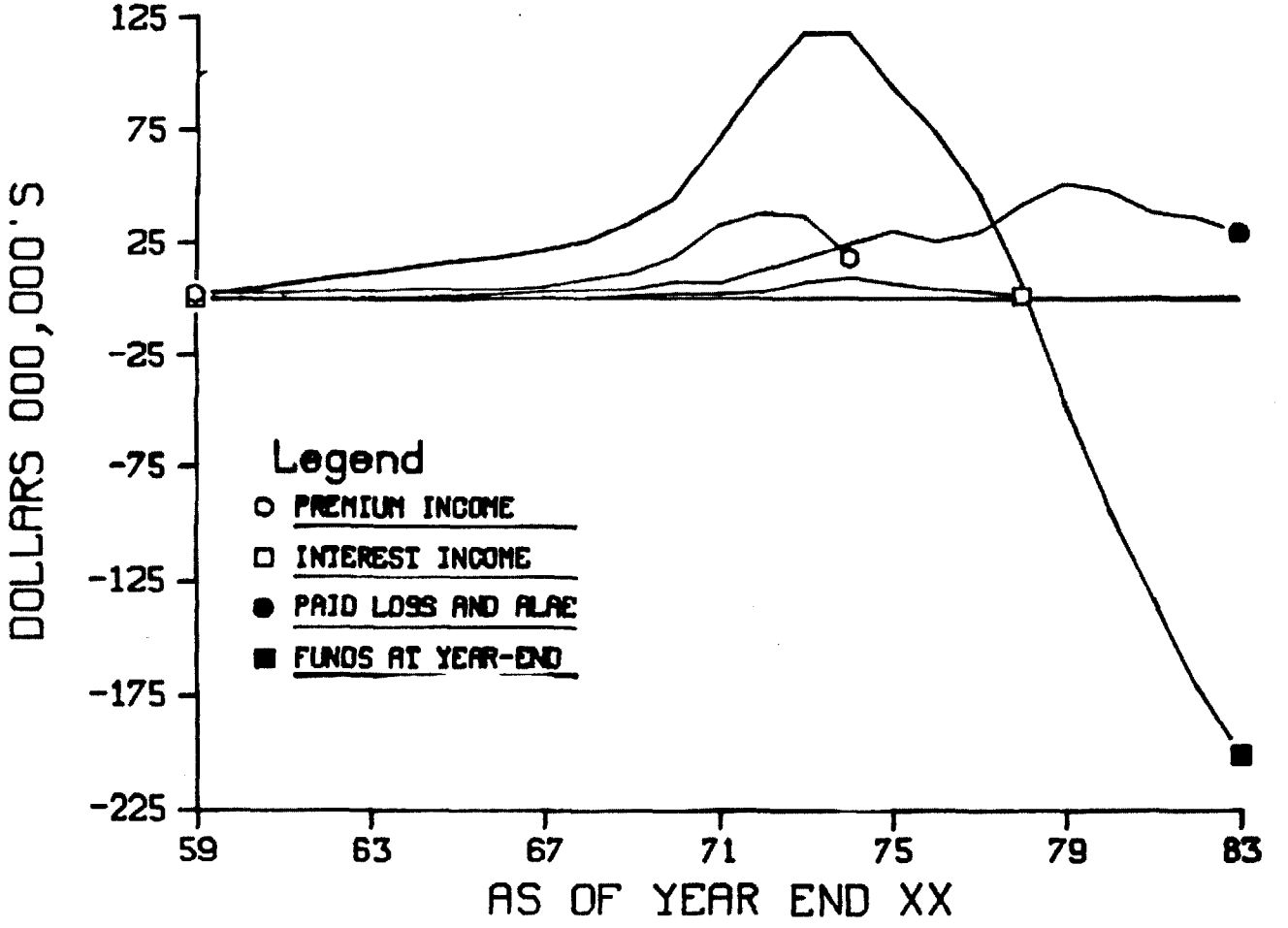

Exhibit IV