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THE FUTURE OUTLOOK FOR STOCK COMPANY PROFITABILITY AND MUTUAL COMPANY SURPLUS POSITION

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1. Optimizing growth of companies so that marginal profitability reflects the marginal uses of surplus.
2. To what extent are the current rates of surplus growth and the current returns on surplus consistent with current growth rates?
3. How are companies managing profitability and growth?
4. What are the vital signs in monitoring the financial health of companies? How does one objectively measure the performance of a company?

The paper "Insurance Company Growth" by Dale S. Hagstrom will be discussed in this session.

MR. RICHARD S. ROBERTSON: As an introduction, Chart 1 compares the surplus levels of the 15 largest U.S. mutual companies over the last ten years. To the extent that the ratio of surplus to assets is a reasonable measure of surplus levels, the mean surplus level has decreased 20% since 1970. How long can companies allow surplus to grow at a rate less than the growth in the volume of business? While it appears that most companies improved their surplus ratios over the last five years, it is possible that this improvement is more apparent than real because, on a statutory basis, surplus includes the surplus of subsidiaries, including property-casualty companies. That surplus is presumably needed to support the business of the subsidiaries and only indirectly might be able to support the policyholders of the primary company. Nevertheless, it appears that the mutual companies have generally stopped allowing their surplus ratios to erode.

Chart 2 presents similar information for the 15 largest stock life insurance companies. As you can see, there has been an even more significant change among the stock companies, particularly for a few, including my own. Why is this happening? We will talk about this later on in the program.

We have put together a panel which includes two of the people in the Society who are among those contributing much effort toward the subject of studying surplus levels. Dale Hagstrom is a consulting actuary with Milliman & Robertson. He has prepared a paper on the subject which he is presenting today and which was distributed to you sometime ago. Don Cody is a consultant who has spent most of his career working for several large mutual life insurance companies; most recently, the New England Life. In his consulting practice, he has continued to work on surplus level questions, and, in addition, he has been a very active contributor to the research which is going on within the Society of Actuaries on surplus levels.

PANEL DISCUSSION

CHART 1
RATIO OF SURPLUS TO ASSETS
MUTUAL LIFE INSURANCE COMPANIES

Company	1980	1975	1970
Prudential	4.68%	4.58%	5.75%
Metropolitan	4.25	3.42	6.22
Equitable	3.07	3.50	4.82
New York Life	5.60	4.71	5.57
John Hancock	4.26	3.86	5.40
Northwestern Mutual	5.68	5.16	5.32
Mass. Mutual	5.76	4.12	5.67
Mutual of New York	5.45	5.65	6.98
Bankers Life	3.58	4.32	4.35
New England Mutual	5.78	5.33	6.48
Mutual Benefit	2.81	3.47	4.47
Connecticut Mutual	5.33	5.77	6.57
Penn Mutual	4.80	3.69	4.83
Western & Southern	9.22	6.89	7.44
Phoenix Mutual	5.99	5.10	6.78
MEAN (weighted)	4.56	4.23	5.73

CHART 2
RATIO OF SURPLUS TO ASSETS
STOCK LIFE INSURANCE COMPANIES

Company	1980	1975	1970
Aetna	3.44%	4.15%	6.85%
Connecticut General	5.02	4.84	4.73
Travelers	4.52	5.41	8.67
TIAA	4.15	4.14	4.53
Lincoln National	6.16	11.88	15.39
State Farm Life	14.56	11.36	11.70
Continental Assur.	6.77	4.35	8.14
National Life & Acc.	15.91	21.49	19.16
Transamerica	6.39	7.07	12.63
American National	14.05	12.69	14.63
Franklin Life	14.57	15.14	14.68
Nationwide Life	6.04	7.98	7.90
Provident L & A	11.99	13.33	16.24
Southwestern Life	7.41	5.99	7.17
United Benefit	8.27	10.09	12.75
MEAN (weighted)	6.14	7.30	9.31

I am a Senior Vice President of Lincoln National Corporation, and my responsibilities include financial reporting and planning. I will be discussing the subject from the perspective of a large, stock life insurance company.

