I

The Natural Reserve Concept and Life Insurance Earnings

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Abstract

There has been a long-standing need for statement of life insurance industry earnings in a form which is generally accepted by the investing public, insurance company management, investment analysts, independent certified public accountants, and actuaries. The use of a natural reserve concept to obtain such a generally accepted statement of earnings appears imminent.

It is the purpose of this paper to demonstrate some of the basic principles and concepts inherent in the use of natural reserves to adjust earnings and to demonstrate differences in earning patterns obtained by several alternative approaches to a pure natural reserve adjustment of earnings.

Some of the more important principles and concepts which underlie the author's understanding of certain generally accepted accounting principles and natural reserve calculations are stated and then demonstrated by the use of monetary projection techniques.

Demonstrations of principles and concepts are made by the use of relatively simple, and easily reproducible, monetary projections over a short period of time. These allow the reader to skip the details if he is interested only in the principles or concepts; to explore the detailed calculations underlying the demonstrations if he is so inclined; or to investigate various alternatives which are not presented in this paper.

I. Purpose, Method, and Introduction

The primary purpose of this paper is to demonstrate how a natural reserve approach may be utilized effectively to adjust life insurance earnings in a manner which appears likely to be accepted as consistent with generally accepted accounting principles. References to these accounting principles in this paper are based on the author's understanding, as an actuary, and not as a certified public accountant.

A second purpose of the paper is to demonstrate earnings patterns obtained by several possible alternative approaches to earnings adjustments—alternatives to the natural reserve method. The method of demonstration is that of monetary financial projections in a format similar to the Annual Statement Summary of Operations. A monetary projection approach was selected because of the ease and relative clarity with which it communicates concepts.

Use of natural reserves to adjust life insurance earnings seems to meet requirements of certain generally accepted accounting principles and incorporates many of the principles used in one of the actuarial profession's most important responsibilities: establishment of gross premiums. If experience follows that assumed by the actuary in setting premium structures, adjusted earnings based on natural reserves will be a constant percentage of the gross premium—a result consistent with one of the traditional methods of expressing profit margins in life insurance premiums.

Consideration is confined in this paper to nonparticipating individual life insurance; but the principles and concepts demonstrated are applicable to other product lines, such as individual health insurance, annuities, and participating insurance.

II. Principles and Concepts

Aggregate actual earnings in a particular year, computed in accordance with the natural reserve concept, arise from three sources: (1) basic earnings anticipated or inherent in the premium structure; (2) net investment income on capital funds and retained earnings from prior years; and (3) profits (or losses) attributable to variations in actual experience from that anticipated under natural reserve assumptions. In this paper the term "adjusted earnings," unless otherwise noted, refers to the "basic earnings anticipated or inherent in the premium structure."

Principles and concepts outlined below are used and demonstrated in natural reserve developments considered in subsequent sections of this paper.

1. *"The basic principle" (match benefit costs and expenses with revenue).*—Use of natural reserves (as defined in Sec. III) in lieu of statutory reserves in insurance financial statements results in a matching of benefit costs and expenses with revenue in conformity with generally accepted accounting principles.
2. *Recognition of revenue (revenue is equivalent to premium income).*—Under the natural reserve concept used in this paper, revenue, to which benefit costs and expenses are matched, is premium income; investment income is not considered a part of revenue for matching purposes.
3. *Recognition of expense and benefit costs.*—Expense and benefit costs are allocated in proportion to the rate at which premium revenue is recognized.
4. *Incidence of adjusted earnings (earnings related to premiums).*—If actual experience with respect to mortality, expenses, persistency, and investment follows that assumed in natural reserve calculations, adjusted life insurance earnings based on natural reserves emerge as a constant percentage of premium revenue; alternatively, adjusted earnings are equal to gross premiums less corresponding natural premiums.
5. *Period of adjusted earnings recognition (premium-paying period).*—Adjusted earnings are recognized over the premium-paying period only, rather than over the period for which insurance benefits are provided.
6. *Investment income on earnings.*—Investment income on prior years' earnings is not utilized in computing natural reserve premiums or natural reserves. In other words, natural reserve adjusted earnings are assumed to be disposed of as earned and do not influence subsequent natural reserve calculations through investment income on these accumulated earnings.

III. Definitions

Natural reserve concepts, and natural reserves themselves, may be best understood by first focusing attention on the definition and concept of a natural reserve premium. A natural reserve premium is a level percentage of the gross premium. It is exactly sufficient, with net investment income on accumulations of natural reserve premiums (less related benefit costs and expenses), to pay benefits and expenses as they accrue based on realistic actuarial assumptions (inherent in the gross premium structure) as to interest, mortality, withdrawal, and expenses.

A natural reserve is calculated using the natural reserve premium and is (1) the accumulation with net investment income of the excess of natural reserve premiums over benefit and expense payments (a retrospective view) or (2) the amount which, with future natural reserve premiums and net investment income, is exactly sufficient to pay benefits and expenses as they accrue (a prospective view) or (3) the prospective gross premium reserve plus the present value of the profit component in the gross premium—a gross premium reserve being defined as equal to the present value of future benefit costs and expenses, less the present value of future gross premiums.

IV. Actuarial Model and Assumptions

The plan of insurance, the assumptions, and the monetary projection method used in this paper have been selected primarily to simplify demonstrations of the principles and concepts outlined in Section II. The actuarial model and actuarial assumptions are outlined in Appendix A and underlie all the subsequently developed monetary projections.

The plan of insurance selected for demonstration purposes is a three-payment, four-year modified endowment which permits analysis over the full life of the plan. Modified endowment refers to a benefit structure of \$1,000 of insurance for four years maturing for \$100 at the end of the fourth year. The limited-pay feature has been selected to demonstrate the concept that adjusted earnings, based on natural reserves, are a function of premium income—the revenue to which benefit costs and expenses are to be matched under the natural reserve concept.

V. Financial Projection Analyses (Policy Years)

Three policy-year, annual premium mode of payment projections are presented in this section. Projection 1 demonstrates the calculation of a natural reserve premium. Projection 2 demonstrates the calculation of natural reserves by the accumulation, with net investment income, of the excess of natural reserve premiums over benefit and expense payments. Projection 3 demonstrates the principal objective—the use of natural reserve increases to generate life insurance adjusted earnings.

A. *Projection 1*

The purpose of Projection 1 is to provide a basis for demonstration of the calculation of the natural reserve premium. Premium income is gross; there are no reserve increases (statutory or natural); and calculations have been made on a policy-year basis using the annual premium mode of payment.

A key to understanding and appreciating the natural reserve concept is an insight into understanding calculation of the natural reserve premium. Once the natural reserve premium is available, calculation of natural reserves involves rather routine actuarial and numerical processes.

On the basis of Projection 1, a total of $129,100 is paid out in surrender and death benefits over the four-year benefit period. Total expense payments amount to $120,650. Total investment income, after investment expenses, comes to $14,563.

Projection 1 shows an aggregate profit margin of $14,813 over the four-year benefit period. Part of the investment income in this projection then includes investment income on the accumulated profits. One of the principles stated in Section II is that investment income on earnings is not to be used in calculating the natural reserve premium. Following this principle, total aggregate investment income in Projection 1 is reduced from $14,563 to $12,087. Appendix B presents two supplementary demonstrations which should help to clarify this investment income calculation situation. Subsequent projections should also help to clarify this; the significant point is that investment income on accumulated adjusted earnings is not recognized in calculating the natural reserve premium and, therefore, is not recognized in natural reserve calculations.

PROJECTION 1

PURPOSE: TO DEMONSTRATE CALCULATION OF NATURAL RESERVE PREMIUM*

	Policy Year				Total All Years
	1	2	3	4	
Amount of insurance in force:					
Beginning of year	$ 1,000,000	$ 800,000	$ 700,000	$ 650,000	....
End of year	800,000	700,000	650,000	620,000	....
Income:					
Premium	$ 100,000	$ 80,000	$ 70,000	$ 0	$ 250,000
Investment	(450)	3,393	6,423	5,197	14,563
Total	$ 99,550	$ 83,393	$ 76,423	$ 5,197	$ 264,563
Benefits:					
Death	$ 5,000	$ 10,000	$ 20,000	$ 30,000	$ 65,000
Surrender/maturity	0	900	1,200	62,000	64,100
Increase in reserve	0	0	0	0	0
Total	5,000	$ 10,900	$ 21,200	$ 92,000	$ 129,100
Expenses:					
Commissions	$ 75,000	$ 4,800	$ 4,200	$ 0	$ 84,000
General	27,000	800	700	650	29,150
Taxes, licenses, and fees	3,000	2,400	2,100	0	7,500
Total	$ 105,000	8,000	$ 7,000	$ 650	$ 120,650
Earnings	($ 10,450)	$ 64,493	$ 48,223	($ 87,453)	$ 14,813
Accumulated earnings	($ 10,450)	$ 54,043	$ 102,266	$ 14,813	....
Accumulated earnings per $1,000 of insurance in force at end of year	($ 13.06)	$ 77.20	$ 157.33	$ 23.89	....

*Mode of premium payment: annual; type of premium: gross; accounting period: policy year; reserve basis: none.

The accompanying tabulation shows selected figures from Projection 1—projected benefit costs, expenses, and net investment income—which have been discussed above and are to be used to calculate the natural reserve premium. In Projection 1 premiums are collected on $2,500,000 of insurance—$1,000,000 in the first policy year, $800,000 in the second, and $700,000 in the third. A division of $237,663 by 2,500 produces a figure of $95.065, which is the natural reserve (annual) premium per thousand of insurance on which premiums were collected during the premium-paying period. Equating of number of thousands of insurance on which premiums are collected with total benefit costs and expenses, less appropriate investment income, may be viewed as the matching of premium revenue with related benefit costs and expenses.

Total benefit payments................	$ 129,100
Total expenses................................	120,650
"Investment income"......................	(12,087)*
	$ 237,663

*$14,563 from Projection 1 reduced by investment income on adjusted earnings.

Alternatively, total premium revenue of $250,000 is expected. If expected revenue is "matched" with benefit costs and expenses (less investment earnings) of $237,663 from above, these projected net costs are 95.065 per cent of expected revenue. Still another technique for the calculation of the natural reserve premium of $95.065 is demonstrated in sec. 1 of Appendix B. As a point of interest, "accumulated earnings per $1,000 of insurance in force at end of year" in Projection 1 are the traditional asset share factors.

In summary, concepts demonstrated by the use of Projection 1 are (1) that benefit costs and expenses are "matched" with related (premium) revenue through the calculation of a natural reserve premium and (2) that investment income on profits generated from use of the natural reserve premium in lieu of the gross premium is not used in the natural reserve premium calculation. Validity of the natural reserve premium definition—level percentage of the gross premium which is exactly sufficient with net investment income to pay benefits and expenses as they accrue based on realistic actuarial assumptions—will be demonstrated in Projection 2 below.

B. *Projection 2*

The purpose of Projection 2 is to demonstrate use of the natural reserve premium (calculated in Sec. V[A]) to generate natural reserves.

In Projection 2 premium income is "natural," and there are no reserve increases (statutory or natural) under the "Benefits" section. Again, calculations are on a policy-year basis, and an annual mode of premium payment is used. Investment income in Projection 2 is less than that in Projection 1 and is equal to the $12,087 previously discussed in Section V(A).

