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AN APPROACH TO RESERVES FOR TERM INSURANCE CONVERSION RIGHTS

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ABSTRACT

The paper sets forth a procedure, based on actual experience, for determining extra life insurance reserves for term insurance conversion rights for annual statement purposes. Illustrative reserves for both the prior-conversion period and the postconversion period are presented for the category of nonrenewal level benefit term plans which do not provide for automatic conversion. The results reflect the latest experience (1966–71) published in *TSA, 1973 Reports*. A number of special tables are provided. These tables, which were developed to produce the illustrations, include (*a*) age-specific conversion rate scales; (*b*) individual age mortality rates for the 1955–60 Male Select Basic Tables; and (*c*) a term plan survivor table.

I. INTRODUCTION

A TYPICAL conversion right under ordinary term insurance policies permits the insured to exchange his policy during a specified period for a standard whole life policy without evidence of insurability. In recent years the Society of Actuaries has published three studies of experience associated with this conversion privilege (*TSA Reports, 1963, 1968*, and *1973*). These studies by the Society, as well as others, have demonstrated that the death rates experienced under such conversion policies are substantially higher than those experienced under similar policies issued to new applicants rated as standard in accordance with regular underwriting procedures.

Papers discussing various aspects of the measurement of the extra mortality costs associated with conversion rights have been published in actuarial journals ever since Dr. T. B. Sprague presented his monumental paper on select mortality tables in 1878, nearly one hundred years ago [13–15].[1] These earlier papers either were based on very limited experience or relied heavily on the use of general solutions to evaluation problems derived from the select mortality concepts introduced by Dr.

[1] A number of papers that have been published on the subject of evaluating conversion rights are listed in the References.

Sprague. This reliance on select mortality theory is quite understandable, since for analytical purposes the volume of data concerning the actual experience of conversion policies was, until recently, indeed meager.

Many life insurance companies have formally recognized the fact that additional financial liabilities have been imposed on their operations because the standard premium rates paid by the holders of conversion policies do not adequately support the standard insurance benefits granted to this class of lives, which experiences substandard mortality. This recognition is given in the form of a special category of life insurance reserves held as an annual statement liability for the substandard mortality costs associated with conversion rights.

II. METHODOLOGY

The purpose of this paper is threefold: (1) to set forth a procedure based on actual experience data for determining, for annual statement purposes, extra life insurance reserves for term insurance conversion rights; (2) to present tabular functions, derived from the most recent published experience data, needed to calculate such reserves; and (3) to illustrate the results of the procedure as it applies to a specific category of term insurance plans. In effect, this paper describes a practical application of the rationale underlying the Society's most recent study, "Experience under Term Conversions and Guaranteed Insurability Options between 1966 and 1971 Policy Anniversaries" [3] (hereinafter "the 1966–71 Study"), as set forth in Appendix II of that study.

The procedure utilizes two scales of death rates, which reflect mortality experienced by two distinct groups of conversion lives: conversion group 1, representing experience under conversion policies issued prior to the end of their term policy conversion periods, and conversion group 2, representing experience under conversion policies issued at the end of their conversion periods. All three of the Society's latest studies on this subject indicate that the mortality rates for group 2 conversions are distinctly higher than the corresponding rates for group 1 conversions.

In addition, the procedure involves the use of two age-specific conversion rate scales, which were developed from data compiled for the 1966–71 Study. The author believes that this is the first time that age-specific scales of this type based upon intercompany experience have been published.

III. THE "ALL OTHER IDENTIFIABLE TERM PLANS" CATEGORY

The 1966–71 Study presented experience for four categories of term plans: plans providing for automatic conversions, renewable term plans, decreasing term plans, and "all other identifiable" term plans. The last

category embraces essentially all nonrenewal level benefit term plans that do not provide for automatic conversion.

The remainder of this paper will be devoted to a discussion of the calculation of terminal and mean reserves based upon the rationale and the experience presented in the 1966–71 Study for this last category designated as "all other" term plans. Illustrative reserves and net premiums, together with certain functions used for their calculation, are shown herein for a specific term plan with a seven-year conversion period. The reader should observe that the reserves illustrated were developed with the intent of reflecting the mortality experience for the period 1955–60 rather than for 1966–71, for which the 1966–71 Study reported aggregate mortality ratios of 90 per cent for the group 1 conversions under the "all other" term plan category (Table 16, p. 161) and 92.7 per cent for comparable regular standard business (Sec. A[3.5], p. 170).

Table 1 presents extra net single premium reserves applicable to individual policies that are in force during the postconversion period. Table 2 presents terminal reserves applicable to individual term policies that are in force during the period prior to the exercise of conversion rights. A short summary of the special notation defined in this paper is given in Appendix III.

The values shown in Tables 1 and 2 were derived according to a number of assumptions that will be disclosed during the course of the text. Preliminary to further analysis, the following four points are presented in the interest of clarity:

1. All conversion policies are issued at the end of a policy year.
2. The right to convert may be exercised only at the end of a policy year but not later than the end of the seventh policy year.
3. The conversion policy is a standard whole life plan with level annual premiums payable for the whole of life.
4. Since annual statement valuation standards for the various life insurance benefits traditionally do not incorporate withdrawal rates, the reserve values shown herein were developed under this traditional approach. They do, however, incorporate conversion rates.

IV. THE POSTCONVERSION PERIOD

The net single premiums shown in Table 1 for the extra mortality costs for the beginning of conversion policy year 1 were evaluated by the application of formulas (1) and (2) below.

The net single premiums shown in Table 1 for durations 6 and over may be duplicated under regular prospective valuation procedures by using an obvious modification of equation (1) to account for the excess

TABLE 1

CONVERSION POLICY
WHOLE LIFE PLAN—$1,000 SUM INSURED
7-YEAR NONAUTOMATIC CONVERSION PERIOD
3 PER CENT

Issue Age		Net Single Premium for Future Extra Mortality Costs Valued at Beginning of Policy Year						
Term Plan x	Life Plan y	1	6	11	16	21	26	31
22	23	$ 0.46	$ 0.28	$ 0.11	$ 0.00	.....	.....	.....
	24	0.83	0.50	0.17	0.00	.....	.....	.....
	25	1.09	0.66	0.16	0.00	.....	.....	.....
	26	1.32	0.81	0.12	0.00	.....	.....	.....
	27	1.52	0.89	0.09	0.00	.....	.....	.....
	28	1.72	0.92	0.17	0.00	.....	.....	.....
	29	12.91	13.23	13.72	14.99	$15.99	$16.57	$16.65
32	33	0.79	0.61	0.41	0.00	.....	.....	.....
	34	1.66	1.42	0.96	0.00	.....	.....	.....
	35	2.55	2.20	1.55	0.00	.....	.....	.....
	36	3.56	3.11	2.04	0.00	.....	.....	.....
	37	4.67	3.96	2.43	0.00	.....	.....	.....
	38	5.92	4.96	2.89	0.00	.....	.....	.....
	39	22.96	23.22	21.65	18.99	19.08	18.32	16.64
42	43	2.53	1.63	1.28	0.00	.....	.....	.....
	44	5.00	3.35	2.51	0.00	.....	.....	.....
	45	7.67	5.37	3.90	0.00	.....	.....	.....
	46	10.57	7.72	5.47	0.00	.....	.....	.....
	47	13.86	10.36	7.52	0.00	.....	.....	.....
	48	17.31	13.32	9.20	0.00	.....	.....	.....
	49	42.74	39.44	34.22	22.27	20.22	16.69	11.64
52	53	7.49	4.62	4.23	0.00	.....	.....	.....
	54	14.87	9.31	8.72	0.00	.....	.....	.....
	55	22.31	14.83	13.25	0.00	.....	.....	.....
	56	30.27	21.41	18.01	0.00	.....	.....	.....
	57	39.12	28.76	23.33	0.00	.....	.....	.....
	58	47.95	37.31	25.44	0.00	.....	.....	.....
	59	84.66	74.33	53.99	21.81	15.22	9.06	3.75

TABLE 2

NONRENEWABLE LEVEL TERM PLAN
7-YEAR NONAUTOMATIC CONVERSION PERIOD
3 PER CENT
($1,000 Sum Insured Conversion Benefit)

End of Policy Year t	Terminal Reserve* for Term Plan Issue Age			
	22	32	42	52
1	$0.39	$0.95	$ 2.08	$ 3.86
2	0.79	1.95	4.18	7.54
3	1.20	2.98	6.32	11.08
4	1.64	4.07	8.49	14.47
5	2.10	5.20	10.67	17.73
6	2.61	6.37	12.81	20.82
7	3.15	7.58	14.92	23.79

* Per term plan policy in force at end of policy year t just *prior* to exercise of conversion rights.

mortality costs associated with the later policy years. The notation in equations (1) and (2) is to be used with the understanding that the interest rate is fixed (3 per cent for the illustrations herein).

$$A^{(j)}_{(x,y)} = \sum_{t=1}^{\infty} v^t G^{(j)}_{(x,y,t-1)} \overline{AR}_{(y,t)} \tag{1}$$

is the net single premium at issue date of conversion policy, per \$1 of sum insured, and

$$G^{(j)}_{(x,y,t-1)} = {}_{t-1}p^{(j)}_{(x,y)} \overline{Eq}^{(j)}_{(x,y,t-1)} \tag{2}$$

is that part of $A^{(j)}_{(x,y)}$ that represents the extra cost of mortality for policy year t discounted to age y for mortality but not for interest, per \$1 amount at risk.