MR. DALE S. HAGSTROM: Today's topic is the outlook for profitability and surplus. It seems to me that the outlook is that profitability is difficult to achieve and that surplus is hard pressed to keep up with inflation-fueled growth, as Dick Robertson has shown just now. Generally, the most profitable products are either those that involve the most surplus strain or those that are the most risky. The risky ones rely on surplus; whereas the former spend surplus. In either case, using current surplus effectively becomes the key. If we want to go after the most profitable business, we have to learn to go after it efficiently, using as little surplus as possible.

The first part of my presentation will be a five minute, simplified summary of a paper, called "Insurance Company Growth", to be published this Summer in the 1982 volume of the Transactions. The principal assumption in the paper is that a company has limited resources which can be measured most conveniently in terms of capital and surplus, which we shall call simply "surplus".

Note that the company can be either a stock company or a mutual company. After I summarize the paper as it applies to either type of company, the rest of my presentation will consider equity concerns when the process is applied to mutual insurance company planning.

Efficient Use of Surplus

A company usually has several ways to invest (or use) its limited surplus. To grow efficiently, the company should consider all of its alternatives, comparing the present value of increases in surplus to the surplus used. Let's refer to the present value of increases in vitality surplus as "profit". Vitality surplus as a concept has been developed by Don Cody. Total surplus minus vitality surplus is buffer surplus, which is surplus that is not free but rather is needed to be relied upon as a buffer against adverse contingencies. The measurement of buffer surplus is discussed in Don's Discussion Note which is included later in this presentation.

Furthermore, let's use a marginal definition of both the profits and the surplus used because the company is interested in deciding among alternatives for future action. Gains and losses yet to emerge on in-force business created by past actions and unaffected by current or future management actions will emerge when the time comes; they are not of current interest if there is nothing we can do that will affect them.

Finally, let's define a profitability ratio in terms of these marginal quantities:

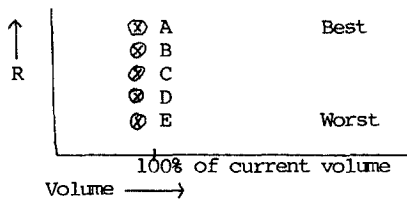
$$R = \text{Profitability Ratio} = \frac{\Delta}{\Delta} \frac{\text{Profit}}{\text{Surplus Used}}$$

That is, we want to look at the question: What is the change in profit

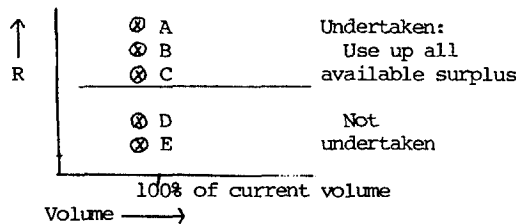
compared to the change in surplus needed? We have three concepts which differ from annual statutory accounting:

- (1) The definition of the present value of future profits.
- (2) A charge of any increase in buffer surplus needed.
- (3) Only marginal effects due to current management efforts considered.

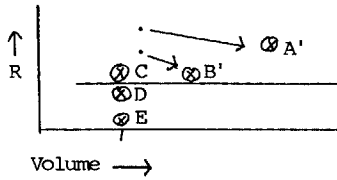
Note that we are discussing the pricing process and the needed theory to price and use surplus efficiently. Related to this pricing theory would be a system of management reporting to measure how well product managers are operating. Such a system will be different from statutory accounting. If statutory accounting is one extreme (with first year expensing and back end profits), then GAAP is an intermediate point on the spectrum (with profit level by duration as a percentage of premium). Continuing to the right on the spectrum, we come to what I envision for internal management reporting, the full present value of profits on new sales is taken into gain in the year of sale. With the profitability ratio R as a measure, we rank the company's alternatives. Those alternatives with the highest profitability ratios should be undertaken in preference to those with the lowest profitability ratios. A simplified diagram shows this.