Thus there are three differences between the figures in Projection 2 and those in Projection 1: (1) premium income in Projection 1 is based on gross premiums, while that used in Projection 2 is based on natural reserve premiums; (2) investment income in Projection 1 is based on gross premiums and accumulated surplus from profits inherent in such gross premiums, while investment income in Projection 2 is based on natural reserve premiums and natural reserves; and (3) there are no accumulated earnings at the end of four years in Projection 2, since, by definition, the natural reserve premium is sufficient only to pay benefits and expenses.

Summation of the Projection 2 line denoted "Excess of natural reserve premium income over benefits and expenses" is zero over the full four-year benefit period. Year-by-year summations of these excesses are shown on the line denoted "Accumulated excess fund." *These accumulations are the natural reserves!*

In summary, principles and concepts demonstrated in this section are (1) that natural reserves are derived from the natural reserve premium; (2) that natural reserves are the accumulations, with net investment income, of the excess of natural reserve premiums over benefit and expense payments; and (3) that natural reserve premiums are exactly sufficient to cover expected benefits and expense payments, taking into consideration certain investment income. Natural reserve increases derived in Projection 2 will be used subsequently in Projection 3 to demonstrate further some of the concepts and principles under review and to show how these increases affect earnings.

PROJECTION 2

PURPOSE: TO DEMONSTRATE CALCULATION OF NATURAL RESERVES*

	Policy Year				Total All Years
	1	2	3	4	
Amount of insurance in force:					
Beginning of year	$ 1,000,000	$ 800,000	$ 700,000	$ 650,000	....
End of year	800,000	700,000	650,000	620,000	....
Income:					
Premium	$ 95,065	$ 76,052	$ 66,546	$ 0	$ 237,663
Investment	(746)	2,842	5,633	4,358	12,087
Total	$ 94,319	$ 78,894	$ 72,179	$ 4,358	$ 249,750
Benefits:					
Death	$ 5,000	$ 10,000	$ 20,000	$ 30,000	$ 65,000
Surrender/maturity	0	900	1,200	62,000	64,100
Increase in reserve	0	0	0	0	0
Total	$ 5,000	$ 10,900	$ 21,200	$ 92,000	$ 129,100
Expenses:					
Commissions	$ 75,000	$ 4,800	$ 4,200	$ 0	$ 84,000
General	27,000	800	700	650	29,150
Taxes, licenses, and fees	3,000	2,400	2,100	0	7,500
Total	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 120,650
Excess of natural reserve premium income over benefits and expenses	($ 15,681)	$ 59,994	$ 43,979	($ 88,292)	$ 0
Accumulated "excess" fund	($ 15,681)	$ 44,313	$ 88,292	$ 0	....
Accumulated "excess" fund per $1,000 in force at end of year	($ 19.60)	$ 63.30	$ 135.83	$ 0	....

*Mode of premium payment: annual; type of premium: natural; accounting period: policy year; reserve basis: none.

C. *Projection 3*

The principal purpose of Projection 3 is to demonstrate the result of using natural reserve increases to calculate adjusted life insurance earnings. Death benefits and surrender/maturity benefits and expenses are the same as those from the previous two projections. Premium income figures are gross and are the same as in Projection 1. Again, policy-year calculations are used with an annual premium mode of payment.

There are only two differences between Projection 3 and Projection 1: increase in reserve and investment income. Reserve increases (see the "Benefits" section) are on a natural reserve basis and are equal to the excess of natural reserve premium income over benefits and expenses derived in Projection 2. Increases in reserves net to zero over the full lifetime of the contract (four years) and thus affect earnings by changing only the incidence of the earnings, not the dollar amount of earnings. Investment income is the same as in Projection 2 and is net of investment income on adjusted earnings. Investment income on the difference between gross and natural premiums is excluded, in accordance with principles set forth in Section II. It may be calculated by methods similar to those used in Projection 1, with the assumption that the profit margin (the difference between the gross premium and the natural reserve premium) is subtracted at the beginning of each policy year.

The principal points to observe in Projection 3 are the following: (1) Adjusted earnings appear only in those policy years in which premium payments are made; there are no earnings during the paid-up period. (2) Adjusted earnings per $1,000 of insurance on which premiums are collected are constant in each policy year and equal $4.935 per $1,000—the difference between the $100.00 gross premium and the $95.065 natural reserve premium. (3) Adjusted earnings, expressed as percentages of collected premium in each year, also are constant and are equal to 4.935 per cent of collected premium.

PROJECTION 3
PURPOSE: TO DEMONSTRATE USE OF NATURAL RESERVE INCREASES TO GENERATE ADJUSTED EARNINGS*

	Policy Year				Total All Years
	1	2	3	4	
Amount of insurance in force:					
Beginning of year	$ 1,000,000	$ 800,000	$ 700,000	$ 650,000	....
End of year	800,000	700,000	650,000	620,000	....
Income:					
Premium	$ 100,000	$ 80,000	$ 70,000	$ 0	$ 250,000
Investment	(746)	2,842	5,633	4,358	12,087
Total	$ 99,254	$ 82,842	$ 75,633	$ 4,358	$ 262,087
Benefits:					
Death	$ 5,000	$ 10,000	$ 20,000	$ 30,000	$ 65,000
Surrender/maturity	0	900	1,200	62,000	64,100
Increase in reserve	(15,681)	59,994	43,979	(88,292)	0
Total	($ 10,681)	$ 70,894	$ 65,179	$ 3,708	$ 129,100
Expenses:					
Commissions	$ 75,000	$ 4,800	$ 4,200	$ 0	$ 84,000
General	27,000	800	700	650	29,150
Taxes, licenses, and fees	3,000	2,400	2,100	0	7,500
Total	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 120,650
Adjusted earnings using natural reserve increases	$ 4,935	$ 3,948	$ 3,454	$ 0	$ 12,337
Adjusted earnings per $1,000 of insurance on which premium collected	$ 4.935	$ 4.935	$ 4.935	$ 0	....
Aggregate natural reserve (Projection 2)	($ 15,681)	$ 44,313	$ 88,292	$ 0	....
Adjusted earnings expressed as percentage of premium income	4.935%	4.935%	4.935%	0.0%	....

*Mode of premium payment: annual; type of premium: gross; accounting period: policy year; reserve basis: natural.

As demonstrated in Projection 3, if actual experience follows that assumed in calculating the natural reserve premium and natural reserves, adjusted earnings emerge as a constant percentage of gross premiums—that is, adjusted earnings are equivalent to gross premiums less natural reserve premiums.

Natural reserve increases do not affect total earnings; they affect only the incidence of earnings. In Projection 1 total profit over the entire life of the contract was $14,813. Projection 3 earnings are $12,337. The difference between $14,813 and $12,337 is equal to the difference between total investment income in Projection 1 ($14,563) and investment income from Projection 3 ($12,087). The difference between gross earnings from Projection 1 and adjusted earnings shown in Projection 3 is the investment income on the margins for profit in the gross premium structure, which—under natural reserve calculation assumptions—is not used in natural reserve computations. These relationships are summarized in the accompanying tabulation.

Projection 1 earnings........	$ 14,813	Projection 1 investment income	$ 14,563
Projection 3 earnings........	(12,337)	Projection 3 investment income	(12,087)
	$ 2,476		$ 2,476

VI. Natural Reserve Components, Financial Projection Analyses (Policy Years)

It is possible to separate a natural reserve into components. The purpose of this section is to demonstrate the conceptual separation of the natural reserve into its two principal components—benefit and expense—in a manner consistent with the calculations made in Projection 2. The expense natural reserve is covered in Projection 4 and the benefit natural reserve in Projection 5. Figures in Projections 4 and 5 add up to those in Projection 2.

Natural reserves have been separated into expense and benefit components for illustrative purposes; other components might have been used—for example, a dividend component could be used for participating insurance, or a federal income tax component might be feasible. Components may then be desirable for those cost areas where assumptions are likely to change "significantly" by "cost area."

A. *Projection 4*

Projection 4 demonstrates the calculation of the expense component of the natural reserve. Expense natural reserves are usually negative during the premium-paying period. On a limited-pay policy, however, the expense natural reserve becomes positive near the end of the premium-paying period. This positive amount represents the provision for maintenance-type expenses (and, possibly, termination expenses caused by death or lapse) beyond the premium-paying period.

The expense natural reserve premium may be derived by matching total premium revenue ($250,000) with total expenses ($120,650) plus an appropriate loss of investment income ($4,810). Hence dividing $125,460 by $250,000 indicates that 50.184 per cent of premium income is needed to cover expenses, taking into consideration loss of some investment income.

PROJECTION 4

PURPOSE: TO DEMONSTRATE EXPENSE NATURAL RESERVES*

	Policy Year			
	1	2	3	4
Amount of insurance in force:				
Beginning of year	$ 1,000,000	$ 800,000	$ 700,000	$ 650,000
End of year	800,000	700,000	650,000	620,000
Income:				
Premium	$ 50,184	$ 40,147	$ 35,129	$ 0
Investment	(3,289)	(1,558)	37	0
Total	$ 46,895	$ 38,589	$ 35,166	$ 0
Benefits:†				
Death	....	....	....	....
Surrender/maturity	....	....	....	....
Increase in reserve	....	....	....	....
Total	....	....	....	....
Expenses:				
Commissions	$ 75,000	$ 4,800	$ 4,200	$0
General	27,000	800	700	650
Taxes, licenses, and fees	3,000	2,400	2,100	0
Total	$ 105,000	$ 8,000	$ 7,000	$ 650
Excess of expense natural premium income over expenses	($ 58,105)	$ 30,589	$ 28,166	($ 650)
Accumulated "excess" fund	($ 58,105)	($ 27,516)	$ 650	$ 0
Accumulated "excess" fund per $1,000 of in force at end of year	($ 72.63)	($ 39.31)	$ 1.00	$ 0

*Mode of premium payment: annual; type of premium: natural—expense; accounting period: policy year; reserve basis: none.
† Not applicable.

Premium income and associated investment income (or loss of investment income, as illustrated in Projection 4) are exactly sufficient to pay all expenses—commissions, taxes and fees, and general insurance expenses—over the benefit period of the policy. "Accumulated excess funds" represent the expense natural reserves. In addition, expense natural reserves per $1,000 in force are shown. Since expense natural reserves are generally negative, it seems more appropriate—and more consistent with generally accepted accounting principles—to illustrate the expense natural reserve in financial statements as an asset rather than as a negative liability.

B. *Projection 5*

Projection 5 demonstrates the calculation of the benefit natural reserve. Since benefit natural reserves generally are positive, they are appropriately illustrated in financial statements as liabilities.

The benefit natural reserve premium is derived by matching revenue of $250,000 with the difference between expected benefit costs of $129,100 and investment earnings of $16,897. In other words, $112,203 ($129,100 minus $16,897) divided by $250,000 equals 44.881 per cent.

Premium and investment income in Projection 5 are just sufficient to pay all benefits—death, surrender, and maturity—over the four-year benefit period. "Accumulated excess funds" represent the benefit natural reserves.