In the foregoing formulas, x is the issue age of the term policy, y is the issue age of the conversion policy, and $\overline{AR}_{(y,t)}$ is the amount at risk for the conversion policy year t. For the purposes of illustration, values of $\overline{AR}_{(y,t)}$ were set equal to $(1 - {}_tV_y)$, where ${}_tV_y$ represents the terminal reserve at the end of policy year t for a level premium whole life plan based on the 1958 Commissioners Standard Ordinary Table with 3 per cent interest [11]. A discussion of the other functions required for equations (1) and (2) follows.

V. POSTCONVERSION MORTALITY RATES

Data for the 1966–71 Study were assembled under the assumption that death rates for each category of conversion policy experience would depend primarily on two variables—the term plan issue age and the duration measured from the issue date of the term plans, provided that the conversions at the end of the conversion period were separated from the earlier issues. The author used this same assumption in the preparation of illustrations, since, in his opinion, the results of the 1966–71 Study appear to give reasonable support to that position.

The index $j = 1$ for equation (2) indicates experience for conversion group 1, conversion policies issued before the end of the conversion period m; the index $j = 2$ indicates conversion group 2, conversion policies issued at the end of the conversion period. Thus, in equation (2), ${}_{t-1}p^{(j)}_{(x,y)}$ is used to represent the probability that a conversion policy indexed by $j = 1$ or $j = 2$ will enter its policy year duration t.

Section A(3.5) of the 1966–71 Study indicates for the "all other" term category that the mortality rates for group 2 conversions were approximately 10 per cent higher than those for group 1. Accordingly, the author used the assumption that group 2 mortality rates for attained

ages under 76 were 10 per cent higher than the corresponding rates for group 1. For attained ages 76 and over, the 10 per cent excess was reduced linearly over a twenty-year period.

Since the 1955–60 Basic Tables show mortality rates only for central ages, interpolated values were used for intermediate ages. These interpolated rates, as shown in Appendix I, were used for the illustrations shown herein.

The second term of equation (2), $\overline{Eq}^{(j)}_{(x,y,t-1)}$, as defined below in equation (3), was used to represent the extra mortality cost for policy year t per unit of amount at risk.

$$\overline{Eq}^{(j)}_{(x,y,t-1)} = f_z^{(j)} q_{[x]+y-x+t-1} - q_{[y]+t-1}, \tag{3}$$

where

$f_z^{(1)} = 1$ for conversion group 1;

$f_z^{(2)} = 1.1$ for conversion group 2 when $z \leq 75$

$= 1.1 - 0.005(z - 75)$ for conversion group 2 when $z > 75$;

$z =$ Attained age at beginning of policy year t.

The values for the last term in equation (3), $q_{[y]+t}$, are also those derived from the interpolated 1955–60 Select Basic Tables. It should be noted that the values of $\overline{Eq}^{(j)}_{(x,y,t-1)}$ become zero in the case of conversion group 1 when t exceeds 15.

The reader should observe that the values of $G^{(j)}_{(x,y,t-1)}$ based on the assumptions used in this paper would differ slightly from those based on a theoretical nicety which would consider the effect of separate persistency rates for conversion policies and for comparable regular standard whole life policies.

VI. THE PRIOR-CONVERSION PERIOD

The terminal reserves shown in Table 2 are those which are applicable to term plans in force at the end of policy year t just prior to the exercise of conversion rights. These reserves for a particular issue age were based on the valuation net level annual premiums defined in equation (4). These premiums per $1 of conversion sum insured benefit are considered to be payable by the term policy survivors, at the beginning of each policy year during the conversion period. The valuation net single premiums required as of the date of issue were derived according to equations (4) and (5). The notation for equations (4) and (5) implies a fixed interest rate (3 per cent) and a fixed conversion period of $m = 7$ years. Values of auxiliary commutation functions $F_x^{(j)}$, D_x^T, and N_x^T for evaluating

equations (4) and (5) are given in Appendix II. The superscript T (for term policies) used herein designates the prior-conversion period.

$$P^T_{(x,m)} = A^T_{(x,m)} \div \ddot{a}^T_{x:\overline{m}|}, \tag{4}$$

$$\begin{aligned} A^T_{(x,m)} &= \sum_{t=1}^{m} v^t {}_tp^T_{(x,t-1)} p_{x+t-1} e^{(j)}_{x+t} A^{(j)}_{(x,x+t)} \\ &= \sum_{t=1}^{m} F^{(j)}_{x+t} A^{(j)}_{(x,x+t)} \div D^T_x, \end{aligned} \tag{5}$$

where

$e^{(j)}_{x+t}$ = Conversion rate at end of policy year t when $t < m$ for conversion group 1 and when $t = m$ for conversion group 2;

$A^{(j)}_{(x,x+t)}$ = Net single premium for conversion costs at attained age $x + t$ computed according to formula (1) shown in Section IV;

p_x = $(1 - q_x)$, from the 1958 CSO Table;

${}_tp^T_{(x,t-1)}$ = Probability that a term policy issued at age x will enter policy year t after all conversion rights have been exercised $(t \leq m)$;

$\ddot{a}^T_{x:\overline{m}|}$ = Annuity due of \$1 payable for each term policy with issue age x which enters, after conversion rights have been exercised, into each policy year during an m-year conversion period

$$= \sum_{t=1}^{m} v^{t-1} {}_tp^T_{(x,t-1)}$$

$$= (N^T_x - N^T_{x+m}) \div D^T_x.$$

Table 3 shows the tabular net level annual and net single premiums valued as of the date of issue, which were derived according to equations

TABLE 3

NONRENEWABLE LEVEL TERM PLAN
7-YEAR NONAUTOMATIC CONVERSION PERIOD
3 PER CENT

(\$1,000 Sum Insured Conversion Benefit)

Term Plan Issue Age	Single Premium $1{,}000A^T_{(x,7)}$	Annual Premium $1{,}000P^T_{(x,7)}$	Annuity Due $\ddot{a}^T_{x:\overline{7}|}$
22	\$2.02	\$0.38	\$5.34
32	4.68	0.92	5.08
42	9.88	2.01	4.92
52	18.61	3.71	5.02

(4) and (5) to produce the illustrations given in Tables 2 and 6. Details concerning the procedure used to calculate the reserves shown in these two tables are given in Section IX, which discusses the subject of mean reserves for the prior-conversion period.

VII. CONVERSION RATES

The solution to equation (5) requires a choice between the two different sets of conversion rates mentioned in the Introduction: one set indexed by $j = 1$ to represent the period prior to the end of the conversion period and another set indexed by $j = 2$ to represent the end of that period. Table 4 shows the rates used for the computation of the illustrative reserves shown in Table 2. The age-specific conversion rates shown in Table 4 were derived by applying a third-degree formula which repro-

TABLE 4

NONRENEWABLE LEVEL TERM PLAN
CONVERSION RATES

Attained Age y	During Conversion Period $e_y^{(1)}$	At End of Conversion Period $e_y^{(2)}$	Attained Age y	During Conversion Period $e_y^{(1)}$	At End of Conversion Period $e_y^{(2)}$
20	5.8%	12.5%	45	9.0%	35.0%
21	5.9	14.0	46	9.0	35.1
22	6.0	15.4	47	9.0	35.1
23	6.1	16.8	48	8.9	35.0
24	6.2	18.2	49	8.8	34.9
25	6.4	19.5	50	8.7	34.6
26	6.5	20.8	51	8.5	34.2
27	6.7	22.1	52	8.3	33.8
28	6.9	23.3	53	8.1	33.3
29	7.0	24.4	54	7.8	32.7
30	7.2	25.5	55	7.5	31.9
31	7.4	26.6	56	7.1	31.1
32	7.6	27.6	57	6.7	30.2
33	7.8	28.5	58	6.3	29.2
34	7.9	29.4	59	5.8	28.1
35	8.1	30.3	60	5.2	26.9
36	8.2	31.1	61	4.6	25.5
37	8.4	31.8	62	4.0	24.1
38	8.5	32.4	63	3.3	22.5
39	8.7	33.0	64	2.5	20.9
40	8.8	33.5	65	.....	16.7
41	8.9	34.0			
42	8.9	34.4			
43	9.0	37.7			
44	9.0	34.9			

duced the central age values shown in Tables 1 and 2 of the 1966–71 Study for the "all other identifiable" term plans category. The parameters for this formula were obtained by the method of least squares, with weighting by the actual number of lives exposed to conversion as derived from the same Tables 1 and 2.

The reader should recognize that the conversion rate for any age group represents the aggregate experience of the contributing companies. As indicated by the range of individual company conversion rates shown in Tables 1 and 2 of the 1966–71 Study, the age-specific conversion rates which might be experienced by any individual company could be considerably higher or lower than those given in Table D of the 1966–71 Study. In this connection, reference should be made to Section A(3.90) of that study, which notes that the coefficients of correlation relating aggregate conversion rates for the "all other" term plan category to the mortality ratios experienced under the associated conversion policies "appear to be quite significant in a negative sense."

VIII. PRIOR-CONVERSION PERIOD SURVIVOR RATES

A valuation standard is needed for equation (5) in order to assess the values of ${}_{t-1}p^{T}_{(x)}$, the probability that a term policy with issue age x will enter policy year t with due consideration of the probabilities of conversion which are applicable prior to or at the end of each policy year. Values of the function ${}_{t-1}p^{T}_{(x)}$ are required also to evaluate the annuity due which is defined in equation (4).

We note that the current valuation standard generally being used to evaluate the death benefits of ordinary term insurance policies is the 1958 CSO Table. Since one purpose of this paper is to consider a design for reserves which would be acceptable for annual statement valuation requirements, the author considered it appropriate to use values of $\ddot{a}^{T}_{x:\overline{t}|}$ and ${}_{t-1}p^{T}_{(x)}$ based on the published 1958 CSO Table, with due modification to reflect the introduction of conversion rates.

