DISCUSSION BY ROGER C. WADE

The paper recently presented by Beckman and Tremelling has opened the door on a variety of questions which have not been previously discussed in the *Proceedings*. This review of that paper addresses some of the more interesting questions which were left unanswered. There is no attempt made here to retill the ground covered by Beckman and Tremelling.

The primary thrust of this review is to give some quantitative indications of the amount of surplus needed by a property-liability insurance company.

There are three basic terms which are necessary to discuss this topic.

The first term is surplus which will simply be defined as the excess of assets over liabilities. In statutory accounting this is equivalent to Surplus as Regards Policyholders.[1] If Generally Accepted Accounting Principles (GAAP) are used, then a higher surplus will result on a pretax basis, primarily due to the inclusion of the so called equity in the unearned premium reserve which results from the treatment of prepaid acquisition expense as an asset under GAAP. In this review statutory accounting will be used.

The second term is solvency. The two conditions of solvency are having assets greater than liabilities and being able to meet obligations as they fall due. In insurance operations, the former condition is the one which is most likely to be violated as large amounts of cash usually can be generated to meet obligations.

The third term is solidity. This is a term of comparatively recent vintage[2] that is not readily definable in accounting terms. It refers to the probability of a company remaining solvent over some specified future period of time. This concept has been extensively explored mathematically[3] and

---

[1] NAIC Fire and Casualty Annual Statement Blank, p. 3, Line 27.

[2] Kimball, Spencer L., "The Purpose of Insurance Regulation", *Minnesota Law Review*, Volume 45 (1961) p. 471.

[3] Seal, Hilary L., *Stochastic Theory of a Risk Business* (John Wiley and Sons, New York, 1969).
Takaes, Lajor, *Combinatorial Methods in the Theory of Stochastic Processes* (John Wiley and Sons, New York, 1967).

is sometimes referred to as the theory of ruin. The theory of ruin is not used in this review because of its complexity and because it was felt to offer little practical advantage over the simpler approach used here.

Calculations for determining the amount of surplus needed by an individual company to establish solidity should take into consideration a variety of factors. The assumptions for the hypothetical firm used here are:

1. Geographical spread is countrywide.

2. Product line mix is the same as the industry average.

3. Reinsurance arrangements are designed such that for the given firm the underwriting results will vary in approximately the same manner as the industry average.

4. The firm's underwriting profitability has been average for a large multi-line insurer.

5. a) The portfolio composition contains the maximum amount of common stock permitted by the New York State law.

   b) The portfolio is an all bond portfolio.

Results are shown for several confidence levels as the amount of surplus should be based on a management decision concerning the amount of risk they are willing to accept as a company. There is no absolute "required" surplus and there is no level of surplus which will guarantee future solvency under all conditions. These confidence levels are based on the assumption that underwriting and investment results are independent and normally distributed. Thus, once a mean and standard deviation have been calculated from historical data it is a simple calculation to determine the probability of any given outcome. The 50% confidence level should be interpreted as the expected outcome. If a -100% change in surplus is indicated for a given confidence level, then it means that insolvency would occur. In Exhibit I, at a 10 to 1 surplus ratio with a common stock portfolio, there is a 1% chance that a greater than 110% decrease in surplus will take place and a 99% chance that less than a 110% decrease in surplus will take place.

Calculations are also shown for varying periods of time. The reason for not showing results beyond a three year period is that the long-term expected outcome for the stock market is positive and thus it is very un-

likely that market results will be negative four years in a row. Even if such an outcome were to occur there would be sufficient lead time for management action to counter the adverse trends in surplus. Common stock data was obtained from *Rates of Return on Investment in Common Stock; the Year by Year Record,* 1926-1965 by L. Fisher and J. H. Lorie. Loss Ratio data was used from a large, countrywide, multiple-line insurer.

One of the more interesting results of this table is that if a 2 to 1 surplus ratio is maintained with a common stock portfolio, the apparent risk is greater and the rewards less than with a i0 to 1 surplus ratio and an all bond portfolio.

There are two characteristics of statutory accounting and GAAP which, if altered, could have a significant effect on the results shown here. First, reserves must be maintained which are sufficient to liquidate all outstanding claims on an ultimate value basis. This is in contrast to an approach which permits a present valuing of reserves. Second, bonds are valued on an amortized rather than a market value basis. This eliminates fluctuations in the valuation of bonds. While the propriety of these nethods is open to question, it is assumed that they will both continue to be valid in the future.

The above calculations are merely an indication of the type of work which remains to be done in this area and we can thank Beckman and Tremelling for broaching this subject in the *Proceedings.*

EXHIBIT 1

Maximum Adverse % Change in Surplus in a One Year Period

Surplus and Confidence Level	Portfolio Type	
	Common Stock	**All Bond**
1 to 1 Surplus Ratio		
50% confidence level	16%	7%
90% confidence level	− 8	4
99% confidence level	− 27	1
99.9% confidence level	− 41	− 1
2 to 1 Surplus Ratio		
50% confidence level	21%	9%
90% confidence level	− 10	3
99% confidence level	− 36	− 2
99.9% confidence level	− 54	− 6
4 to 1 Surplus Ratio		
50% confidence level	30%	13%
90% confidence level	− 16	1
99% confidence level	− 55	− 9
99.9% confidence level	− 82	− 16
10 to 1 Surplus Ratio		
50% confidence level	60%	25%
90% confidence level	− 34	− 5
99% confidence level	−110	− 30
99.9% confidence level	−165	− 47

EXHIBIT 2

Maximum Adverse % Change in Surplus in a Two Year Period

	Portfolio Type	
Surplus and Confidence Level	**Common Stock**	**All Bond**
1 to 1 Surplus Ratio		
50% confidence level	32%	14%
90% confidence level	− 2	9
99% confidence level	− 29	6
99.9% confidence level	− 49	3
2 to 1 Surplus Ratio		
50% confidence level	42%	18%
90% confidence level	− 2	9
99% confidence level	− 38	2
99.9% confidence level	− 64	− 3
4 to 1 Surplus Ratio		
50% confidence level	61%	26%
90% confidence level	− 6	9
99% confidence level	− 60	− 5
99.9% confidence level	− 99	− 15
10 to 1 Surplus Ratio		
50% confidence level	119%	50%
90% confidence level	− 13	8
99% confidence level	−121	− 27
99.9% confidence level	−198	− 52

EXHIBIT 3

Maximum Adverse % Change in Surplus in a Three Year Period

	Portfolio Types	
Surplus and Confidence Level	Common Stock	All Bond
1 to 1 Surplus Ratio		
50% confidence level	48%	21%
90% confidence level	7	15
99% confidence level	− 3	11
99.9% confidence level	− 51	8
2 to 1 Surplus Ratio		
50% confidence level	63%	26%
90% confidence level	9	16
99% confidence level	− 35	8
99.9% confidence level	− 67	2
4 to 1 Surplus Ratio		
50% confidence level	91%	39%
90% confidence level	10	18
99% confidence level	− 56	1
99.9% confidence level	−104	− 12
10 to 1 Surplus Ratio		
50% confidence level	179%	75%
90% confidence level	17	23
99% confidence level	−115	− 19
99.9% confidence level	−210	− 50