PROJECTION 5
PURPOSE: TO DEMONSTRATE BENEFIT NATURAL RESERVES*

	Policy Year			
	1	2	3	4
Amount of insurance in force:				
Beginning of year	$ 1,000,000	$ 800,000	$ 700,000	$ 650,000
End of year	800,000	700,000	650,000	620,000
Income:				
Premium	$ 44,881	$ 35,905	$ 31,417	$ 0
Investment	2,543	4,400	5,596	4,358
Total	$ 47,424	$ 40,305	$ 37,013	$ 4,358
Benefits:				
Death	$ 5,000	$ 10,000	$ 20,000	$ 30,000
Surrender/maturity	0	900	1,200	62,000
Increase in reserve	0	0	0	0
Total	$ 5,000	$ 10,900	$ 21,200	$ 92,000
Expenses:†				
Commissions	....	....	....	....
General	....	....	....	....
Taxes, licenses, and fees	....	....	....	....
Total	....	....	....	....
Excess of benefit natural premium income over benefits	$ 42,424	$ 29,405	$ 15,813	($ 87,642)
Accumulated "excess" fund	$ 42,424	$ 71,829	$ 87,642	$ 0
Accumulated "excess" fund per $1,000 of in force at end of year	$ 53.03	$ 102.61	$ 134.83	$ 0

*Mode of premium payment: annual; type of premium: natural—benefits; accounting period: policy year; reserve basis: none.
† Not applicable.

VII. Financial Projection Analyses (Calendar Years)

Financial Projections 1-5 have been made on the policy-year basis because of the ease with which these projections may be followed and because of the extensive application of actuarial assumptions on a policy-year basis. Principles and concepts outlined in these projections also hold true, however, if calculations are made on a calendar-year basis.

Calendar-year projections involve two demonstrations: Projection 6 is designed to demonstrate calculation of calendar-year natural reserves (and hence natural reserve increases) in a manner similar to that used on a policy-year basis in Projection 2; Projection 7 is designed to demonstrate the use of these calendar-year natural reserve increases to present adjusted life insurance earnings on a calendar-year basis.

A. *Projection 6*

Projection 6 premium income is natural reserve premium income and is equal to premium income shown in Projection 2; there are no reserve increases, either statutory or natural. Total benefits and expenses are equal to those shown in the previous projections and are $129,100 for benefits and $120,650 for expenses; net investment income totals $12,087, which is the same as the total investment income in Projection 2.

The principal difference between the results of Projection 6 and those of Projection 2 is the incidence of "excess of natural reserve premium income over benefits and expenses." These "excesses" are, in essence, the natural reserve increases. Incidence of natural reserve increases in Projection 6 is different from that in Projection 2, as would be expected if one compared financial results on a calendar-year basis with those on a policy-year basis. Natural reserve increases in both Projection 2 and Projection 6, however, net to zero over the lifetime of the policy. It takes five years to show complete financial results on a calendar-year basis, as in Projection 6, but only four years of financial projections are required with policy-year calculations, as in Projection 2.

PROJECTION 6

PURPOSE: TO DEMONSTRATE CALCULATION OF CALENDAR-YEAR NATURAL RESERVES*

	Calendar Year				
	1	2	3	4	5
Amount of insurance in force:					
Beginning of year	$ 1,000,000	$ 997,500	$ 795,000	$ 690,000	$ 635,000
End of year	997,500	795,000	690,000	635,000	620,000
Income:					
Premium	$ 95,065	$ 76,052	$ 66,546	$ 0	$ 0
Investment	(298)	1,124	4,388	5,144	1,729
Total	$ 94,767	$ 77,176	$ 70,934	$ 5,144	$ 1,729
Benefits:					
Death	$ 2,500	$ 7,500	$ 15,000	$ 25,000	$ 15,000
Surrender/maturity	0	0	900	1,200	62,000
Increase in reserve	0	0	0	0	0
Total	$ 2,500	$ 7,500	$ 15,900	$ 26,200	$ 77,000
Expenses:					
Commissions	$ 75,000	$ 4,800	$ 4,200	$ 0	$ 0
General	27,000	800	700	650	0
Taxes, licenses, and fees	3,000	2,400	2,100	0	0
Total	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 0
Excess of natural reserve premium income over benefits and expenses	($ 12,733)	$ 61,676	$ 48,034	($ 21,706)	($ 75,271)
Accumulated "excess" fund	($ 12,733)	$ 48,943	$ 96,977	$ 75,271	$ 0
Accumulated "excess" fund per $1,000 in force at end of year	($ 12.76)	$ 61.56	$ 140.55	$ 118.54	$ 0

*Mode of premium payment: annual; type of premium: natural; accounting period: calendar year; reserve basis: none.

B. *Projection 7*

Projection 7 is similar to Projection 3 , except that Projection 3 is on a policy-year basis and Projection 7 is on a calendar-year basis. In Projection 7 premium income is on a gross basis; calendar-year reserve increases, from Projection 6, are on a natural reserve basis.

Projection 7 adjusted earnings are the same as those in Projection 3 and equal $4,935, $3,948, and $3,454 for years 1, 2, and 3, respectively. In Projection 7 there are no earnings in those calendar years in which premiums were not collected. This again demonstrates one of the principal concepts underlying the use of natural reserves: earnings are related directly to premium revenue. Adjusted earnings, as used, thus include neither net investment income on prior years' earnings nor profits (or losses) arising from variations in actual experience from that assumed.

Projection 7 (calendar-year) adjusted earnings are equal to Projection 3 (policy-year) adjusted earnings in the first three years (1) because the annual premium was collected at the beginning of each year and, under the natural reserve concept used in this paper, earnings are tied to premiums, and (2) because the natural reserve premium, previously calculated on a policy-year basis, was used in Projection 6 (calendar-year basis) to generate natural reserve funds at the end of each year; increases in these calendar-year natural reserves were then used in Projection 7.

If traditional actuarial methods had been used to derive mean calendar-year natural reserve increases in lieu of those increases derived from Projection 6, earnings in Projection 7 would have been significantly different from those in Projection 3. This difference may be traced primarily to the inappropriateness of the linear relationship inherent in mean reserve interpolation methods. Distortions in reserve increases are particularly apparent with respect to the expense component of the natural reserve.

PROJECTION 7
PURPOSE: TO DEMONSTRATE USE OF CALENDAR-YEAR NATURAL RESERVE INCREASE TO ADJUST EARNINGS*

	Calendar Year				
	1	2	3	4	5
Amount of insurance in force:					
Beginning of year	$ 1,000,000	$ 997,500	$ 795,000	$ 690,000	$ 635,000
End of year	997,500	795,000	690,000	635,000	620,000
Income:					
Premium	$ 100,000	$ 80,000	$ 70,000	$ 0	$ 0
Investment	(298)	1,124	4,388	5,144	1,729
Total	$ 99,702	$ 81,124	$ 74,388	$ 5,144	$ 1,729
Benefits:					
Death	$ 2,500	$ 7,500	$ 15,000	$ 25,000	$ 15,000
Surrender/maturity	0	0	900	1,200	62,000
Increase in reserve	(12,733)	61,676	48,034	(21,706)	(75,271)
Total	$ 10,233	$ 69,176	$ 63,934	$ 4,494	$ 1,729
Expenses:					
Commissions	$ 75,000	$ 4,800	$ 4,200	$ 0	$ 0
General	27,000	800	700	650	0
Taxes, licenses, and fees	3,000	2,400	2,100	0	0
Total	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 0
Adjusted earnings using natural reserve increases	$4,935	$ 3,948	$ 3,454	$ 0	$ 0
Aggregate natural reserve (Projection 6)	($ 12,733)	$ 48,943	$ 96,977	$ 75,271	$ 0

*Mode of premium payment: annual; type of premium: grow; accounting period: calendar; reserve basis: natural.

VIII. Earnings Patterns Under Alternative Techniques

From a theoretical actuarial viewpoint, a strong case may be made for the position that earnings based on the use of natural reserves are "true earnings." From a practical viewpoint, however, other techniques which avoid some of the complexities of the use of the complete natural reserve method, and which do not produce earnings materially different from those obtained by direct use of natural reserves, are considered in this section. The purpose of this section is to present a comparison of earnings patterns obtained by several alternative methods with earnings obtained by the natural reserve method.

Comparisons are not intended to represent results from all types of insurance or all distributions by year of issue (just to mention two variables). It is felt, however, that the comparisons made here are valid for demonstrating the nature of differences in life insurance earnings patterns produced in financial statements adjusted using several of many possible methods.

In order to tie in the "cash flow" earnings of Projection 1 with other methods of earnings presentation considered in this section, all earnings are assumed to be retained (as contrasted with payment to stockholders) and earn interest and, hence, total $14,813 regardless of method instead of $12,337 of *adjusted* earnings from Projection 3.

Financial results of each alternative method of reporting earnings are presented in Table 1. The alternatives are briefly described in the Notes to Table 1. Comparisons are based on data underlying previously outlined monetary projections. Additional mathematical details are outlined in Appendix C for those interested in following the transitions from data in Projections 1-3.

Statutory reserves have been computed by increasing the decrement rates due to death, outlined in Appendix A (paragraph 1), by appropriate ratios of 1958 CSO mortality rates to 1955-60 Basic Mortality Table, Select and Ultimate, rates. The approximate average age at which these ratios were developed is 58.

If the natural reserve method (illustrated in col. G) is designated as the standard by which reasonableness of other earnings adjustment techniques are to be judged, what are the implications concerning possible alternative methods of reporting life insurance earnings? Alternatives represented by columns A, B, and C are shown for illustrative purposes only.

TABLE 1

Year	Statutory Earnings								
	Net Level	Full Preliminary Term	Cash Flow Earnings (Projection 1)	Statutory Net Level Reserve (3½ Per Cent) Earnings Adjusted for Amortization of Acquisition Expenses	Statutory Net Level (6 Per Cent in Lieu of (3½ Per Cent) Reserve Earnings Adjusted For Amortization of Acquisition Expenses	Earnings Allocated by In-Force Amounts of Insurance Over Benefit Period	Natural Reserve Earnings (Modified to Include Interest on Accumulated Profit)	Earnings Based Revenue Defined as Premium and Investment Income	Natural Benefit Reserve Earnings with Amortization of Acquisition Expenses via Premium Income
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
1............	($ 59,498)	($ 10,450)	($ 10,450)	($ 2,498)	($ 546)	$ 4,702	$ 5,231	$ 5,574	$ 4,126
2............	35,183	8,227	64,493	4,793	5,316	3,762	4,499	4,669	4,688
3............	28,996	6,904	48,223	2,396	2,212	3,292	4,245	4,279	5,810
4............	10,132	10,132	(87,453)	10,132	7,831	3,057	838	291	189
Total	$ 14,813 Col. 5*	$ 14,813 Col. 4*	$ 14,813 Col. 1*	$ 14,813 Col. 8*	$ 14,813 Col. 10*	$ 14,813 Col. 12*	$ 14,813 Col. 15*	$ 14,813 Col. 17*	$ 14,813 Col. 19*

*Appendix C column references.

Notes To Table 1

Column A.—Earnings are stated on a statutory accounting basis using statutory net level reserves (3½ per cent interest) ; detailed calculations may be found in column 5 of Appendix C.