The reader should recognize that reserves constructed with functions based on the 1958 CSO Table [11] should be regarded as approximations to those based on a more refined standard which would reflect fully the select withdrawal and mortality rates experienced during both prior- and postconversion periods.

Table 5 presents the term plan survivor table which was constructed to derive values of ${}_{t-1}p^{T}_{(x)}$. Appendix II shows a number of valuation functions that were used to derive the reserves and related values shown in Tables 2, 3, and 6.

The following definitions are applicable to Table 5:

l_x^T = "Survivors," the number of term policies included in l_{x-1}^T entrants at age $x-1$ that survive to enter the policy year commencing at age x (it is assumed that the conversion period has not expired)
$= l_{x-1}^T p_{x-1} - n_x^{(1)}$, where $p_x = 1 - q_x$, from the 1958 CSO Table;

$n_x^{(1)}$ = Number of group 1 conversions at attained age x arising from l_{x-1}^T entrants
$= l_{x-1}^T p_{x-1} e_x^{(1)}$;

$n_x^{(2)}$ = Number of group 2 conversions at attained age x arising from l_{x-1}^T entrants under the assumption that the conversion period expires at attained age x
$= l_{x-1}^T p_{x-1} e_x^{(2)}$.

TABLE 5

TERM PLAN SURVIVOR TABLE

Age x	Survivors l_x^T	Number of Conversions		Age x	Survivors l_x^T	Number of Conversions	
		Before End of Conversion Period $n_x^{(1)}$	At End of Conversion Period $n_x^{(2)}$			Before End of Conversion Period $n_x^{(1)}$	At End of Conversion Period $n_x^{(2)}$
20	1,000,000	.....	.....	45	128,031	12,663	49,243
21	939,320	58,890	139,749	46	115,885	11,461	44,698
22	881,345	56,256	144,391	47	104,840	10,369	40,438
23	826,041	53,665	147,791	48	94,902	9,271	36,461
24	773,365	51,115	150,055	49	85,949	8,293	32,890
25	722,485	49,403	150,518	50	77,875	7,421	29,512
26	674,223	46,868	149,987	51	70,663	6,564	26,412
27	627,817	45,085	148,711	52	64,208	5,811	23,666
28	583,337	43,231	145,990	53	58,419	5,149	21,168
29	541,401	40,752	142,045	54	53,276	4,507	18,895
30	501,375	38,900	137,770	55	48,694	3,948	16,793
31	463,285	37,022	133,082	56	44,649	3,412	14,947
32	427,139	35,131	127,587	57	41,066	2,949	13,293
33	392,938	33,240	121,461	58	37,881	2,547	11,805
34	361,055	30,971	115,256	59	35,077	2,160	10,464
35	331,011	29,177	109,137	60	32,635	1,790	9,260
36	303,107	27,073	102,686	61	30,500	1,471	8,153
37	276,913	25,394	96,134	62	28,629	1,193	7,187
38	252,667	23,471	89,469	63	27,011	922	6,285
39	229,990	21,916	83,129	64	25,636	657	5,495
40	209,071	20,172	76,796	65	.....	.....	4,157
41	189,790	18,543	70,833				
42	172,234	16,827	65,037				
43	156,080	15,436	64,662				
44	141,390	13,983	54,225				

IX. CALCULATION OF MEAN RESERVES

Mean reserves for the postconversion period may be obtained directly by simple interpolation between consecutive values of a network of single premiums of the type illustrated in Table 1.

Illustrative mean reserves for the prior-conversion period are shown in Table 6. The calculation of mean reserves for the prior-conversion period requires the definition of a special "prior election" terminal reserve that arises from the use of election rates and the assumption that all conversion policies are issued at the end of a policy year. We first define equations (6) and (7), which are applicable only to the final conversion year

TABLE 6

NONRENEWABLE LEVEL TERM PLAN
7-YEAR NONAUTOMATIC CONVERSION PERIOD
3 PER CENT
($1,000 Sum Insured Conversion Benefit)

POLICY YEAR t	MEAN RESERVE FOR TERM PLAN ISSUE AGE			
	22	32	42	52
1.....	$0.39	$0.94	$ 2.04	$ 3.78
2.....	0.77	1.91	4.11	7.39
3.....	1.18	2.94	6.22	10.85
4.....	1.61	4.01	8.35	14.17
5.....	2.07	5.12	10.48	17.35
6.....	2.57	6.27	12.59	20.36
7.....	3.10	7.46	14.65	23.25

m. The mean reserve calculation for policy duration m follows from equation (8).

$${}_mV^T_{(x,m)} = \text{"Prior conversion" extra terminal reserve at attained age } x+m, \text{ under a policy with issue age } x, \text{ that is required to provide the cost of conversion for a sum insured of \$1; this is the requirement per term plan policy which is in force at age } x+m \text{ just prior to the possible exercise of the final conversion privilege} \tag{6}$$

$$= e^{(2)}_{x+m} A^{(2)}_{(x,x+m)} ;$$

$${}_mIV^T_{(x,m)} = \text{Initial reserve required at age } x+m-1 \text{ to support } {}_mV^T_{(x,m)} \tag{7}$$

$$= {}_mV^T_{(x,m)}\ {}_1E_{x+m-1}, \text{ where } {}_1E_x \text{ is the one-year pure endowment function, from the 1958 CSO Table (see Appendix II);}$$

$$
\begin{aligned}
{}_mMV^T_{(x,m)} &= \text{Mean reserve for policy year } m \\
&= 0.5[{}_mV^T_{(x,m)} + {}_mIV^T_{(x,m)}] \,.
\end{aligned} \tag{8}
$$

For policy-year durations less than m, we may obtain "prior-conversion" terminal reserves by the recursive formula (9). Initial reserves and mean reserves follow by the application of obvious modifications of formulas (7) and (8).

$$
\begin{aligned}
V^T_{(x,m)} &= \text{"Prior-conversion" terminal reserve at end of policy year } t < m \\
&= e^{(1)}_{x+t}A^{(1)}_{(x,x+t)} + (1 - e^{(1)}_{x+t})[{}_{t+1}IV^T_{(x,m)} - P^T_{(x,m)}] \,.
\end{aligned} \tag{9}
$$

X. CONCLUSION

This paper has presented a number of functions required to evaluate conversion rights for a specific term plan category, namely, nonrenewable level benefit term plans with level premiums and with nonautomatic conversion periods. The reserves illustrated for a specific conversion period ($m = 7$) were computed according to a set of assumptions which were deemed to be appropriate for annual statement purposes.

Companies offer many types of nonrenewable level term plans. It is quite possible that the extra reserves required for some of these plans could be evaluated directly from the values shown in this paper. For example, the functions shown herein can accommodate any conversion period expiring up to age 65, provided that all other stated assumptions still hold. If these assumptions do not hold, then, of course, new calculations would have to be made to reflect the changed conditions.

The author hopes that the results presented here will encourage companies to establish extra valuation reserves based on procedures which will combine the results of actual experience with certain aspects of select mortality theory. The author also hopes that, on the basis of the concepts presented here, some member of the Society will accept the challenge to formulate comparable valuation procedures for other types of term plans, including the other three categories covered by the 1966–71 Study, namely, plans providing for automatic conversion, renewable term plans, and decreasing term plans. A further challenge is presented to the Society to collect additional experience for guaranteed insurability options, a subject covered only in part by the 1966–71 Study, in order to establish a basis for formulating comparable valuation procedures for this class of business.

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REFERENCES

1. *American-Canadian Mortality Investigation*, VII, 11.
2. CAMMACK, E. E. "Premiums for Nonparticipating Life Insurance," *TASA*, XX, 379.
3. "Experience under Term Conversions and Guaranteed Insurability Options between 1966 and 1971 Policy Anniversaries," *TSA*, *1973 Reports*.
4. FASSEL, ELGIN G. "Term Conversion Option," *TSA*, I, 177.
5. GRIFFIN, FRANK L., JR. "A New Approach to the Problem of Term Insurance Conversion Costs," *RAIA*, XXXI, 374.
6. HUNTINGTON, HENRY S. "Derivation Premium Rates for Renewable Term Insurance," *TSA*, X, 329.
7. ———. "Gross Premium Rates for Renewable Term Insurance," *TSA*, XII, 526.
8. JOHNSTON, FREDERICK H. "Convertible Term Business," *TASA*, XXII, 466.
9. "1955–60 Basic Tables," Tables 1 and 2, *TSA*, *1962 Reports*.
10. PAPPS, P. C. H. "Mortality Experience under Term Policies and under Policies Issued at Old Ages," *TASA*, XXIV, 304.
11. Society of Actuaries. *Monetary Tables Based on 1958 CSO and CET Mortality Tables and 3% Interest, Curtate Functions*. Vol. I. 1961.
12. ———. *Monetary Tables Based on 1958 CSO Mortality Tables and 3% Interest, Curtate Functions*. Vol. II. 1961.
13. SPRAGUE, T. B. "On the Premiums for the Insurance of Recently Selected Lives," *JIA*, XX, 95.
14. ———. "On the Construction and Use of a Series of Select Mortality Tables, to Be Employed in Combination with the Institute $H^{M(5)}$ Table," *JIA*, XXI, 229.
15. ———. "On the Construction and Use of a Series of Select Mortality Tables, to Be Employed in Combination with the Institute $H^{M(5)}$ Table," *JIA*, XXII, 391.
16. WEST, CHARLES E. "Mortality on Term Insurance and Attained Age Conversions," *TASA*, XL, 97.
17. ZIOCK, RICHARD W. "Gross Premiums for Term Insurance with Varying Benefits and Premiums," *TSA*, XXII, 19.