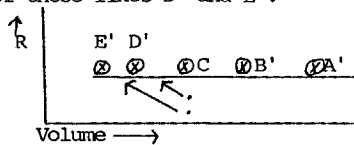
If the company had no control over its prices, the process would stop when those alternatives with the highest profitability ratios, once chosen, used up all the available surplus.



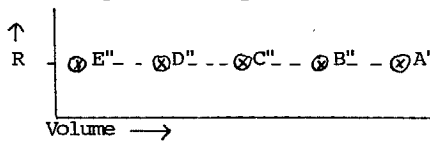
However, the process becomes more complicated when we remember that an insurance company has the power to set prices on its insurance contracts. Now we get back to pricing theory. The company should pursue aggressively those alternatives (such as A and B) with the highest profitability ratios, perhaps by cutting price, increasing guarantees, or by raising commissions. This aggressiveness gets more of the most profitable business. Call the additional business A' and B'. The additional business sold is a little less profitable, but it is still more profitable than some alternatives.



The company should pursue less aggressively those alternatives (D and E) with the lowest profitability ratios, perhaps by increasing the price or by cutting commissions. Thus, the company gives up its least profitable business and increases the overall profitability ratio. After raising the price, the company sells less of product lines D and E. Let's call the next marginal sale of these lines D' and E'.



We work to set the prices in the various lines of business and on the various plans of insurance such that the profitability ratios are equal for all alternatives at the margin. There is more than one level where the prices can produce equal profitability ratios, but we select the one level where all available surplus is fully committed.



At this point, nothing more can be sold without precluding something else, but any such trade produces no net gain. The gain on the new sale is offset by the foregoing gain on the sale not made.

The company cannot do better; this is the most efficient use of surplus possible. The main idea is that the company gets to the point where trade-offs (recognizing its limited surplus) produce no net gain.

Let me back up to make three technical points. The first is that the calculation of marginal profit as we change the price is difficult. A variety of difficulties have been listed in the paper. One is that we need to be aware of changes not only in the usual pricing items - persistency, claim costs, expenses and taxes - but also both in sales volume and in the profitability of other policies affected by the change in price. Such other policies may be (a) business already in force, (b) business that would have been sold even without the change in price, plus (or net of) (c) business that would have lapsed without the change in price.

The second technical point is that this strategy of setting prices involves marginal expenses. Expense charges on a marginal basis are made for comparison purposes only. It is assumed that the marginal profits on

business sold this year are sufficient, in total, to cover expenses that are not charged on a marginal basis. If the overhead expenses and other expenses not charged on a marginal basis are greater than the profit in a year on a marginal basis, then the company is in trouble. The trouble does not arise from pricing on a marginal basis; after all, we have shown that the company is doing the best it can do. Rather, the company must find a way to cut its overhead or other expenses.

The third technical point extends the second. A year's marginal profit net of overhead expenses yields the ultimate rate of surplus growth. This rate must match the current or expected growth rates in liabilities if the surplus/liability ratio is not to decrease further.

The paper ("Insurance Company Growth") just summarized has received three written discussions that will appear in the Transactions. One of these discussions comes from Frank Irish, who is concerned with the case of a mutual insurance company. Mr. Irish agrees with the concept of charging policyholders in various lines for their proportional use of buffer surplus if surplus is the main limitation on the company's service capacity. However, Mr. Irish prefers to avoid the use of marginal concepts and suggests a planning process that avoids them. Mr. Irish is concerned that the concepts of marginal expenses and marginal profitability are subject to misuse, misunderstanding and possibly inequity. It seems to me that this is particularly true if a mutual insurance company uses marginal concepts only in certain situations; that is, only where competition seems to require it. If a mutual insurance company uses marginal concepts not at all, I recommend to the company Mr. Irish's planning process. But, if the company does use marginal concepts in any situation, I recommend a correct theoretical understanding of their application. More favorable pricing treatment is given to the more price sensitive segments of the business only to the extent that the incremental result is still more profitable than the alternative uses of surplus that are precluded. This means that the company must look at everything marginally. Seeking price sensitive business may in fact be a bad use of surplus, so an incomplete application of marginal concepts should not be used to justify seeking such business.