Column B.—Earnings are stated on a statutory accounting basis using full preliminary term reserves (3½ percent interest); details are shown in column 4 of Appendix C.

Column C.—Earnings are on a cash flow basis, ignoring provision for reserves of any kind, and are the same as those earnings shown in Projection 1.

Column D.—Earnings are stated by use of statutory net level reserve earnings from column 5 (Appendix C) as adjusted by capitalization of $95,000 of initial acquisition expenses and amortization without any consideration given to investment income, based on expected premium income (details are shown in col. 8 of Appendix C).

Column E.—Earnings are on the same basis as in column D, except that the interest rate used to calculate statutory net level premium reserves is increased from 3½ per cent to 6 per cent (see col. 10 of Appendix C).

Column F.—Earnings are allocated over the four-year benefit period, rather than over the three-year premium-paying period, based on the amount of insurance in force at the beginning of each policy year (see cols. 11 and 12 of Appendix C).

Column G.—Earnings are stated using natural reserves, as previously defined, and are the same earnings as shown in Projection 3 after adjustment for interest on accumulated profit (see cols. 13-15 of Appendix C).

Column H.—Earnings are stated by use of a form of natural reserve based on a definition of revenue as premium income plus investment income, rather than as premium income alone—as is the case in the definition of the natural reserve method previously cited in this paper (see cols. 16 and 17 of Appendix C).

Column I.—Earnings demonstrated in column I are computed theoretically in a manner similar to the full natural reserve method; details are displayed in columns 18 and 19 of Appendix C.

One alternative technique, illustrated in column D, is to use net level statutory reserves and separately capitalize and amortize acquisition expenses. A comparison of column D with column G shows that this technique results in a distorted deferment of earnings to later policy years, as compared with the modified (for investment income on surplus) natural reserve method illustrated.

A second alternative, illustrated in column E, is to capitalize and amortize initial acquisition costs and adjust the net level statutory mortality reserve to a realistic interest basis only. A comparison of the figures in columns E and G shows that this alternative also results in a deferment of earnings to later policy years as compared with the natural reserve method. Although earnings are not deferred as distortedly as in column D, this method still apparently results in a significant deferral of earnings.

If earnings are spread over the entire benefit period as illustrated in column F, rather than the premium-paying period as with the natural reserve earnings in column G, earnings are positive in all policy years (as compared with negative early earnings under the two previous alternatives), but, compared with the natural reserve earnings in column G, earnings are still deferred somewhat to later policy years.

The alternative illustrated in column H is to utilize a definition of revenue as equal to premium plus investment income rather than "premium income" as defined under the current natural reserve concept. A comparison of columns H and G demonstrates that this alternative does not produce significantly different earnings patterns from the natural reserve earnings in which revenue is assumed to be that of premium income only.

Earnings in column I are derived from use of the natural benefit reserve increases, with acquisition expenses capitalized and amortized without interest following the expected premium income pattern. Theoretically, the earnings patterns in columns G and I should be very similar; the differences may be traced to the amortization of acquisition expenses via premium income *without* interest.

The author's preference is for the use of natural reserves with capitalization and amortization of acquisition costs by expected premium income (without any interest discount), which is the alternative illustrated in column I. This technique generally results in a conservative statement of early earnings in comparison with the natural reserve earnings in column G; however, the separation of expense and benefit components and the avoidance of some technical actuarial problems encountered when the expense part of the adjustment is made a part of the natural reserve actuarial factors are felt to outweigh considerably the moderate conservatism of the earnings adjustment.

A comparison of earnings in columns G, H, and I—natural reserve earnings, earnings based on total income, and natural benefit reserve earnings with capitalization and amortization of acquisition costs, respectively—present patterns of earnings which the author finds reasonable a priori. The earnings patterns derived from a capitalization and amortization of initial acquisition expenses with statutory reserves on a net level basis (col. D), or on a net level statutory mortality but realistic interest basis (col. E), are possible alternatives which apparently result in significant deferrals of earnings to later years.

APPENDIX A
ACTUARIAL MODEL AND ASSUMPTIONS: THREE-PAYMENT, FOUR-YEAR MODIFIED ENDOWMENT

1. In-force and decrement schedule per 1,000 policies issued

Policy Year	Beginning of Year In Force	Decrements Due To:	
		Death	Lapse
1...........	1,000	5	195
2...........	800	10	90
3...........	700	20	30
4...........	650	30	0
5...........	620	....	....

2. Benefits per $100 of gross annual premium
   a) Insurance—$1,000.
   b) Endowment value—$100 at the end of the fourth policy year.
3. Cash surrender values

Policy Year	Per $100 of Gross Annual Premium
1	$ 0
2	10
3	40

4. Net investment income rate
   Six per cent (rate after reduction for investment expenses).
5. Expenses

Type of Expense	Percentage of Gross Premium		Year 4 (Per 1,000 of Insurance)
	First Year	Years 2 and 3	
Marketing..........	15%	0%	$0
Issue/selection...	11	0	0
Maintenance......	1	1	1
General expenses............	27%	1%	$1
Commissions.....	75	6	0
Taxes, licenses, and fees............	3	3	0
Total.................	105%	10%	$1

6. Incidence of occurrence
   Premiums are collected and expenses incurred at the beginning of each *policy* year; death benefits paid at mid-policy year; and cash surrender values paid at the end of the policy year.

APPENDIX B
NATURAL RESERVE INVESTMENT INCOME

1. Alternate Natural Reserve Premium Calculations

ΔG = Reduction in gross premium necessary for accumulated earnings ($14,813) from Projection 1 to be zero at the end of the period (year 4);

$$(\Delta G)\ [1{,}000(1.06)^4 + 800(1.06)^3 + 700(1.06)^2] = \$14{,}813,$$

where 1,000, 800, and 700 are $1,000's of insurance on which premium is collected;

$$[1{,}000(1.06)^4 + 800(1.06)^3 + 700(1.06)^2] = 3001.81;$$

therefore,

$$\Delta G = (\$14{,}813) \div (3001.81) = \$4.935.$$

Gross premium per $1,000 of insurance...........	$100.000
Minus ΔG from above..	4.935
Natural reserve premium per $1,000................	$ 95.065

2. Calculation of Investment Income Used to Arrive at Natural Reserve Premium in Section V(A)

Year	Number of $1,000's of Insurance (1)	Earnings for Year [(1)×4.935]* (2)	Accumulated Earnings at Beginning of Year (3)	Interest on Accumulated Earnings at 6 Per Cent [(3)×0.06] (4)	Earnings plus Interest at End of Year [(3)+(4)] (5)
1...........	1,000	$4,935	$4,935	$296	$5,231
2...........	800	3,948	9,179	551	9,730
3...........	700	3,454	13,184	791	13,975
4...........	0	0	13,975	838	14,813
	....	....	....	$2,476†	....

*See sec. 1 page 13.

† Investment income differences from Projections 1 and 2: $14,563 (Projection 1) minus $12,087 (Projection 2) equals $2,476.

APPENDIX C
EARNINGS PATTERNS UNDER ALTERNATIVE TECHNIQUES—DERIVATIONS

Year	Cash Flow Earnings From Projection 1	Statutory, 3½ Per Cent Interest Reserve Increase		Statutory Earnings		Projection 1 Gross Premium Income	Effect on Earnings from Capitalization and Amortization (Col. 6) of First-Year Acquisition Cost of $95,000	Statutory Earnings Modified with Spread of First-Year Acquisition Cost [(5)+(7)]	Increase in 6 Per Cent Net Level Statutory Reserve
		Full Preliminary Term	Net Level	Full Preliminary Term [(1)–(2)]	Net Level [(1)–(3)]				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1........	($ 10,450)	$ 0	$ 49,048	($ 10,450)	($ 59,498)	$ 100,000	$ 57,000	($ 2,498)	$ 47,096
2........	64,493	56,226	29,310	8,227	35,183	80,000	(30,400)	4,783	28,777
3........	48,223	41,319	19,227	6,904	28,996	70,000	(26,600)	2,396	19,411
4........	(87,453)	(97,585)	(97,585)	10,132	10,132	.....	.....	10,132	(95,284)
Total	$ 14,813	$ 0	$ 0	$ 14, 813	$ 14,813	$ 250,000	$ 0	$ 14,813	$ 0

Year	(8)+(3)–(9)	Earnings Allocation by Amount of Insurance		Natural Reserve Earnings From Projection 3	Interest on Surplus	Natural Reserve Earnings Modified for Investment Income on Surplus [(13)+(14)]	Earnings Allocated by Premium and Investment Income		Increase in Net Level Natural Benefit Reserve from Projection 5	(1)+(7) –(18)
		Amount in Force at Beginning of Year (000's)	$14,813 Total Earnings Spread over Benefit Period				Total Income from Projection 1	$14,813 Total Earnings Allocated per Col. 16		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
1........	($ 546)	$ 1,000	$ 4,702	$ 4,935	$ 296	$ 5,231	$ 99,550	$ 5,574	$ 42,424	$ 49,126
2........	5,316	800	3,762	3,948	551	4,499	83,393	4,669	29,405	4,688
3........	2,212	700	3,292	3,454	791	4,245	76,423	4,279	15,813	5,810
4........	7,831	650	3,057	.....	838	838	5,197	291	(87,642)	189
Total	$ 14,813	$ 3,150	$ 14,813	$ 12,337	$ 2,476	$ 14,813	$ 264,563	$ 14,813	$ 0	$ 14,813

Discussion of Preceding Paper

B. Franklin Blair

Mr. Pharr has prepared a paper which will be quite helpful in clarifying the principles and concepts behind natural reserves. It should be helpful both to students and to those with responsibility for applying the natural reserve concept to financial statements. The paper serves a useful purpose in demonstrating that the adoption of a natural reserve concept does not necessarily produce a unique value for "adjusted earnings," since Mr. Pharr has presented at least four methods for applying natural reserves to the allocation of earnings by policy year.

It seems to me, however, that the principles on which this paper is based have been carried to an unjustified extreme in at least two particulars. As a result, the author has painted himself into a corner from which there is, in my opinion, no completely satisfactory escape. The two principles which seem to me to be open to question are (1) that benefit costs and expenses should be matched with revenue, with the objective of having net income matched with revenue, and (2) that revenue is equivalent to premium income.

My remarks about accounting principles are, like Mr. Pharr's, "based on the author's understanding, as an actuary, and not as a certified public accountant." Remembering this limitation on my understanding, it does not seem to me that "generally accepted accounting principles" as applied in most other businesses require that expenses be spread evenly in proportion to revenue. I believe, for example, that accelerated depreciation is often used for statement purposes as well as for tax purposes, and that the consistent use of approved methods of accelerating depreciation would not result in a qualified certificate from a company's certified public accountants. Certainly, where research and development expenses are expensed rather than capitalized, and the research and development prove productive, these expenses are not matched against the revenue anticipated. Pension costs also are often not matched evenly against revenue—in fact they are often matched against revenues in years long after the pension liability is incurred.