APPENDIX I

1955–60 SELECT BASIC TABLES
MALES

Age at Issue x	Values* of $1{,}000q_{[x]+t-1}$ for Policy Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
20	.77	.85	.91	.92	.92	.91	.93	.96	.99	1.04	1.06	1.11	1.18	1.26	1.34
21	.74	.80	.86	.88	.88	.87	.89	.93	.97	1.02	1.06	1.12	1.22	1.32	1.40
22	.70	.75	.81	.84	.84	.84	.86	.90	.95	1.01	1.07	1.16	1.28	1.40	1.49
23	.66	.72	.80	.83	.83	.83	.85	.90	.96	1.03	1.11	1.23	1.37	1.49	1.60
24	.62	.70	.79	.82	.83	.83	.86	.91	.99	1.07	1.17	1.32	1.48	1.60	1.75
25	.59	.68	.79	.82	.83	.85	.88	.94	1.03	1.14	1.26	1.44	1.60	1.75	1.91
26	.55	.67	.80	.83	.85	.87	.91	.98	1.09	1.22	1.37	1.58	1.75	1.91	2.12
27	.53	.66	.81	.85	.87	.90	.96	1.05	1.18	1.33	1.50	1.74	1.91	2.12	2.36
28	.53	.66	.81	.86	.89	.95	1.02	1.14	1.30	1.48	1.67	1.91	2.12	2.36	2.66
29	.54	.67	.83	.89	.93	1.01	1.10	1.25	1.44	1.65	1.87	2.12	2.36	2.66	3.02
30	.56	.69	.85	.92	.97	1.08	1.20	1.39	1.61	1.85	2.10	2.36	2.66	3.02	3.45
31	.58	.72	.88	.97	1.04	1.18	1.32	1.54	1.79	2.08	2.35	2.66	3.02	3.45	3.96
32	.62	.76	.93	1.04	1.13	1.30	1.46	1.72	2.00	2.32	2.63	2.96	3.38	3.95	4.51
33	.66	.81	1.01	1.13	1.26	1.45	1.64	1.92	2.22	2.57	2.92	3.29	3.73	4.34	5.05
34	.71	.88	1.11	1.26	1.41	1.61	1.84	2.13	2.46	2.85	3.24	3.66	4.10	4.75	5.56
35	.77	.97	1.22	1.40	1.58	1.81	2.08	2.38	2.73	3.15	3.59	4.05	4.51	5.20	6.10
36	.84	1.06	1.35	1.56	1.78	2.03	2.33	2.64	3.02	3.47	3.96	4.48	4.96	5.69	6.67
37	.92	1.18	1.50	1.74	1.99	2.27	2.61	2.94	3.34	3.83	4.37	4.94	5.46	6.22	7.26
38	1.02	1.33	1.67	1.95	2.22	2.55	2.91	3.26	3.69	4.22	4.81	5.41	6.00	6.79	7.78
39	1.14	1.49	1.85	2.17	2.46	2.86	3.23	3.61	4.07	4.64	5.28	5.93	6.60	7.42	8.36
40	1.26	1.67	2.05	2.42	2.73	3.19	3.58	4.00	4.48	5.09	5.79	6.48	7.25	8.13	9.01
41	1.39	1.85	2.26	2.68	3.01	3.54	3.95	4.41	4.92	5.58	6.34	7.07	7.96	8.90	9.77
42	1.52	2.04	2.49	2.96	3.32	3.91	4.36	4.86	5.40	6.10	6.92	7.72	8.74	9.77	10.65
43	1.63	2.20	2.71	3.23	3.65	4.26	4.78	5.33	5.89	6.62	7.52	8.42	9.60	10.65	11.90
44	1.74	2.37	2.95	3.52	4.00	4.63	5.23	5.83	6.42	7.19	8.16	9.18	10.53	11.90	13.27
45	1.87	2.55	3.21	3.83	4.38	5.03	5.73	6.39	7.01	7.81	8.86	10.01	11.52	13.11	14.73
46	2.00	2.75	3.50	4.18	4.78	5.47	6.29	6.99	7.65	8.49	9.61	10.89	12.58	14.38	16.26
47	2.15	2.97	3.82	4.56	5.22	5.97	6.90	7.65	8.35	9.25	10.44	11.84	13.70	15.70	17.82
48	2.34	3.25	4.23	5.02	5.69	6.59	7.65	8.35	9.25	10.20	11.34	12.81	14.81	16.92	19.07
49	2.55	3.56	4.67	5.52	6.19	7.26	8.35	9.25	10.20	11.11	12.33	13.87	16.00	18.22	20.37
50	2.77	3.89	5.14	6.05	6.73	7.97	9.25	10.20	11.11	12.16	13.41	15.02	17.29	19.63	21.77
51	3.00	4.23	5.62	6.62	7.30	8.72	10.18	11.11	12.10	13.27	14.57	16.30	18.70	21.17	23.32
52	3.23	4.58	6.13	7.21	7.91	9.48	11.08	12.10	13.08	14.45	15.84	17.70	20.24	22.88	25.08
53	3.41	4.88	6.58	7.76	8.51	10.18	11.95	13.05	14.11	15.67	17.23	19.27	21.98	24.96	27.49
54	3.60	5.19	7.05	8.34	9.16	10.90	12.84	14.03	15.19	16.95	18.73	21.00	23.88	27.22	30.10
55	3.81	5.53	7.55	8.98	9.88	11.65	13.73	15.03	16.31	18.29	20.34	22.90	25.96	29.63	32.86
56	4.06	5.91	8.11	9.70	10.67	12.45	14.64	16.05	17.47	19.69	22.06	24.96	28.21	32.18	35.71
57	4.34	6.34	8.72	10.50	11.55	13.30	15.56	17.10	18.69	21.16	23.89	27.21	30.66	34.85	38.62
58	4.72	6.87	9.49	11.55	12.73	14.23	16.37	18.09	19.92	22.59	25.77	29.76	33.45	37.49	41.05
59	5.15	7.45	10.33	12.73	13.92	15.22	17.23	19.12	21.22	24.11	27.78	32.48	36.40	40.24	43.54
60	5.62	8.10	11.22	13.92	15.14	16.36	18.16	20.22	22.61	25.76	29.94	35.35	39.51	43.12	46.17
61	6.14	8.80	12.15	15.14	16.36	17.70	19.18	21.41	24.10	27.55	32.28	38.36	42.73	46.14	49.32
62	6.71	9.56	13.12	16.35	17.70	18.71	20.34	22.70	25.72	29.51	34.82	41.47	46.04	49.32	52.10
63	7.30	10.34	13.97	17.22	18.71	19.99	21.69	24.04	27.36	31.65	37.51	44.28	48.88	52.10	55.42
64	7.93	11.19	14.86	18.09	19.99	21.40	23.22	25.55	29.18	34.02	40.45	47.26	51.89	55.42	59.19
65	8.63	12.12	15.83	19.03	21.40	22.95	24.95	27.28	31.23	36.67	43.68	50.49	55.18	59.19	63.48

* Based on the third-difference Gauss "forward" interpolation formula applied to Table 1 rates shown in the *1962 Reports*, p. 46. A few adjustments were made so that an attained-age value for any issue age would not exceed the corresponding attained-age value for a younger issue age.

APPENDIX II

AUXILIARY FUNCTIONS—3 PER CENT

Age x	D_x^T	N_x^T	$F_x^{(1)}$	$F_x^{(2)}$	${}_1E_x$
20....	1,000,000	10,056,559	.....	.....	.969136
21....	911,961	9,056,559	57,175	135,679	.969097
22....	830,752	8,144,598	53,027	136,102	.969068
23....	755,945	7,313,846	49,111	135,249	.969039
24....	687,125	6,557,901	45,415	133,322	.969019
25....	623,222	5,870,776	42,615	129,838	.969000
26....	564,651	5,247,554	39,251	125,612	.968971
27....	510,473	4,682,903	36,658	120,916	.968942
28....	460,491	4,172,430	34,127	115,246	.968903
29....	414,939	3,711,939	31,233	108,866	.968854
30....	373,070	3,297,000	28,945	102,514	.968806
31....	334,687	2,923,930	26,745	96,141	.968748
32....	299,587	2,589,243	24,640	89,487	.968689
33....	267,572	2,289,656	22,635	82,709	.968621
34....	238,700	2,022,084	20,475	76,198	.968544
35....	212,463	1,783,384	18,728	70,051	.968437
36....	188,886	1,570,921	16,871	63,991	.968311
37....	167,537	1,382,035	15,364	58,163	.968155
38....	148,415	1,214,498	13,787	52,554	.967951
39....	131,160	1,066,083	12,498	47,407	.967718
40....	115,758	934,923	11,169	42,520	.967447
41....	102,021	819,165	9,968	38,076	.967146
42....	89,888	717,144	8,782	33,942	.966825
43....	79,084	627,256	7,821	32,764	.966476
44....	69,555	548,172	6,879	26,675	.966097
45....	61,148	478,617	6,048	23,519	.965680
46....	53,735	417,469	5,314	20,726	.965214
47....	47,198	363,734	4,668	18,205	.964699
48....	41,479	316,536	4,052	15,936	.964126
49....	36,472	275,057	3,519	13,957	.963495
50....	32,083	238,585	3,057	12,159	.962796
51....	28,264	206,502	2,626	10,564	.962029
52....	24,934	178,238	2,257	9,190	.961204
53....	22,025	153,304	1,941	7,981	.960301
54....	19,501	131,279	1,650	6,916	.959320
55....	17,305	111,778	1,403	5,968	.958252
56....	15,405	94,473	1,177	5,157	.957078
57....	13,756	79,068	988	4,453	.955786
58....	12,320	65,312	828	3,839	.954369
59....	11,076	52,992	682	3,304	.952825
60....	10,004	41,916	549	2,839	.951126
61....	9,078	31,912	438	2,427	.949282
62....	8,273	22,834	345	2,077	.947272
63....	7,578	14,561	259	1,763	.945078
64....	6,983	6,983	179	1,497	.942680
65....	.....	.....	.....	1,099	.....