The Question of Equity

For mutual companies, a large question is whether the proposed strategy is fair and equitable. In 1980 the American Academy of Actuaries adopted guidelines for the equitable distribution of surplus to participating policyholders of mutual insurance companies. The Academy guidelines generally endorse the contribution principle as a basis for dividend philosophy - distributable surplus is allocated to policyholders in proportion to their classes' contribution to surplus. However, I want to draw the attention of stock companies to the fact that yesterday's session on dividend principles discussed the extension of the Academy guidelines to any new par business in stock companies and to non-guaranteed-premium business. So some of what follows may become relevant to stock companies also.

Historically, mutual insurance companies have used the contribution principle, and this formulation of equity has gone hand in hand with their growth. When the public was not so sensitive to the initial premium

level, and when the mutual insurance company was not constrained by surplus, the promise of "insurance at cost" was sufficient to ensure efficient growth. The mutual insurance company could avoid the risk of losses on most, if not on all, product lines because of the comfortable dividend margins. Valuable sales effort was not wasted on products that eventually caused losses that had to be made up by other product lines. Hence, the growth was reasonably efficient.

Today, however, there are three differences.

- (1) The customers that companies most often target to achieve quick growth are more price sensitive.
- (2) The products require more surplus in comparison to potential profit.
- (3) The companies have less surplus, relatively.

Furthermore, the companies face some situations where a strict (retrospective) application of the contribution principle will produce losses. At the root of many of these situations is the mismatch of asset and liability maturities under conditions of ever higher interest rates. The problem these days often arises as: What interest rate should we credit on funds likely to move to get high rates elsewhere (leaving a capital loss) versus what interest rate should we credit on funds not likely to move? We have on the one hand perhaps group annuity policyholders or individual policyholders with large amounts at stake, often with relatively high interest guarantees by historical standards. Many of these high guarantees made their contracts appear at issue to be almost non-par, at least from the company's point of view. Yet, the company may now need to pay additional interest to conserve the business.

Yes, the owners of small life insurance policies or of traditional par annuities with low guarantees may have earned an increase in dividends, but if extra interest is not paid to the more interest rate sensitive policyholders (temporarily, until interest rates fall), then the company of these same persisting policyholders will be hurt, perhaps critically.

Not to conserve the business that is interest rate sensitive (because of a need for retrospective equity) is to invite disaster prospectively.

If pricing according to a strict formulation of the contribution principle is fair retrospectively but is a disaster prospectively, what is the value of such a strict formulation? In fact, such a strict formulation is like a straw man set up to be knocked down. No mutual insurance company should use such a strict, purely retrospective, form of the contribution principles. A prospective test of whether the dividend scale can be continued is usually performed. Surely the actuary must blend both retrospective and prospective analyses. The two perspectives can be blended to include the following points.

1. If a mutual insurance company wishes to use marginal concepts in any part of its strategic planning, then the company should use marginal concepts throughout. In most cases the resulting prices can be restated in terms of the contribution principle.

2. If we interpret the pricing principle proposed as a guide to the allocation of fixed expenses, then the fixed expenses are allocated in such a way that the expenses are supportable. The distribution of business among lines of business and among plans of insurance does not shift away from the distribution projected in the planning process; such a shift would have left the fixed expenses unsupported. The Academy recommendation says that indirect costs should be allocated using sound principles of expense allocation. One might argue that traditional principles of expense allocation, when applied to indirect (i.e., fixed) expenses, are not sound if they do not recognize such a possible shift in distribution of business.
3. In the few cases where a deviation from the contribution principle is needed to avoid prospective disaster, the recommendations adopted by the Academy seem to allow this protection to the mutual insurance company and its policyholders. Even if the actuary chooses to make the most narrow interpretation of the Academy's recommendations, the actuarial report can disclose a deviation, the need for the deviation, and the effect of the deviation, from whatever formulation of the contribution principle the actuary uses.