The principle that "revenue is equivalent to premium income" is, in my opinion, much too narrow a definition of revenue. (As the actuary of a company which is in a phase 1 tax position, I certainly wish that the Internal Revenue Service would adopt the principle that "revenue is equivalent to premium income.") It is, I think, illogical not to consider investment income as a part of revenue for matching purposes. Failure to do so is in part responsible for the ridiculous and dangerous situation in which all the earnings are thrown into the premium-paying period on limited payment policies (and presumably also on single premium insurance other than credit insurance). This anticipation of the earnings after the policy becomes full paid might lead to the unfortunate result of paying out too much in dividends to stockholders during the premium-paying period if any substantial volume of limited payment business were written. It would also result in overstating adjusted book values so that unwary buyers might perhaps pay too much for the stock of a company whose earnings would soon fall off when the limited payment business became full paid.

This principle that "revenue is equivalent to premium income" reminds me of a story often attributed to Abraham Lincoln. One of his favorite riddles is said to be, "How many legs would a dog have if you called his tail a leg?" Most people would answer "Five," to which Abraham Lincoln would reply, "The correct answer is four, since calling a tail a leg doesn't make it a leg." Similarly, it seems to me that saying that "revenue is equivalent to premium income" doesn't make it equivalent to premium income.

Another example of twisting terms out of their normal meaning is the sentence in the first paragraph under "Principles and Concepts" stating, " In this paper the term 'adjusted earnings,' unless otherwise noted refers to the 'basic earnings anticipated or inherent in the premium structure'." This, I believe, is not the generally accepted definition of adjusted earnings. The term, as usually used, also includes two items described by Mr. Pharr as "net investment income on capital funds and retained earnings from prior years" and "profits (or losses) attributable to variations in actual experience from that anticipated under natural reserve assumptions." These two items are omitted in Mr. Pharr's narrow use of "adjusted earnings" throughout most of his paper. I believe some term other than "adjusted earnings" should be used to designate the rather limited amount to which Mr. Pharr incorrectly applied the term "adjusted earnings."

I can appreciate the practical problems which influenced Mr. Pharr to limit his paper to consideration of nonparticipating individual life insurance. Moreover, his demonstrations are only for one particularly simple short-term individual life policy. The fact that Mr. Pharr felt that this limitation was desirable (perhaps necessary?) and did not discuss at all the application of the principles and concepts to other product lines—particularly participating insurance—seems to me to indicate that perhaps the application to these other lines is not so simple as Mr. Pharr and other advocates of the natural reserve method would have the rest of us believe.

The following points are not quite so fundamental in nature; nevertheless I feel that they should be mentioned:

1. Under "Definitions" Mr. Pharr states: "A natural reserve premium is a level percentage of the gross premium." This may be proper for level premium, level benefit policies; I think it is an undue generalization in situations where the gross premium or the policy benefits are unlevel. In these situations there is no inherent reason why the built-in profit margin needs to be a level percentage of the gross premium; if the profit margin is not a level percentage of the gross premium, the natural reserve premium will not be a level percentage of the gross premium.

2. Under "Definitions" Mr. Pharr gives one definition of a natural reserve as "the gross premium reserve less the profit component in the premium and the assumed net investment income on that profit." I believe that this definition would be more accurate if the words "the present value of" were inserted after the word "less."

3. In his discussion of Projection 4, Mr. Pharr says, "Since expense natural reserves are generally negative, it seems more appropriate—and more consistent with generally accepted accounting principles—to illustrate the expense natural reserve in financial statements as an asset rather than as a negative liability." I do not agree with Mr. Pharr, although I realize that this recommendation is made in the exposure draft of the audit guide proposed by the AICPA Committee on Insurance Accounting and Auditing. For a given insurance policy at a given duration, either the expense or the benefit portion of the natural reserve may be positive or negative, depending upon plan design. Because the policy cannot actually be separated into an expense element and a benefit element which could exist separately, I believe that, instead of trying to place a conventional balance-sheet interpretation on each portion separately, it is preferable—both theoretically and practically—to consider expenses and benefits *in toto* and to report the entire amount either as an asset or as a liability as the case may be. The possible income tax consequences of inflating life insurance company assets by showing the expense natural reserve as an asset are appalling to me. Incidentally, I am disappointed that many who, like Mr. Pharr, are advocating the use of some natural reserve method in financial reporting gloss over or completely ignore possible federal income tax implications of the natural reserve method.

4. Mr. Pharr shows projections on a policy-year basis and on a calendar-year basis and comes up with the same earnings for the first three calendar years as for the first three policy years. Part of the earnings during the first policy year are normally incurred during the second half of the policy year, so that any method which gives the same results for the first calendar year and for the first policy year is likely to be oversimplified or to contain some fundamental error of theory. His anomalous result is caused primarily by assuming that earnings are related directly to revenue and that "revenue is equivalent to premium income." To me this demonstrates the artificiality and fallacies of his basic concepts.

5. Mr. Pharr shows natural reserves earnings on several different bases; one of these is his regular basis, in which revenue is equivalent to premium income, and another is an alternative basis, in which revenue is defined as premium and investment income. The results on these two bases are shown in columns G and H of Table 1 of his paper. He points out: "A comparison of columns H and G demonstrates that this alternative does not produce significantly different earning patterns from the natural reserve earnings in which revenue is assumed to be that of premium income only." This may be true for the particular example which Mr. Pharr has chosen, but his example is far from a typical permanent policy, since it builds to a maximum surrender value of $100 per $1,000 of insurance and runs for only four years, so that investment income on this policy is naturally small in relation to premium income. My guess would be that on many whole life policies (and especially on limited payment life policies) the figures corresponding to column H would be considerably different from those corresponding to column G, so that we would find that defining revenue as premium plus investment income would give significantly different earnings patterns from the arbitrary and narrow definition of revenue which Mr. Pharr has used in most of his paper.

In conclusion, I was glad to see that Mr. Pharr stated that his "preference is for the use of natural reserves with capitalization and amortization of acquisition costs by expected premium income (without any interest discount)." This is the alternative illustrated in column I of Table 1. The fact that "[t]his technique generally results in a conservative statement of early earnings in comparison with the natural reserve earnings in column G," mentioned earlier, is a good recommendation for this method, so I would also prefer it to some of Mr. Pharr's other alternatives. I am very much concerned that the natural reserve method will be misused to produce unreasonably large earnings in the early policy years.

That a concern for the soundness of financial reporting principles is not confined to the life insurance industry is well illustrated by the following quotation from remarks made by Mr. W. Blackie, chairman of the board of the Caterpillar Tractor Company, at the annual meeting of the company's shareholders on April 14, 1971:

> The basic thinking which has permeated Caterpillar's financial reporting is to the effect that over the long term "conservatism" in the determination of earnings is most likely to be in the best interests of the Company and its shareholders. This means that within the tolerances of generally accepted accounting principles the practices selected for the determination of the Company's financial results have almost invariably been those which would operate to minimize the possibility of overstating reported earnings. This has served to avoid not only the hazard of retrospective reduction of earlier reported results but also the danger of having decisions made and acted upon on the basis of figures which might eventually transpire to have been something less than realistic . . . . .
>
> The fact of the matter is that changes in accounting practices cannot change *real* profit—or loss. All that they can do is alter the method of measuring something which, in the case of a going concern, is more in the nature of a concept than a hard reality.

John M. Bragg

The point of my discussion is this: If conventional expense factors are used in working natural reserves, the result will be an unjustifiable capitalization of expense.

The apparent intent of the audit guide is to capitalize acquisition expenses which are of a direct nature, such as sales commissions and other items which will occur if the particular policy is sold but will not otherwise occur. Conventional expense factors, which are designed to reproduce a company's total expenses, contain allowances which, especially in the first year, are far in excess of such "capitalizable" expense; this is because they contain provision for "overhead," which, in the opinion of this discussant, should not be capitalized.

The paper "Prices and Profits" (*TSA*, XX, 61-62) exhibits conventional and functional general expense factors. Functional general expense factors consist of full maintenance expenses, plus, in the first year, only those additional general expenses, such as medical and inspection costs, cost of supplies and postage, and the like, which will definitely be incurred if the business is sold but will not otherwise occur; overhead is not included in functional expense. The author advocated that functional expenses of this nature should be used in the determination of "optimum" premiums and felt that functional expenses are frequently used (implicitly or subconsciously), even when prices are calculated with conventional factors, as a result of arbitrary changes which are made in order to meet competition or other realities.

It now appears that the same functional general expenses (plus, of course, the additional sales commission) are appropriate for the calculation of natural reserves, on a basis which will not result in the capitalization of overhead and will be in accordance with the intent of the audit guide.

Table 1 indicates the extent of capitalization which results from the use of various expense rates. The illustration is based on whole life insurance of $10,000 for males aged 35, and utilizes the premium ($190.10) and the sales commission rate (85 per cent) which were found to be "optimum" in the "Prices and Profits" paper.

Mr. Pharr's expense factors are shown here as a matter of information; they are, however, intended for a three-payment, four-year endowment and are completely arbitrary and inappropriate for a whole life contract.

TABLE 1
EXPENSES FOR $10,000 WHOLE LIFE INSURANCE
AGE 35, MALE, $190.10 ANNUAL PREMIUM

	Pharr (Conventional)*	Joint Actuarial Committee (Conventional)†	Bragg (Conventional)‡	Bragg (Functional)‡
First year:				
Sales commission	$142.57	....	$161.58	$161.59
Other per cent of premium	57.04	$285.15	69.20	24.14
Per-policy expense	....	.....	29.62	8.20
Per-thousand expense	....	47.50	26.50	3.20
Medical and inspection	....	....	13.59	13.59
Total	$199.61	$332.65	$300.49	$210.71
Maintenance:				
Per cent of premium	$19.01	$15.21	$24.14	$24.14
Per-policy expense	....	....	6.10	4.47
Per-thousand expense	....	12.50	4.00	3.20
Total	$19.01	$27.71	$34.24	$31.81
Acquisition expense to be capitalized = first year minus maintenance	$180.60	$304.94	$266.25	$178.90
Capitalized expense as per cent of premium	95%	160%	140%	94%

*Appendix A of Pharr paper.
† Section B-26 of committee report.
‡ *TSA*, XX, 61-62.

They do appear to be conventional, however, because of the very high ratio of first-year to maintenance general expense.

The conventional expense factors of the joint Actuarial Committee exhibit an extremely high ratio of first-year to maintenance expense and can result in the capitalization of 160 per cent of first-year premiums, as compared with only 94 per cent for the Bragg functional expenses. The difference of 66 per cent can typically cause a major difference in adjusted earnings; when it is applied (on an amortized basis) to the results of many past years' issues, it can result in a tremendous, and in this discussant's opinion, unjustified, additional "asset"; in effect, it would be nothing more than the capitalization of the overhead of many past years. The Bragg conventional factors, which happen to spread some of the overhead expenses in renewal years, would also result in overcapitalization (140 per cent versus 94 per cent on the functional basis).

Some observers are uneasy with Bragg functional expenses because they do not seem to reproduce the total expenses of the company, They do not contain any allowance for overhead, which is regarded as a single sum applicable on a "per company per calendar year" basis and is rather like negative profit which must be overcome out of revenues (minus direct costs) of the year before a positive profit emerges. Overhead consists of a myriad of items, including many salary, rent, marketing, advertising, and selection expenses which will occur in a particular calendar year regardless of the volume of business written, and can be thought of as the bundle of expense which keeps the company in business as a going concern capable of issuing new insurance. Overhead can typically be in the range of 40-50 per cent of a company's entire general expense.