NOTE.—The values in the first four columns are based on functions shown in Table 5. ${}_1E_x = v(1 - q_x) =$ Value at age x of \$1 pure endowment payable at age $x + 1$, from the 1958 CSO Table. $D_x^T = v^{x-20} l_x^T$, $N_x^T = \sum_{s=64}^{x} D_s^T$, $F_x^{(1)} = v^{x-20} {}_{n_x}^{(1)}$, $F_x^{(2)} = v^{x-20} {}_{n_x}^{(2)}$.

APPENDIX III

SUMMARY OF NOTATION

x = Issue age of term plan;

y = Issue age of conversion plan;

z = Attained age at beginning of a policy year;

m = Conversion period;

j = Index used to identify the point in time when a conversion policy is issued;

$f_z^{(j)}$ = Multiple used to express the level of mortality rates at attained age z for a conversion policy;

$q_{[x]+t-1}$ = Select mortality rate for policy year t of a policy with issue age x;

$\overline{AR}_{(y,t)}$ = Amount at risk for policy year t under a policy with issue age y, per \$1 of sum insured;

$e_{x+t}^{(j)}$ = Conversion rates as defined in Section VI;

${}_tV^T_{(x,m)}$ = "Prior-conversion" terminal reserve as defined in Section I;

${}_tIV^T_{(x,m)}$ = "Prior-conversion" initial reserve as defined in Section I;

$${}_tMV^T_{(x,m)} = 0.5({}_tIV^T_{(x,m)} + {}_tV^T_{(x,m)}) ;$$

$${}_{t-1}p^{(j)}_{(x,y)} = 1 \text{ for } t = 1$$

$$= \prod_{s=0}^{t-2} (1 - q_{[y]+s} - \overline{Eq}^{(j)}_{(x,y,s)}) \text{ for } 1 < t \leq m ;$$

$$\overline{Eq}^{(j)}_{(x,y,t-1)} = f_z^{(j)} q_{[x]+y-x+t-1} - q_{[y]+t-1} ;$$

$$G^{(j)}_{(x,y,t-1)} = {}_{t-1}p^{(j)}_{(x,y)} \overline{Eq}^{(j)}_{(x,\ t-1)} ;$$

$$A^{(j)}_{(x,y)} = \sum_{t=1}^{\infty} v^t G^{(j)}_{(x,y,t-1}\ \overline{AR}_{(y,t)} ;$$

$$p_x = 1 - q_x, \text{ from 1958 CSO Table ;}$$

$${}_1E_x = vp_x ;$$

$$l_x^T = l_{x-1}^T p_{x-1} - n_x^{(1)} ;$$

$$p^T_{(x,t-1)} = l^T_{x+t-1} \div l^T_x ;$$

$$n_x^{(j)} = l^T_{x-1} p_{x-1} e_x^{(j)} ;$$

$$F_x^{(j)} = v^{x-20} n_x^{(j)} ;$$

$$D_x^T = v^{x-20} l_x^T ;$$

$$N_x^T = \sum_{s=64}^{x} D_s^T ;$$

$$A_{(x,m)}^T = \sum_{t=1}^{m} v^t {}_t p_{(x,t-1)}^T p_{x+t-1} e_{x+t}^{(j)} A_{(x,x+t)}^{(j)}$$

$$= \sum_{t=1}^{m} F_{x+t}^{(j)} A_{(x,x+t)}^{(j)} \div D_x^T ;$$

$$P_{(x,m)}^T = A_{(x,m)}^T \div \ddot{a}_{x:\overline{m}|}^T ;$$

$$\ddot{a}_{x:\overline{m}|}^T = [N_x^T - N_{x+m}^T] \div D_x^T .$$

DISCUSSION OF PRECEDING PAPER

WILLIAM H. BOWMAN:

John Boermeester should be congratulated on bringing together in his paper the theory of reserves for term conversions with the most recent intercompany study of conversion experience. While the paper discusses only conversions from nonrenewable term plans, where the conversion is not automatic, the author has made the theory clear enough so that it may be extended to other types of term conversions.

In recent years many companies have experienced a shift from permanent to term insurance, probably because of the recent recession and the emphasis on the lower going-in cost for term insurance. In my own company the proportion of term insurance (policies and riders) has increased to 38 per cent of total volume. Our sales of term policies are 70 per cent on renewable plans and 30 per cent on nonrenewable plans; I hope, therefore, that some member of the Society will accept the author's challenge to extend his theory to renewable term plans.

With the increased emphasis on the sales of term insurance, it becomes more crucial to answer the question of whether reserves set up for term conversions will qualify as "life insurance reserves" for federal income tax purposes. These reserves would qualify if they are "computed on the basis of a recognized mortality table and assumed rate of interest, and are set aside to mature or liquidate . . . future unaccrued claims arising from life insurance." Term conversion reserves (before and after conversion) would seem to qualify as life insurance reserves if the rationale of the 1972 *Mutual Benefit* case is extended, but we probably will have to wait until the Internal Revenue Service has challenged these reserves to see any resolution of the question. (In *Mutual Benefit* the Third Circuit Court of Appeals allowed the company to include in its life insurance reserves an extra reserve to offset the potential losses on future settlement options, where the reserve was computed on recognized mortality and interest assumptions.)

The definition of "life insurance reserves" mentions the mortality and interest elements, but it does not restrict the calculation of the reserve to those elements. I would assume that, as long as a company had developed reasonable conversion rates, either from its own experience or from intercompany experience, it would be allowed to use those rates in the calculation of reserves for term conversions.

One improvement the author might have made in this paper is the use of more current mortality tables than the 1955–60 Basic Tables. However, the 1966–71 intercompany study of term conversions did use the 1955–60 tables for expected deaths, since the 1965–70 Basic Tables probably were not available at that time.

CLAUDE Y. PAQUIN:

There was a time when actuaries were concerned with reserves for the latter's own sake. There was safety in reserves, it was thought, and only a fool would have none.

We have now progressed to the point where actuaries show concern for the soundness of assets and the risks and returns associated with investments. Reserves are more and more taken for granted, and the belief that the current mandatory valuation standards can absorb such "minor" benefits as conversion rights is far from uncommon. After all, the 1958 CSO Table contains substantial safety margins, especially in relation to select mortality, let alone ultimate mortality, and in these days of high interest rates even a 4 per cent valuation interest rate can provide a fair cushion when one is discounting future contingent payments.

Candor compels me to quote Judge Learned Hand on one of the prime motives for the current interest in conversion and other sundry reserves:

> Over and over again courts have said that there is nothing sinister in so arranging one's affairs as to keep taxes as low as possible. Everybody does so, rich or poor; and all do right, for nobody owes any public duty to pay more than the law demands; taxes are enforced exactions, not voluntary contributions. To demand more in the name of morals is mere cant [*Comm'r* v. *Newman,* 159 F.2d 848, 850 (2d Cir., 1947)].

Higher reserves can serve to reduce the gain from operations defined at section 809 of the Internal Revenue Code of 1954, as amended, while the interest required to support these reserves can reduce the taxable investment income defined at section 804 (of particular interest to mutuals). *Mutual Benefit Life Ins. Co.* v. *Comm'r* (58 TC 679 [1972], *aff'd,* 488 F.2d 1101 [3d Cir., 1973], *cert. denied,* 419 U.S. 882 [1974]) provides a good illustration of what good planning (and good reserves!) can accomplish: the insurer there reportedly saved a tidy $888,000 in taxes, which is no small sum.

John Boermeester's paper establishes well, to my mind, the distinction that should be made between pre-exercise conversion reserves and

post-exercise conversion reserves. In determining the former, it may be well and good, on a practical basis, to take into account the possibility of effecting savings in issue expenses, most particularly underwriting costs. (But query how "practical" it is to disregard income tax consequences.) In determining post-exercise conversion reserves, prospectively, one is faced with a different problem, in kind and in size. John and I had a discussion on this (*TSA*, XXV, 41–54) with respect to group life conversion reserves. The remarks which can be found there on income tax foreshadowed those I make today. One important difference today is that we have since been blessed, through the Freedom of Information Act, with the revelation that

> [a] mortality or morbidity table which is based upon actuarial principles, i.e., the giving of mathematical values to the probabilities of death or disability through the application of the laws of probability to valid mortality or disability statistics or data, will be considered to be "recognized" for purposes of Section 801(b)(1)(A) [of the Internal Revenue Code] [IRS, *Audit Technique Guidelines for Insurance Companies,* 122.234(5)(f)2].

This may serve to allay our fears on what confers "recognition" upon a mortality or morbidity table: valid data and professional methods!

Practitioners who deal with statutory life insurance reserves are accustomed to single-decrement tables. This paper introduces another source of decrements—conversions—in addition to mortality. The existence of more than one decrement forces the author to refer to terminal reserves "applicable to term plans in force at the end of policy year t just prior to the exercise of conversion rights." Those of us who have dealt with the problem of reserves in a multiple-decrement context, as have GAAP practitioners, have experienced the cumbersomeness of trying to describe the reserve "applicable just prior to" some year-end event. I have suggested before (*TSA*, XXV, 496) that perhaps the adoption of the terms "preterminal" and "postterminal" would be useful in referring to a year-end reserve immediately before, or immediately after, as the case may be, the year-end decrements. (Since a reserve is a form of asset share, or an amount allocated pro rata between individuals comprising a population, a reserve *factor* should never be determined without reference to the population existing at that time; in other words, decrements generally reduce both the common fund, or collective reserve, *and* the population, when they take place.)