There is obviously some room for difference of opinion about what expenses are overhead and what expenses are to be included in functional expense factors; for example, underwriting salaries might be in this doubtful category. Nevertheless, under any interpretation, there is a large block of expense which remains as overhead.

A discussion of overhead from the viewpoint of the audit guide is in order. Overhead is, of course, a "cost" of a calendar year and should be matched against the "revenue" of that calendar year. It should not be capitalized, as will apparently happen with the use of conventional expense factors. Bragg functional expense factors do not include, and therefore do not capitalize, overhead expenses; they do not ignore overhead expenses but merely treat them in the natural course of events as a full matched charge against the revenue of the year.

Incidentally, this discussant is in favor of the "two-factor" method of determining natural reserves, which keeps the capitalized acquisition expenses as a separate amount; in this fashion the actuary can compare this asset with known ledger disbursements of acquisition expenses and satisfy himself that the capitalization is reasonable.

Mr. Pharr is to be congratulated on this very fine paper, which contributes greatly to our knowledge of the subject of natural reserves and the many methods which are available for their determination and for the adjustment of earnings.

Gary E. Corbett

"The Natural Reserve Concept and Life Insurance Earnings" will have the distinction of being the first paper in the *Transactions* to address itself to the problem of general-purpose financial reporting for life insurance companies. Readers will find that Mr. Pharr's paper provides a valuable introduction to the concept of natural reserves and how such reserves can be employed to produce earnings that are in accord with generally accepted accounting principles.

Mr. Pharr's three-payment, four-year modified endowment, while excellent for the purpose of demonstrating principles and concepts, should not be relied upon to indicate real-world differences resulting from the use of alternate reserving methods. Studies run for our company and for the Joint Actuarial Committee all support the conclusion that it is extremely difficult to generalize as to the probable effect on earnings of any reserving method. For any given company the effect depends on the planage-duration mix and on the assumptions with respect to interest, mortality, withdrawals, and expenses used in the reserves.

The author is thus on dangerous ground when he uses the results of his sample plan to illustrate the effect on earnings of alternative reserving methods. For example, he states a preference for the use of natural benefit reserves plus a no-interest capitalization and amortization of acquisition costs by expected premium income: "This technique generally results in a conservative statement of early earnings in comparison with the natural reserve earnings." Not so. In many situations the result of ignoring interest in the expense reserve is overstated earnings in the early policy years.

If we look at a whole life plan issued at age 35 with 1955-60 select and ultimate mortality, Linton B withdrawals, and acquisition expenses at 90 per cent of premium plus $10 per thousand, we find the expense factors shown in Table 1 per $1,000 surviving. Compared with natural expense reserves at 6 per cent, ignoring interest would overstate first-year earnings by $0.96 per thousand, or 3.9 per cent of the natural expense reserve. A typical first-year profit resulting from the application of natural reserves to this plan-age, would be around $2. The overstatement of $0.96 per thousand is thus about 50 per cent. As the assumed interest rate declines, the difference becomes less, but even at 3 per cent the earnings overstatement is $0.48 per thousand, or close to 25 per cent.

TABLE 1

Duration	Interest Rate			
	0%	3%	4.5%	6%
1........	25.49	25.01	24.77	24.53
5........	31.33	30.78	30.40	29.99
10........	32.05	32.14	31.93	31.63
15........	29.87	30.80	30.89	30.84
20........	26.71	28.38	28.78	28.99

It would be just as fallacious to assume from the above example that ignoring interest in the expense reserve always results in such overstatement as it would be to assume the converse from Mr. Pharr's example. However, studies that I have seen to date lead me to believe that, at least for whole life, an overstatement is more likely than an understatement.

With a few simplifying assumptions, the effect of ignoring interest can be studied algebraically. If we assume level interest at rate i, first-year total terminations at rate w_1, level renewal-year total terminations at rate w_r, the term of the policy at n, and acquisition expenses at E, the formula for the first-year natural expense reserve (NER_1) is

$$NER_1 = E(1 - w_1) \left\{ \frac{1 - (1 - w_r)^{n-1} v^{n-1}}{1 - (1 - w_r)v + (1 - w_1)v[1 - (1 - w_r)^{n-1} v^{n-1}]} \right\}.$$

Substituting in this formula, we can find values of NER_1 for varying i, w_1, w_r, and n. For example, if $w_r = 0.05$ and $n = 20$, we can establish that the first-year expense asset at $i = 0$ will exceed the first-year natural expense reserve at $i = 0.06$ if $w_1 > 0.31$. If $w_r = 0.10$, the earnings overstatement occurs only if $w_1 > 0.41$. However, if $n =$ 50 we find the overstatement occurring for $w_1 > 0.11$ if $w_r = 0.05 = 0.10$, These overstatements are in the area of 2 per cent of the natural expense reserve, considerably less than shown by the whole life age 35 table shown earlier, but still resulting in material overstatements of earnings. Real-world results indicate that the assumption of a level total-termination rate in renewal years understates the real difference when compared to the typical pattern of total-termination rates which grade down for a number of years after issue.

I recommend to the reader that he treat Mr. Pharr's paper as an excellent introduction to the theory of natural reserves but that he draw no conclusions from the comparative earnings shown in Table 1. These comparisons, are correct for the three-payment, four-year modified endowment described in the paper but have no valid extension to other plans.

Conclusions with respect to the effect on earnings of different reserving methods must be based on considerably more extensive studies involving realistic assumptions and plans.

Michael B. Hutchinson

My comments relate not so much to Mr. Pharr's paper itself, which is an excellent demonstration of the mechanics of the AICPA natural reserve method of adjusting earnings, but rather to the context in which the paper should (or perhaps, more important, should not) be regarded.

The paper is a demonstration of how *one* possible method of adjusting earnings works. It should not be regarded as a discussion of a variety of possible methods. The section on alternative techniques is not really a discussion of alternatives to the AICPA method but rather an examination of possible approximations using the natural reserve method as "a standard by which to judge the reasonableness of other techniques." The paper neither asks nor answers the question as to whether the AICPA method is universally appropriate.

The natural reserve method seems to have been widely accepted by both accountants and actuaries, largely, I feel, because the method, for the first time, provided a basis on which the two professions could communicate on the matter of adjusting earnings. If for no other reason than that, the development of the method must be regarded as a giant step forward. However, I feel that we, as actuaries, may be premature in accepting the AICPA method as the best available.

To be acceptable to an actuary, any theoretical method of adjusting earnings should be consistent with the techniques used by the actuary in setting his premium rates.

Acceptance by actuaries of the natural reserve method seems to rest on the fact that under the method "anticipated" earnings emerge in a manner consistent with "one of the traditional methods of expressing profit margins in life insurance premiums"—that is, as a level per cent of premiums. However, although the "level profit loading" concept is well entrenched in actuarial rate-making tradition, it is by no means the universal manner in which actuaries regard profit when they set premium rates. To the extent that different rate-making techniques exist, different methods of adjusting earnings are more appropriate.

An actuary may employ conservative assumptions in setting his premiums, counting for his profit on emerging experience more favorable than that reflected in premium assumptions. Such an actuary would anticipate a pattern of earnings emergence quite different from that assumed in the AICPA approach. The "risk release" method (or, more specifically, the limiting case described as the "completion of contract" method) described in the Appendix to the joint committee's report would be much more consistent with that actuary's rate-making approach.

Disciples of Anderson tend to regard profit in terms of a per cent yield on investment in new business. A consistent method of adjusting earnings would involve amortization of that initial investment. Other rate-making techniques may suggest other methods of adjusting earnings.

To summarize, I feel that the theoretically correct method used to adjust earnings should be consistent with the method used to set rates. Hopefully, the AICPA will permit a range of methods, thus allowing such consistency. Forcing an actuary to use someone else's rate-making techniques to adjust earnings makes no more sense than forcing him to use someone else's premiums assumptions.

Donald B. Maier

This paper is an interesting demonstration of the mechanics of applying a particular natural reserve concept and several other methods of determining yearly earnings to one peculiar plan of insurance. The steps one might use in applying these various methods to this plan are clearly demonstrated, and the extension of the application of these methods to more realistic traditional types of plans should not be difficult.

Because the basic assumptions chosen by Mr. Pharr, particularly the plan of insurance, are so unique, however, one can really draw no valid conclusions concerning the application of the various earnings bases to realistic situations. In particular, there is nothing in the paper to support the statement that "the principles and concepts demonstrated are applicable to . . . participating insurance."

The following is a list of comments, in no particular order with respect to importance, on the paper.

1. Minimum cash values calculated in accordance with the Standard Nonforfeiture Law are about \$30 at duration 1, \$95 at duration 2, and \$150 at duration 3, as opposed to Mr. Pharr's cash values of 0, 10, and 40. Certainly the cash value at the end of the premium-paying period would have to be the single premium on the tabular basis. Use of the legal minimums and Mr. Pharr's lapse assumptions would eliminate earnings in accordance with any method of calculation.

2. Mr. Pharr states that methods of arriving at earnings involving statutory reserves result in a "distorted deferment of earnings." This may or may not be so, but in this case it would appear that it is his peculiar plan that results in "distorted" earnings. The plan provides for the payment of \$1,000 at death in the fourth year and \$100 to those who survive the fourth year. This results in \$900 of earnings for each survivor who was supposed to have died according to the tabular basis, and Mr. Pharr has decided that ten more people should survive than would have in accordance with his tabular basis. The natural reserve method in the paper results in earnings being recognized when premiums are received. Since a substantial part of the earnings depends on the experience after the premium-paying period, it would, of course, be folly to have paid out those earnings to stockholders prior to the paid-up period.

3. In Section VIII Mr. Pharr shows earnings patterns under alternative techniques. Normally, earnings would be shown earlier under the natural reserve method (col. G) than under other methods. Surprisingly, column H, with earnings allocated on premium and investment income, shows higher earnings allocated to the early years. This results from the distribution of interest on retained earnings on the total income allocation base. If interest on retained earnings were treated separately in a manner similar to that used for the natural reserve basis, column H would show lower early earnings than column G.

Joseph C. Noback

The author is to be congratulated for submitting this paper for discussion at this meeting because his efforts provide us with a basis for discussing the December, 1970, exposure draft of the audit guide for life insurance companies. The paper is deficient in several ways:

1. It deals with only one plan of insurance, and that plan is an entirely fictitious one.
2. It does not establish a set of criteria for use in judging and comparing different methods of reporting earnings of life insurance companies.
3. It accepts the December, 1970, exposure draft method as the ideal method without critical evaluation.
4. It fails to mention the rather unusual treatment accorded single premium and other limited payment life policies in the 1970 expense draft.
5. It does not discuss annuities and health insurance.
6. It does not examine the principle of recoverability.
7. It fails to discuss the desirability of verifying assumptions or the need for adequate documentation.
8. Finally, while it recommends an alternative method for amortizing acquisition expenses, it fails to define this alternative method in precise terms and to give reasons for its widespread adoption.

In short, the paper treats a very complex subject in a very simplistic manner.