I join the author in his hopes that the results he has presented will generate converts for the establishment of proper conversion reserves, properly constructed, for those reasons articulated by Judge Learned

Hand if not for the others that the author had in mind. This paper may well serve as a catalyst for this endeavor. For selfish reasons, I would also like to encourage the author to publish interpolated tables for female lives and for male and female lives combined of the same type as his most convenient 1955–60 Male Select Basic Table: all of them together would provide a most convenient reference, for which the entire profession might be grateful, regardless of their utility in conversion reserve work. A "Boermeester extension" for all the 1955–60 Basic Tables would earn its author many thanks from the profession.

HARRY PLOSS:

I would like to thank Mr. Boermeester for writing a fine technical paper on a subject of current interest. With actuaries now required to certify that annual statement policy reserves are adequate for the unmatured liabilities of the company in addition to meeting Standard Valuation Law requirements, many more discussions of this nature will occur. The two broader questions, in my opinion, are (1) What types of liabilities are substantial, yet not conservatively valued by the Standard Valuation Law? and (2) What is an appropriate set of criteria for valuing these excess liabilities?

Life insurance contracts now offer certain guarantees that often are not explicitly reserved. Among these guarantees are renewability at guaranteed rates and conversion privileges. These policyholder "rights" have an expected cost to the insurance company and, hence, are liabilities. These assorted liabilities should be valued in a consistent way; that is, excess mortality for term conversions should be valued using the same principles as for excess mortality for term renewals. Perhaps most important are the accounting principles that should be used for valuing these liabilities.

It is desirable to use accounting principles that accurately reflect the financial operations of a company. For example, one company may not pay commissions on term conversions, and this company experiences basic group-type mortality. It does asset share calculations and finds that its whole life term conversions are profitable! Should this company set up a liability for term conversions? Probably not. Reduced commissions and expenses seem to be an important offset to excess mortality. An appropriate gross premium valuation should be done to verify any proposed conversion reserves.

The magnitude of the single premiums and reserves given in Tables 1 and 2 of the paper is disturbing. The financial picture is similar to the

"renewable term paradox." In gross premium calculations, five-year renewable term may be less expensive than five-year nonrenewable term because acquisition expenses can be amortized over a longer period of time. With net premium reasoning, however, since the policyholder is getting more (a renewability option), the five-year renewable term premium must be more expensive. These reserves could exert serious upward pressure on term insurance gross premiums.

Gross premium valuation, however, involves considerable judgment and can lead to abuse. The optimistic valuation practices of the last century led to our current net premium valuation methods. Net premium methods result in easier calculation and regulation. There are advantages to the insurance industry in using uniform methods and gaining the approval of the tax and regulatory authorities.

PAUL E. SARNOFF:

The Society owes a debt of appreciation to Mr. Boermeester for his work in compiling mortality information on convertible and converted term insurance and for the analysis provided in his paper. The concepts he presents are useful in helping the actuary determine appropriate premium rates and dividend scales for these classes of policies.

The paper is intended to explain the need for and the method of calculating statutory reserves on ordinary convertible term benefits and converted policies. It is disappointing, therefore, to note the following:

A. The paper does not examine the question of whether the minimum statutory reserve is inadequate for these benefits and policies.
B. It does not make clear the mortality assumption used.
C. It does not refer to, much less give, the theoretical derivation of the reserve formula for a converted policy, nor does it explain how the result of adding the extra reserve to the basic reserve can be theoretically justified as being equivalent to the total reserve required in accordance with the prospective definition given in the Standard Valuation Law.
D. It implies that a company ought to hold a reserve for ordinary term conversions even though it is not required by statute or ruling, and regardless of whether the standard policy reserve is fully adequate.

The following discussion elaborates on each of the above observations.

A. *Adequacy of Statutory Reserves*

Although the paper refers to the difference in mortality experience between converted term insurance and newly issued standard ordinary insurance at the same attained age, and indicates that the difference

may impose added liabilities on the insurance company, it does not make a convincing case that the standard statutory reserve, based on the prescribed mortality table, is inadequate.

Table 1 of this discussion compares mortality rates according to mortality tables that are referred to in the paper or are germane to subsequent discussion. This table illustrates mortality rates associated with term insurance issued at age 22 and converted seven years thereafter, at attained age 29, to a new whole life insurance policy. These ages

TABLE 1

COMPARISON OF MORTALITY RATES PER $1,000 BY ATTAINED AGE—MALE

Attained Age	1955–60 Basic Table Select and Ultimate		(1) $\times f_z^{(2)}$	(2) $\times g$	1958 CSO	Modified 1958 CSO [(5) + (3) − (2)]
	Issue Age 22 (1)	Issue Age 29 (2)	(3)	(4)	(5)	(6)
29	0.90	0.54	0.99	1.18	2.08	2.53
30	0.95	0.67	1.05	1.46	2.13	2.51
31	1.01	0.83	1.11	1.23	2.19	2.47
32	1.07	0.89	1.18	1.32	2.25	2.54
33	1.16	0.93	1.28	1.38	2.32	2.67
34	1.28	1.01	1.41	1.21	2.40	2.80
35	1.40	1.10	1.54	1.32	2.51	2.95
36	1.49	1.25	1.64	1.50	2.64	3.03
37	1.60	1.44	1.76	1.73	2.80	3.12
38	1.75	1.65	1.93	1.98	3.01	3.29
39	1.91	1.87	2.10	1.87	3.25	3.48
40	2.12	2.14	2.33	2.14	3.53	3.72
50	6.94	6.94	7.63	6.94	8.32	9.01
60	17.69	17.69	19.46	17.69	20.34	22.11
70	42.90	42.90	47.19	42.90	49.79	54.08

NOTE.—$f_Z^{(2)} = 1.1$ for $Z \leq 75$ and $1.1 - 0.005(Z - 75)$ for $Z > 75$; $g = 2.18$ for policy years 1 and 2, 1.48 for policy years 3–5, 1.20 for policy years 6–10, and 1.00 for policy years 11 and over.

are typical of much insurance of this type and are the same as those of one cell for which the paper provides information. Columns 1 and 2 of Table 1 show rates of mortality according to the 1955–60 Basic Select and Ultimate Mortality Table for male lives as referred to by the paper. For the first column the select period commences with the issue of the term insurance, while for the second column the select period commences with the issue of the whole life insurance seven years thereafter.

Column 3 reflects the application of the assumed experience factor $f_x^{(j)}$ to the mortality rates in column 1 and represents assumed mortality experience under insurance converted at the end of the conversion period. While the paper gives some experience justifying the aggregate level of the assumed experience factor, it does not give any justification for assuming that it is a flat percentage over the broad range of attained ages to age 75, nor does it give any support for the somewhat surprising assumption of a factor greater than 1.00 for durations after the fifteen-year select period.

The mortality rates in column 4 are derived on the basis of the application of the appropriate experience factors of my company to the mortality rates shown in column 2 (that is, the select mortality rates based on the issue age of the whole life conversion policy). My company has recently conducted a mortality study, by duration since conversion, of certain classes of term conversion. While this study does not conform to the classification of term conversions as used by the Society of Actuaries intercompany mortality investigation, on which the paper is based, it does give information as to the pattern, by duration since conversion, of mortality ratios based on the 1955–60 Basic Table. I am presenting these mortality rates to illustrate the significant effect of the incidence of mortality upon the pattern of reserve factors by duration.

Column 6 shows mortality rates that are not directly referred to in the paper. I am introducing this column into my discussion for use later in discussing reserve methodology. It is shown here for convenience in comparison with the other columns of this table. Column 6 represents the 1958 CSO Mortality Table increased to include the effect of the excess mortality, on the basis assumed for this purpose in the paper, over standard select mortality, at each attained age under a policy of converted term insurance. Since the excess mortality depends on duration since conversion, column 6 depends on duration since conversion. It represents, in effect, the mortality rate required to make the mortality provision in the reserve on a policy of converted term insurance as strong, in relation to the actual experience under the policy, as the standard unadjusted mortality rate does with respect to a standard ordinary select new issue.

When we compare columns 1, 3, 4, and 5, we note that the mortality rate prescribed for calculating minimum standard reserves shown in column 5 provides considerable margin over the mortality experience under converted term insurance in any of columns 1, 3, or 4. In view of this comparison, it appears that a rather convincing case would have

to be made on grounds other than the age-by-age comparison of mortality experience rates before one could conclude that the statutory reserve does not make adequate provision for mortality under converted term insurance.

One approach that the author might have used but did not is to consider the situation with regard to other similar types of contract provisions:

1. *Options to purchase additional insurance.* These options provide the insured the opportunity to purchase additional policies of life insurance on the standard ordinary basis on specified future dates without then offering additional evidence of insurability. Additional premiums for this option are charged, to cover the cost of mortality in excess of standard select mortality that is experienced after exercise of the option. In my view, it is entirely appropriate for a company offering these options to establish additional mortality reserves to accumulate the net portion of the option premiums to the respective option dates and then to release the reserve gradually over the period in which the excess mortality is experienced.
2. *Antiselection at time of premium payment.* Every time the insured under a life insurance policy is faced with a chance to pay a premium on its due date, he has an opportunity to select against the company. Some insureds, presumably including a number whose health has deteriorated to the point where it is hardly worthwhile to continue premium payment, choose to let their insurance continue under the extended insurance option. This antiselection is appropriately recognized by the various policy values and reserve bases that companies employ in the determination of the extended insurance benefit period under the contract, and in the reserve for that benefit. Those insureds who choose to withdraw their policy values from the company by cash surrender presumably place a lower value on the possibility of their beneficiaries collecting the death claim proceeds than on their own needs to avail themselves currently of policy cash values. Hence, the average level of death claim experience among the remaining policyholders who continue, and thus may be presumed to rank the two expectations in the opposite order for themselves, may well be higher. While a reduction in the cash value guaranteed the withdrawing policyholder is sometimes advocated as provision for this antiselection, no increase in the reserves held for continuing policyholders generally is made, since the mortality tables used to value all individual life insurance policies issued in the last thirty years are derived from previous experience reflecting this antiselection, and the mortality tables now used to value older issues contain even higher mortality rates.