When the accountants attempt to restate the earnings of a life insurance company on a more meaningful basis, they will have to cope with a vast array of plans of insurance:

1. Endowment plans
2. Term plans
3. Family income plans
4. Double protection plans
5. Single premium plans
6. Twenty-payment life plans
7. Sixty-five life plans
8. Ordinary life insurance, and even
9. An extra-ordinary life insurance

They will also have to cope with

1. Loss-of-time benefits
2. Hospital-surgical benefits
3. Major medical benefits
4. Group life insurance plans
5. Group health insurance plans
6. Group annuity plans

If they are to judge the validity and applicability of the method described in the December, 1970, exposure draft, then this method must be applied to all these branches of the business and not only to a three-payment, four-year partial endowment plan.

The exposure draft states that life insurance policies are "long term contracts for the performance of services." It defines revenue as "premium income" and recommends that earnings be reported as a level percentage of premium income. This recommendation sounds reasonable and attractive. However, it may not stand critical evaluation.

Consider a block of $100 million of whole life insurance issued on medically examined lives all aged 35. The history of this block of business reveals that premium income is a declining function of time and that it drops rapidly during the first few years. As a consequence, under the exposure draft method, the maximum amount of earnings, from this closed block of business, is reported in the first year and relatively smaller amounts in subsequent years of the premium-paying period. In short, the premium income curve is like a ski slide or, perhaps, an equilateral hyperbola.

Since the exposure draft allocates earnings as a percentage of premium income, it seems to follow that the principal service provided by a life company is that of collecting premium income. How many policyholders would accept this proposition, namely, that the only service the life insurance company provides is to collect their premiums each year? (The widow who paid premiums on her husband's life insurance for several years after his death seems to have been convinced of that. When asked, she said, "He would have wanted it that way.")

Isn't it more reasonable to start with the premise that a life insurance company provides several services to its life insurance policyholders? The company assumes a number of risks: (1) mortality risks, (2) investment risks, (3) morbidity risks, (4) withdrawal risks, and (5) inflation risks. That is, the company assumes the risk that one or more of these elements will fluctuate adversely in future years; that more claims will occur than originally expected or that less interest will be earned than originally assumed; that the principal sum invested may be lost; that surrenders may exceed expectations; or that expenses will rise.

Without setting down any specific numbers, let us examine the total services provided by a closed block of business. Let us look at $100 million of whole life insurance issued on a medically examined basis to individuals aged 35 and focus attention on the mortality risk and the investment risk as the primary services purchased by the prospective policyholders. Earnings to be reported are a matter of timing. As a consequence, let us compare the first few policy years with the total life of the block of business under consideration.

Since these lives have all been subject to very careful underwriting and since they are only 35 years of age, the portion of the total mortality risk assumed in the first few policy years is relatively small. The major risk will occur about ten to twenty years after these policies were issued.

If we look at the investment risk, we find that, since acquisition expenses consume all the premium income in the first policy year, there is very little investment risk in the first few years. Again, the assets under this block of business will attain a maximum in fifteen to twenty years. Hence the maximum investment risk will occur at these *later* durations.

While the precise curve for any particular plan and age of issue will depend on the characteristics of the block of business being written, it would seem that, for most forms of permanent insurance, the curve of risk services provided to the policyholders is a bell-shaped curve. This curve will have a value close to zero the first year, attain a maximum between the tenth and twenty-fifth year, and then return to zero when the block of business terminates.

This general reasoning suggests that Mr. Pharr's paper may not reveal the significant underlying characteristics of the December, 1970, exposure draft method. It also suggests that Appendix B of the "Response of the Joint Actuarial Committee" has similar limitations.

It seems to me that further study is required. In that connection, it may be pertinent to report to the Society that, on May 15, 1971, Messrs. Kenneth Stringer and Paul Pinkerton, New York partners in the accounting firm of Haskins & Sells, notified the AICPA committee that they were engaged in a comprehensive study of the exposure draft method and that they would submit their findings shortly. In their study, Stringer and Pinkerton plan to examine, in a critical manner, the characteristics of the exposure draft method and certain other methods for restating earnings for a wide variety of insurance and annuity plans.

I am sure that we all welcome more discussion and study of this vital subject. In that way basic principles can be established.

Mel Stein

Mr. Pharr is to be congratulated for writing this timely elementary introduction to the natural reserve concept. Unfortunately, the contents of this paper are so simple that its sole value seems to be that it introduces the basic natural reserve concept in laymen's terms.

Sections IV-VI of this paper, which contain Projections 1-5, could have been replaced by the following definitions and equations, which would have taken up much less room in the *Transactions:*

$_tNR$ = Natural terminal reserve at end of policy year t;
$_tP^N$ = Natural reserve premium;
DB_t = Policy year t death claims;
GP_t = Gross premiums received in policy year t;
e_t = Expenses paid at beginning of policy year t;
C_t = Commissions paid at beginning of policy year t;
TLF_t = Tax, licenses, and fees paid at beginning of policy year t;
I_t = Policy year t investment income;
E_t = Policy year t "earnings";
AEF_t = Accumulated excess fund at end of policy year t;
GPF_t = Ratio of policy year t gross premium to policy year 1 gross premium;
S/M_t = Surrenders and maturities payable at end of policy year t;

$$P^N = \frac{\sum_{t=1}^{5} (DB_t/(1+i/2) + e_t + C_t + TLF_t)_{t-1}p_x(1+i)^{-(t-1)}}{\sum_{t=1}^{5} GPF_{t\ t-1}p_x(1+i)^{-(t-1)}};$$

$$\Delta AEF_t = I_t + (P^N - e_t - C_t - TLF_t - DB_t - S/M_t),$$

where

$$I_t = (AEF_{t-1} + P^N - e_t - C_t - TLF_t)i - DB_t\frac{i}{2};$$
$$AEF_t = AEF_{t-1} + \Delta AEF_t;$$
$$_tNR = AEF_t \div {}_tp_x.$$

Splitting the above equations into benefit and expense portions is self-explanatory.

Projection 3, whose purpose is to demonstrate that adjusted earnings are a constant percentage of collected premiums in each year, could have been replaced by the formulas below, which show that (under the arbitrary investment income definition used) this constant ratio is mathematically predetermined.

$$E_t = (GP_t - C_t - e_t - TLF_t)(1+i) - DB_t\left(1+\frac{i}{2}\right) - [AEF_t - AEF_{t-1}(1+i)];$$

$$AEF_t = (_tP^N - C_t - e_t - TLF_t)(1+i) - DB_t\left(1+\frac{i}{2}\right) + (1+i)AEF_{t-1};$$

$$AEF_t - (1+i)AEF_{t-1} = (_tP^N - C_t - e_t - TLF_t)(1+i) - DB_t\left(1+\frac{i}{2}\right);$$

thus

$$E_t = (GP_t - {}_tP^N)(1+i),$$

and

$$\frac{E_t}{GP_t} = \left(1 - \frac{_tP^N}{GP_t}\right)(1+i)$$

and is constant for all years, but *only* if i is constant for all years. The calendar-year calculations shown in Projections 6 and 7 are not supported by any formulas. I feel confident, however, that an assumption of all sales on July 1 (e.g., an even distribution of sales throughout the calendar year) was used and, because of practical considerations, would be used to develop calendar-year natural reserves. As most companies, sales are skewed, this approach can result in substantial distortion and may well be distinctly less accurate than policy-year mean reserves based on the *initial* and terminal reserves, calculated on an annual basis and offset by a due and deferred *modified* natural reserve premium asset. In any case the illustrations used are so limited in scope that no conclusions can be reached from the comparisons in the paper.

While Mr. Pharr is to be congratulated for introducing this subject to actuarial literature, it is hoped that more comprehensive, more technical, and more general papers on this topic will follow.

Ralph P. Walker

The author's paper serves a useful purpose in showing the earnings patterns under assumed conditions. We should also consider what happens when actual conditions depart from the assumed conditions. This, I believe, would demonstrate a great weakness of the natural reserve approach and would show how earnings are distorted by this concept. The natural reserve concept fails to take into account that, where current conditions depart from assumed conditions, there is a likelihood that future actual experience will depart from future assumed experience. The effect of this is either to accelerate earnings or to decelerate earnings as the actual experience departs from assumed experience. This may be shown by an example which is admittedly illogical but nevertheless proves the discontinuity in earnings under the natural reserve concept. Assume that there are no expenses and no withdrawals and that mortality is released according to the 1958 CSO Mortality Table. The interest assumption at the time of issue was 3½ per cent with a gross premium of $11.60 on the ordinary life plan at age 20. The natural reserve premium on these assumptions would be $8.51, with an annual profit of $3.09 if experience equals that assumed. If at the end of one year the interest rate declines to 2½ per cent and remains at this level for the life of the contract while all other assumed conditions are experienced, we have profits released in the manner shown in Table 1.

The severe discontinuity of earnings after the tenth year results from using the natural reserve concept with the assumptions "locked in" until the gross premium valuation produces greater reserves. It should be obvious that profits after the eleventh year are all zero, since the entire gross premium is used in providing benefits. The gross premium valuation will produce greater reserves after the eleventh year and smaller reserves prior to the ninth year than the natural reserve approach. The failure to revise future interest assumptions accelerates earnings in the early years and completely eliminates earnings in the later years. Is this a logical way to release earnings? Most accountants, I feel, would say that losses should not be deferred.

Is the natural reserve concept any more logical than the use of a gross premium valuation less the present value of the profit assumed at time of issue? This approach immediately recognizes all future gains or loses, and, while it, too, could be subject to a certain amount of manipulation, it has the advantage of requiring only one valuation for adjusted earnings instead of two. To say that there would not be two is to ignore the fact that actuaries do not have a crystal ball. I will readily admit that some of the assumptions that I have made in the past have not been experienced. I feel sure that the same is true of many other actuaries. Since the gross premium valuation would be applied on an aggregate basis and the difference between the various assumed experience factors and the actual experience factors would not all vary in the same direction over all periods of time, it would be necessary to make a gross premium valuation from time to time to check on the adequacy of natural reserves.

TABLE 1

Year	3½ Per Cent NLP Terminal Reserve or Natural Reserve under Issue Assumption	2½ Per Cent Gross Premium Valuation Reserve	Adjusted Earnings or Profit under Natural Reserve Concept
1...........	7.03	....	3.09
2...........	14.28	....	2.93
3...........	21.77	....	2.86
4...........	29.50	....	2.79
5...........	37.50	....	2.71
6...........	45.78	....	2.63
7...........	54.34	....	2.55
8...........	63.18	....	2.46
9...........	72.32	69.84	2.37
10...........	81.74	81.57	2.28
11...........	91.48	93.57	0.10
12...........	....	....	0

In a small company it is doubtful whether the additional information available to the stockholders is worth the extra cost of producing it. Since it is impossible to come up with the true earnings, it seems to me that a much more practical approach would be to use cash surrender values for policies with values and net level premium reserves for those with no values. Cash surrender values are a reasonably close approximation to asset shares. On the minimum cash value basis the effect is to amortize initial expenses of $20 per thousand plus 40 per cent of the adjusted premium plus 25 per cent of the adjusted premium on the plan or the ordinary life plan, whichever is less. There is a very real question whether companies with larger initial expenses should be allowed to amortize them over the period of the policy. This would have the further advantage of showing no loss or gain on surrender. This may not be true in actual fact but probably comes closer to actual fact than showing large losses on surrender under the natural reserve concept in early years and large gains on surrenders under the legal reserve basis. Such information would be much less costly to produce for most companies and should be accurate enough for all practical purposes. If I seem to depart from the purpose of the paper, it is because actuaries have not been given the opportunity of discussing the theory of the natural reserve concept—only its implementation.