Another related situation is that under policies having contract premiums that increase on specified future dates after issue. Under these contracts the insured is faced with the decision, on each premium increase

date, as to whether it is worthwhile for him to continue the contract with the increased premium amount. Generally, no specific provision is made in reserves (as distinguished from immediately preceding nonforfeiture values) for antiselection that might be considered to occur on such premium increase dates.

3. *Group conversions.* On the surface it may appear that the situation on converted ordinary term insurance is similar to that under converted group insurance, for which it is the general industry practice to establish substantial extra mortality reserves. However, there are very significant differences between the two types of insurance. People covered under group insurance are not subject to the same standards and methods of determining insurability upon becoming covered for group insurance as are people becoming covered for ordinary term insurance. Group insurance converted on termination of employment is typically among employees then at the higher ages, for many of whom the reason for termination of employment is related to their state of health. Moreover, there is generally a great incentive to the agent and the former employer to assist terminating employees to replace their group coverage with newly underwritten ordinary insurance if they qualify, thereby leaving the class of employees taking conversion policies to include many persons with quite serious impairments, and virtually none in a condition comparable to newly selected ordinary lives. Hence the excess mortality of group conversions is substantial, as contrasted with the relatively minor excess mortality experienced under ordinary term conversions. The excess mortality under group conversions is so significant, in fact, that it is the usual industry practice to include, as a benefit charge against the case experience of the former employer's group insurance, an amount reflecting the present value of the excess mortality cost of the conversions from that case, so that the employer bears a proper share of the cost of this valuable conversion right instead of the cost's being assessed against the general body of policyholders. Furthermore, companies generally transfer funds from the group insurance line to the ordinary line in order that the ordinary department may have funds on hand to help pay for the claims as they emerge in the future. Generally, the mortality tables used to value group life insurance are chosen to include, without separate identification, provision for future conversion benefit charges, and reserves are generally held, and appropriately so, with respect to the converted ordinary insurance policies, reflecting the mortality experience actually observed on policies of this class.

The paper refers to the slight extra mortality that arises under type 1 ordinary conversions, that is, those that are issued prior to the expiration of the conversion period. This extra mortality is attributed to the statement that the insured has a "right" to convert his insurance, and, therefore, a reserve should be set up during both the preconversion

and postconversion periods to recognize this right. In the case where an insured exercises his right to convert an ordinary term policy prior to the expiration of the term period, the right he is exercising is that of voluntarily paying a greater premium than the term premium for coverage to the end of the conversion period, in exchange for paying thereafter a lower premium than he would have to pay if he deferred making the conversion until the end of the conversion period. It is difficult for me to see how exercising a right that makes sense only if the insured expects to survive beyond the end of the conversion period for a substantial number of years can result in extra mortality requiring increased reserves.

As far as the term conversions that occur at the end of the conversion period are concerned, the situation is different in that, if the insured chooses not to convert, coverage will not extend beyond the normal expiry date, and thus an opportunity for antiselection is presented. In comparing this situation with those mentioned in items 1–3 above, it seems to me that the question of whether a postconversion extra reserve should be held hinges on the company's experience. That experience depends on a wide variety of factors, including the company's marketing organization and strategy, its clientele, the distribution of its term insurance plan, and such policy provisions as premium waiver disability benefits. Only if the company's experience, resulting from the circumstances of its own business, produces an experience reserve in excess of the regular policy reserve should there be a need to augment the regular reserve. In addition, the concept of a preconversion additional policy reserve merits the following examination.

The determination of the policy reserve for a contract that provides, in addition to the basic benefit insured, one or more optional benefits in the event of a change in policy terms or circumstances is traditionally based on a single valuation of the most valuable of the possible benefits. For example, a life insurance policy with nonforfeiture benefits is valued using the regular reserve for the death benefit, which is ordinarily more valuable than any nonforfeiture benefit promised. However, if the cash value is greater, the reserve held is increased to that level. For preconversion term insurance the death benefit payable on death within the term period is clearly more valuable than any deferred option to continue coverage beyond normal expiry, and the regular reserve for that benefit, which assumes continuation of the term policy until the earlier of expiry or prior death of the insured, should be a more than adequate provision for any possible deferred right of conversion.

Table 2 of this discussion shows a comparison of the mean reserves and valuation annual premiums computed according to the mortality experiences indicated in Table 1. This illustration is not necessarily representative of the situation for all issue ages and conversion periods, but it is an important cell from the standpoint of typical issue-age distributions.

TABLE 2

COMPARISON OF MEAN RESERVES PER $1,000 BY DURATION OF A WHOLE LIFE POLICY CONVERTED AT ATTAINED AGE 29 FROM A TERM INSURANCE ISSUED AT AGE 22
NET LEVEL PREMIUM METHOD
MORTALITY TABLE

(3 Per Cent Interest; Curtate Functions; Age Nearest Birthday)

Policy Year	1955–60 Basic Table		Issue Age 22 Adjusted	Issue Age 29 Adjusted	1958 CSO	Modified 1958 CSO
	Issue Age 22 (1)	Issue Age 29 (2)	(3)	(4)	(5)	(6)
1	11.48	11.58	11.90	11.41	12.16	24.35
2	22.84	23.18	23.65	22.44	23.63	35.82
3	34.50	34.99	35.71	33.78	35.42	47.69
4	46.46	47.06	48.08	45.56	47.54	59.93
5	58.72	59.46	60.75	57.63	59.98	72.47
6	71.27	72.18	73.72	70.13	72.76	85.31
10	124.46	126.02	128.63	123.31	127.02	139.91
20	275.19	276.52	283.57	274.17	280.32	295.50
Valuation annual premium	11.75	12.15	12.21	11.81	12.99	12.99

Column 5 is computed on the basis of the 1958 CSO Table, the statutory minimum basis prescribed for new issues of standard ordinary insurance. The valuation premium on this basis is larger than any of the premiums on the first four bases and is equal to that of the last.

The reserves in column 1 are in each case exceeded by the minimum-basis reserves in column 5, and it is therefore reasonable to conclude that the statutory minimum reserve basis for conversions before the end of the conversion period is adequate. The reserves in column 2, based on the 1955–60 Select Basic Table, are in each case somewhat less than the column 5 reserves. The reserves in column 3 represent those based on the paper's assumed mortality table for experience on conversions that occur at the end of the conversion period. The column 3 reserves

slightly exceed the 1958 CSO reserves except in the first policy year.

The reserves in column 4 represent those based on the assumed mortality rates that reflect the incidence of term conversion mortality by duration according to the previously mentioned mortality study of my company. A comparison of the reserves in columns 3–5 shows that the incidence and level of mortality by duration do indeed have a significant effect on the level of reserves. The column 3 reserves slightly exceed the 1958 CSO reserves, but the column 4 reserves are slightly less than the reserves on the statutory table. On the basis of these results, it is my opinion that there is not sufficient evidence to conclude that the statutory reserves make an inadequate provision for the mortality under converted ordinary term insurance.

B. *Mortality Assumption Not Clearly Stated*

The paper clearly defines the excess mortality function on which its reserves are based. This excess mortality is represented as the excess of mortality according to experience under converted term insurance over the corresponding standard select ordinary experience dating the select period from issue of the conversion policy. However, the paper defines the reserve on converted term insurance as the sum of (1) the standard ordinary policy reserve on an otherwise similar newly selected life and (2) provision for excess mortality determined as the present value of future excess mortality on the amount at risk (the excess of the sum insured over the basic standard ordinary policy reserve).

Unfortunately, this method of defining the mortality basis for policy reserves confuses more than it enlightens. It is not clear from the paper just exactly what mortality table is being used to calculate these policy reserves. In the establishing of a policy reserve, one of the matters to which the actuary gives careful thought is whether the policy reserve basis meets the definition of a life insurance reserve as defined in section 801 of the United States Internal Revenue Code. The Code includes the requirement that the reserve be computed or estimated on the basis of recognized mortality tables. I believe that it will be difficult for most actuaries, and impossible for any revenue agent, to identify the mortality table used in the computations described in the paper.

C. *Theoretical Formula Derivation Lacking*

The paper indicates that the proper postconversion reserve on converted term insurance consists of the sum of the standard ordinary

life insurance policy reserve and the net single premium reflecting the excess mortality on the amount at risk. The Standard Valuation Law specifies that the method of determining policy reserves shall be to determine the excess of the present value of future benefits guaranteed under the policy over the present value of future valuation annual premiums. The paper does not indicate whether the method proposed is equivalent to the method prescribed by the Standard Valuation Law or whether it is merely a method that produces a convenient approximation to the theoretically correct reserve. Since the proposed method involves the existence of a reserve at the inception of the converted policy, a special definition is needed of the valuation annual premium, since the regular definition that the present value at the date of issue of the future guaranteed benefits equals the then present value of the valuation annual premiums cannot apply. The reader is left with the impression that the paper has described a computational method for arriving at an increased policy reserve, but the theoretical justification for the method is not presented, and the need for such a justification has not even been recognized.