Robert C. Winters

The absence in actuarial literature of any consideration of general-purpose financial statements for life insurance companies has hampered the recent efforts to deal with this subject. Mr. Pharr's paper is a welcome step toward filling this void.

The use of a three-pay, four-year endowment in the development simplifies the demonstrations, but necessarily at the price of generality. I suggest that Mr. Pharr's calculations should be regarded as illustrative and that they do not of themselves support any general conclusions. The range of possible plans of insurance and company situations is too broad to be covered by a single example, particularly one in which investment income is only 5 per cent of total income.

While I think firm conclusions are not warranted, the tables in the paper provide useful illustrations of alternative methods for reporting life insurance company earnings. I would like to offer two additional illustrations based on Mr. Pharr's example. The first is a table matching costs to revenue defined as premiums plus investment income (Table 1). This table differs from the results shown in column 17 of Appendix C in the paper. The approach taken in the paper allocates earnings on a basis which includes investment income on retained profit. Table 1 uses only the investment income on the investable funds after deduction of the profit each year. In this instance profit is regarded as a deduction at the end of the year rather than at the beginning, as suggested in Mr. Pharr's principle 6 (Sec. II). Leaving profit to the end of the year and then taking it out with a year's interest is both more tractable algebraically and closer to actual company operations. As the final line of the table shows, the earnings under this approach do emerge as a level percentage of premiums plus investment income, assuming that the actual experience factors match those assumed.

TABLE 1

	Policy Year				Total
	1	2	3	4	
Natural reserves, end of year........	($ 15,420)	$ 44,627	$ 88,498	.....	.....
Income:					
Premium..................................	$ 100,000	$ 80,000	$ 70,000	$ 0	$ 250,000
Investment...............................	(450)	3,095	5,858	4,371	12,874
Total.........................	$ 99,550	$ 83,095	$ 75,858	$ 4,371	$ 262,874
Benefits:					
Death, surrender, maturity.......	$ 5,000	$ 10,900	$ 21,200	$ 92,000	$ 129,100
Increase in reserves................	(15,420)	60,047	43,871	(88,498)	.....
Total........................	($ 10,420)	$ 70,947	$ 65,071	$ 3,502	$ 129,100
Expenses......................................	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 120,650
Adjusted earnings........................	$ 4,970	$ 4,148	$ 3,787	$ 219	$ 13,124
Adjusted earnings per $1,000 in force, beginning of year..........	$ 4.970	$ 5.185	$ 5.410	$ 0.337	.....
Adjusted earnings with all earnings retained.....................	$ 4,970	$ 4,446	$ 4,352	$ 1.045	$ 14,813
Adjusted earnings as per cent of total income.............................	5.0%	5.0%	5.0%	5.0%	5.0%

Table 2 shows earnings on the basis of the per cent completion of contract approach. Under this approach the cost matching includes recognition of the cost of deviations in the experience factors from the expected values. The amounts of deviations recognized are established at a level which makes the valuation premium equal the gross premium. There are many combinations of deviations that produce the result; the values in Table 2 reflect the following provisions for deviations:

Death—20 per cent higher than expected values in policy years 1 and 2, 15 per cent higher in policy year 3, and $6\frac{2}{3}$ per cent higher in policy year 4.

Lapse—20 per cent higher than expected value in policy year 1, 25 per cent lower in policy year 2, and 40 per cent lower in policy year 3.

Interest—0.21 per cent lower than expected value in all years.

Expense—No deviation in first-year expenses, general expenses 50 per cent higher than expected value in renewal years.

TABLE 2

	Policy Year				Total
	1	2	3	4	
Natural reserves, end of year	($ 11,463)	$ 46,804	$ 89,551	....	....
Income:					
Premium..................................	$ 100,000	$ 80,000	$ 70,000	$ 0	$ 250,000
Investment...............................	(450)	3,332	5,988	4,434	13,304
Total.........................	$ 99,550	$ 83,332	$ 75,988	$ 4,434	$ 263,304
Benefits:					
Death, surrender, maturity.......	$ 5,000	$ 10,900	$ 21,200	$ 92,000	$ 129,100
Increase in reserves................	(11,463)	58,267	42,747	(89,331)	....
Total.........................	($ 6,463)	$ 69,167	$ 63,947	$ 2,449	$ 129,100
Expenses....................................	$ 105,000	$ 8,000	$ 7,000	$ 650	$ 120,650
Adjusted earnings.......................	$ 1.013	$ 6,165	$ 5,041	$ 1,335	$ 13,554
Adjusted earnings per $1,000 in force, beginning of year..........	1.013	$ 7.706	$ 7.201	$ 2.054	....
Adjusted earnings with all earnings retained....................	$ 1,013	$ 6,226	$ 5,476	$ 2,098	$ 14,813

Robert N. Powell

Mr. Pharr is to be complimented on enriching the literature with this paper, which so clearly sets forth the conceptual basis for natural reserves. In Projections 6 and 7 Mr. Pharr illustrates the derivation and effect on earnings of a "theoretical" basis for mean reserves and goes on to state that "if traditional actuarial methods had been used ... earnings in Projection 7 would have been significantly different from those in Projection 3."

To emphasize this important point, Tables 1 and 2 compare the reserves per $1,000 and the earnings developed by Mr. Pharr with those developed using the "traditional" mean reserve approach of one-half of the initial (after deducting expenses assumed payable at the beginning of the policy year) and terminal reserve.

Although the total earnings (without interest on prior earnings) are the same on either basis, the traditional approach creates a substantial mismatching of profits. Use of the traditional mean reserve, in addition to producing a substantially wrong incidence of profits, will reduce the usefulness of the management information that is available from this approach.

TABLE 1
MEAN RESERVE PER $1,000

	Year				
	1	2	3	4	5
Theoretical.........	($12.76)	$61.56	$140.55	$118.54	$0
Traditional.........	($14.77)	$64.38	$142.10	$117.42	$0

TABLE 2
Adjusted Earnings Using Natural Reserve Increases

	Year					Total
	1	2	3	4	5	
Theoretical...............	$4,935	$3,948	$3,454	$ 0	$ 0	$12,337
Traditional...............	$6,935	($ 291)	$4,621	$1,781	($709)	$12,337

Author's Review of Discussion

Joe B. Pharr

I express my sincere thanks to the gentlemen who have taken the time to provide written discussions on the natural reserve concept and its application to adjustment of life insurance earnings. Opinions expressed by the discussants provide a valuable reference source for those actuaries concerned with the application of the natural reserve concept. In the following paragraphs I have attempted to summarize the most important points raised by the discussants.

The natural reserve concept described treats premium income as revenue. It is pointed out that other definitions of revenue may be as valid as premium income. It has been suggested that revenue be equal to premiums plus investment income or that revenue be spread over the life of the contract in relation to the premium in-force or in relation to the points in time at which a life insurance company is "released" from its risks such as mortality, lapse, and interest.

Several of the discussants warned of the simplistic nature of the model used to demonstrate natural reserve concepts and principles. Warnings were issued on drawing general conclusions from earnings patterns under alternate techniques demonstrated in the paper. The primary purpose of the paper was to demonstrate, with admittedly a very simplified model, basic principles and concepts underlying the natural reserve concept. A secondary purpose was to demonstrate the nature of differences in life insurance earnings patterns produced by using possible alternatives (or modifications) to a "pure" natural reserve approach. Several of these alternatives have either been recently used by life companies or are being contemplated as alternatives to the pure natural reserve approach. With these points in mind, I add my warning to that of the discussants, that a reader should beware of drawing general conclusions from the simplified model employed in the paper. The only rule for adjustment of life insurance earnings with natural reserves is that "there is no universally exploitable rule."

Applicability of the natural reserve concept to mutual life insurance companies has been questioned by a number of the discussants.

As pointed out in the "Response of the Joint Actuarial Committee on Financial Reporting to the December, 1970 Exposure Draft of Audits of Life Insurance Companies," the natural reserve concept is one case of a family of reserving methods. This point has been echoed by several of the discussants.

Concern over federal income tax implications has been expressed. Points made to alleviate these concerns are (1) that the United States government is not "fooled" by statutory earnings and has established federal income tax laws to produce a desired amount of tax revenue; (2) that neither the Treasury Department nor the life insurance industry is interested in changing the federal tax laws, because of adjusted earnings, due to the extreme complexity of the law; and (3) although fears have been expressed with reference to audit guides recently issued for casualty insurance companies and other industries, none of these fears has been justified, since the movement to generally accepted accounting principles in these guides did not bring about changes in the tax laws. A point which supports reservations about federal income tax implications is that political pressures will mount, once companies show higher earnings and higher surplus than under statutory accounting principles. This area of political pressure could become very real.

Interest has been shown in investment income calculations for the calendar-year projections. Projection 6 investment income calculations were made as shown in Table 1.

My own view on the application of the natural reserve concept of life insurance earnings is that I favor a definition of revenue equal to premium income when used in conjunction with reasonable actuarial assumptions typically found to be inherent in gross premium calculations. These reasonable (or realistic) actuarial assumptions, sometimes described as most likely, are in practice usually conservative—particularly in the interest and mortality areas. The combination of revenue equal to premium income with actuarial assumptions which are on the conservative side in essence results in the use of a "definition" of revenue equal to premium income plus investment income and also gives a margin (although not scientifically established) for release from risk.

TABLE 1
PROJECTION 6 INVESTMENT INCOME (CALENDAR YEAR)

Calendar Year t	Investment Income (or Loss of Investment Income) At 6 Per Cent on								Total
	Premiums Less Per Cent of Premium Expenses*		General Expense		Death Benefits		Natural Reserve at Beginning of Year		
	Policy Year		Policy Year		Policy Year		Policy Year		
	t	t–1	t	t–1	t	t–1	t	t–1	
1.........	$ 512	....	($ 810)	....	0	....	$ 0	....	($ 298)
2.........	2,066	$ 512	(24)	($ 810)	0	($150)	(470)	....	1,124
3.........	1,808	2,066	(21)	(24)	0	(300)	1,329	($470)	4,388
4.........	....	1,807	(20)	(21)	0	(600)	2,649	1,329	5,144
5.........	....	....	....	(20)	...	(900)	....	2,649	1,729
									$12,087

* Commissions and premium tax.

Despite the caution, expressed in the present exposure draft, on gratuitous references to actuaries, I would like to express my sincere appreciation for the time and effort many of my associates took to review initial drafts of the paper. Although it is not appropriate to record all the names of these fine individuals in this "author's review," I would be remiss if I did not take this opportunity to mention the encouragement and incentive provided by Tommy Bowles; the "fathership" of the natural reserve concept begun several years ago by Gary Corbett; and the encouragement and critique—but mostly encouragement—provided by Sam Turner, without whose efforts the paper would have never been completed.