The following is offered as an example of what is to me a satisfactory theoretical framework for calculating extra mortality reserves. The information in column 6 of my Tables 1 and 2 is presented to indicate the manner in which I would specify reserve factors in the event that my company decided to make a specific additional provision for rights of conversion of term insurance on the basis of mortality experience indicated in the paper. The method is in fact the method (but not, of course, the reserve basis) that we follow in determining the reserve for extra mortality under conversions of group insurance. In column 6 of Table 1, I have previously defined a set of mortality rates reflecting the total mortality experience under converted term insurance. Using these mortality rates, I have derived a set of commutation functions and basic values, which are then used to determine reserve factors as the excess of the present value of future benefits over the present value, computed on the same mortality table and interest rate, of the valuation annual premium, applicable to an otherwise similar select standard ordinary new issue computed on the 1958 CSO (unadjusted) Mortality Table. This approach is a straightforward application of the prospective reserve formula described in the Standard Valuation Law, and there should be no difficulty in describing the nature of the mortality table assumed or in understanding the nature of the reserve formula itself.

D. *Implication that Extra Reserves Are Necessary*

The paper leads the reader to believe that extra mortality reserves of the type described are necessary and that a company which does not establish such reserves is somehow doing a less satisfactory job of safeguarding its policyholders' interests than one which does follow the recommended methods.

It is my belief that the question of a specific provision for the excess mortality arising from term conversions is a matter for the judgment of the individual actuary. Further, it is my firm conviction, on the basis of the points brought out in the above discussion, that no such reserve is appropriate, at least under the circumstances prevailing in my company—notably, the average extra mortality observed to result from conversions actually secured by our own agency force from original term insurance with the specific policy provisions included in such insurance by my company. However, I respect the right of other actuaries to establish such reserves, when appropriate in their opinion, to the circumstances of their own company.

I would like to thank the author for his paper, which should be valuable in highlighting this interesting problem.

(AUTHOR'S REVIEW OF DISCUSSION)

JOHN M. BOERMEESTER:

I wish to thank William Bowman, Claude Paquin, Harry Ploss, and Paul Sarnoff for their fine discussions, which have added valuable thoughts to the intriguing subject of constructing experience-based valuation tables for term insurance conversion rights.

Mr. Bowman observes the growing importance of term insurance business and points out that term conversion reserves would seem to qualify as "life insurance reserves" for federal income tax purposes if the rationale of the 1972 *Mutual Benefit* case is extended. Under this case, the court allowed the company to include an extra reserve to offset the potential losses under future settlement option elections.

Mr. Paquin also discusses tax aspects, with a quotation from Judge Learned Hand. He points out that we have been blessed through the Freedom of Information Act with the revelation of what manner of tables are to be recognized under the IRS *Audit Technique Guidelines*.

Mr. Ploss emphasizes that actuaries are now required to certify that annual statement policy reserves are adequate for the unmatured liabilities of a company in addition to meeting valuation law requirements. He calls attention to some of the problems associated with asset share

calculations and with gross premium valuations that might be made to help judge whether current annual statement liabilities are adequate. He also notes that net premium methods of valuation probably result in easier calculations and regulation.

Mr. Sarnoff presents an analysis based on the assumption that all benefits and rights which are granted in connection with the issue of an ordinary policy must be valued in one package along with the basic life insurance benefits. Whether or not the model valuation law actually mandates the use of such an assumption in connection with the valuation of the substandard mortality rates associated with the conversion rights of an original term policy appears, at least to me, to be a moot point.

In considering this point, we should remember that actuaries are now required to certify that annual statement policy reserves are adequate for all unmatured liabilities of a company, in addition to those specifically covered by valuation law. The model law is silent when it comes to describing how conversion rights should be valued, except that the law's catch-all provision for "all other benefits" could permit, I believe, the use of extra or additive reserves that may be calculated quite independently of the standard reserves for the basic life insurance benefits alone. The paper clearly states that one of its purposes is to set forth an approach for calculating *annual statement* reserves. This is not the same as proposing a change in the sections of the law that prescribe how minimum *statutory* reserves should be calculated. My reason for making this distinction stems directly from my view that the paper should not attempt to suggest any text for filling what might appear to some as a void in the model law.

Mr. Sarnoff mentions four general areas which he hoped might have been developed further in the paper. His first point concerns the question of whether or not minimum statutory reserves are adequate. I would first observe that the model law sets forth an explicit minimum standard for valuing ordinary life insurance benefits under policies issued to *standard* lives. The 1958 CSO Table required for this standard business has, as is well known, certain margins. The reasons why these margins were deemed to be necessary under law were presented to the Society in 1956 and 1958 (see *TSA,* VIII, 504; X, 686). It is my understanding that the margins so established for valuing standard business should not be invaded to support substandard business or to support nontrivial costs for extra benefits, additional rights, or special contingencies. The model law does require that extra reserves must be established for disability and accidental benefits. Mr. Sarnoff men-

tions that many companies do establish additive reserves for group conversions. Some companies have established additive reserves to provide for expected losses under future settlement option elections, a situation not unlike that under term policies, where losses can be expected under future conversion elections.

Mr. Sarnoff's second point relates to the identification of the mortality and other tables used for valuation. While the paper does not suggest a simple name for identification purposes, I do believe that the bases are reasonably described in the text. If a company were to adopt the bases used in the paper for its annual statement purposes, I suppose that it might use a caption such as "The 1975 Derived 1966–71 Intercompany Term Conversion Experience Tables." Examiners would have to understand that this caption meant the applicable tables constructed from published data, including Table 4, Table 5, Appendix I, and Appendix II of the paper. This understanding for an examiner would not be unlike that required for him to accept a short title now used to identify all the functions required under the model law for valuing disability benefits, for example.

Mr. Sarnoff's third point concerns theory. The definition of what a theoretically correct reserve structure might be for conversion rights will depend, I believe, on the circumstances that may exist. If an actuary believes that he needs to establish reserves for conversion rights in order that he can properly certify that his company's annual statement policy reserves are adequate, and if he believes that the law is silent on how such reserves must be calculated, then, in my opinion, the definition of a theoretically correct reserve must depend on the assumptions he uses regarding the nature of the company's business. On the other hand, I believe that the definition of a theoretically correct reserve structure for model-law purposes probably must await resolution of the question as to whether or not the model law requires that the substandard mortality rates associated with conversion rights of an original term policy must be valued in one package along with the basic life insurance benefits, the moot point noted earlier.

Mr. Sarnoff's last point concerns the wisdom of establishing extra reserves for conversion rights. I certainly agree with his view that there should be no statutory compulsion for an actuary to establish extra reserves for his company if he is convinced that the amounts would be trivial. On the other hand, if he has reason to expect that the future will develop substantial substandard experience along the lines of that reported in the 1966–71 Study, I believe that he should seriously consider establishing appropriate reserve amounts.

Now for some miscellaneous comments:

1. Under Mr. Sarnoff's point A, he wonders about the justification for choosing *f*-factors that do not vary by duration. The underlying reasons are discussed in Section V of the paper, with reference to Table 16 and Section A(3.5) of the 1966–71 Study. I did not introduce any refinement by duration, since the experience given in Table 16 for the first fifteen policy years is quite scanty. The choice of 1.1 for the *f*-factor deemed applicable for conversion group 2 should not come as a surprise to the reader. Reference to Table 16, which shows 3,295 deaths for the conversion group 2 ultimate mortality experience, strongly suggests to me that the ultimate rates for this group do not show any particular tendency to revert to standard.

2. In Mr. Sarnoff's discussion under point A, in connection with antiselection at time of premium payment, he states in effect that no specific provision is generally made in reserves for antiselection that might be considered to occur on premium increase dates. While the word "generally" might describe the present situation, I know of at least one prominent company that does establish extra reserves in connection with renewable term policies.

3. In Mr. Sarnoff's discussion under point A, he states that it is difficult for him to see why there is any need for increased reserves for those who exercise conversion rights prior to the end of the conversion period. In response, I can only point to the results of the 1966–71 study, which show that extra mortality costs in general do exist in connection with conversion group 1 among the companies that contributed to the study.

4. Mr. Sarnoff states that under point A "the death benefit payable on death within the term period is clearly more valuable than any deferred option to continue coverage beyond normal expiry." I fail to grasp how this statement could possibly be true for most of the age–term period combinations being issued under common term plans. Consider a class of freshly selected lives, with each life covered by an n-year level term policy with an n-year conversion period. As the unexpired term period approaches zero, so do the values of the term insurance benefits. However, as the unexpired term period shortens, the values of the conversion rights steadily increase, since some of the members of this original select class will deteriorate in health to such an extent that they will not qualify as standard for new whole life insurance. Consequently, there must be a crossover point in these two sets of values somewhere during the term period, after which point the value of the conversion right assumes the dominant role.

5. Under point C, Mr. Sarnoff presents the concept of the method he would use to calculate the total reserve for a policy in the post-conversion period. He illustrates the results of his calculations for a specific situation: a conversion policy with issue age 29 issued at the end of a seven-year conversion period. The extra reserves for his illustration as measured by differencing values in columns 5 and 6 of his Table 2 are of the same magnitude, as one should expect, as those shown in Table 1 of the paper. Mr. Sarnoff states that "there should be no difficulty in describing the nature of the mortality table assumed." His caption for column 6 of Table 2 is simply "Modified 1958 CSO." How would he describe the mortality table assumed to an examiner? Would he not encounter the same type of situation as that discussed earlier under his point B? Would not the examiner need to understand that the caption "Modified 1958 CSO" involves not only data derived from the 1966–71 study but also their coupling with values derived from the 1958 CSO Table? Mr. Sarnoff's method would seem to require separate column 6 data for a network of possible combinations of issue ages, conversion dates, and conversion periods. From a practical viewpoint, the work required to produce a network of reserves conceivably could be as voluminous as that required under the approach suggested by the paper.