MR. DONALD D. CODY: The ratios of surplus to assets for the mutual companies studied by Dick Robertson as well as the ratios of surplus (including MSVR) to assets (excluding separate accounts) for a number of other mutual companies available to me appear to be increasing in the last five years as a generality. However, the level of these ratios is still well below that of some years ago, and mutual companies appear still to be highly leveraged. Mutual companies appear to be striving to increase relative surplus in the face of the capacity utilized by C-1, C-2 and C-3 risks, comprehending risks from defaults, stock market losses, disintermediation, and claim and other premium inadequacies. Some of this surplus growth probably arises from the release of the new business fund as a result of the introduction of CRVM reserves on new business in recent years, a source of surplus which will eventually disappear with concomitant decreased premium margins.

Also, Dick notes that stock company surplus ratios have been falling from their previously higher levels. There is little doubt, therefore, that surplus available (total surplus less capacity utilized by in-force business) must indeed be the basic constraint on growth in most companies.

If contingency surplus needed against all risks (Dale's buffer surplus) is determined so as to reduce the probability of insolvency to some level like .001, the balance of surplus available for growth can be determined. It is important, therefore, to determine such contingency surplus needed as a first step in corporate planning. This is a complex matter for which I have described a practicable solution in an extensive Discussion Note to be reproduced in the RECORD as part of this Panel Discussion. (This Discussion Note is reprinted in total below.) The Note is intended not only for purposes of this Panel Discussion, but also to remind actuaries working in the valuation and surplus area that surplus needed for the serious C-3 risk (changes in the interest environment, notably disintermediation) must be augmented by surplus needed for the C-1 (defaults and common stock) risk and for the C-2 (premium inadequacies for

claims, etc.) risk. Study of this whole area is the responsibility of the SOA Committee on Valuation and Related Problems, while the C-3 risk is being studied by the SOA Task Force on C-3 Risk.

DISCUSSION NOTE

Contingency Surplus Needed for C-1, C-2 and C-3 Risks(Capacity Utilized)

This is a companion wrap-around Discussion Note to my previous one which provided background for the Panel Discussion at the SOA meeting in Atlanta on October 19-21, 1981, on "Impact of Inflation on Insurance and Annuity Valuation: the C-3 Risk". The previous Note was entitled "Contingency Surplus Needed for the (C-3) Risk of Change in Interest Environment" and is printed in RECORD 7:4 (1981). It intensively described the C-3 risk to the extent understood by the SOA C-3 Task Force in late 1981 but discussed the C-1 and C-2 risks in only a summary manner. The present Discussion Note provides a detailed discussion of these latter risks, the combination of all risks, and implications on planning. While there is some repetition of the contents of the previous Note, fuller understanding of the C-3 risk requires a reading of it.

1. General

1.1 Categories of Risk

The SOA Committee on Valuation and Related Problems has defined investment and insurance risks as follows:

- C-1 Risk: Asset defaults and loss of market value of common stocks and related reductions in investment income.
- C-2 Risk: Losses due to premium inadequacy, other than C-1 and C-3 risks.
- C-3 Risk: Losses due to changes in interest environment, other than C-1 risk.

An additional risk category not in the SOA nomenclature involves risks of an accounting nature not yet admitted in statutory financials, such as potential FIT liabilities, bad debts, or lawsuits, which I will call C-4 risks.

1.2 Structure of Reserves and Surplus

The reserve and surplus structure of a life insurance company is as follows:

Reserves: Actuarial reserves held in the statutory financials are intended to provide good and sufficient provision for in-force contractual obligations based on reasonable variations of claims, expenses, terminations, withdrawals and investment earnings (including capital gains and losses) from those expected under normal conditions.

Contingency Surplus Needed: Contingency surplus needed is intended to provide additional good and sufficient provision for in-force contractual obligations on the assumption of further plausible variations of which the probability of occurrence is quite small. The level of such needed surplus varies inversely with the level of probability, e.g., surplus

needed at the .0001 level is higher than at the .001 level. Management must decide on this level of probability, and regulators would have an interest. This contingency surplus needed represents the extent to which in-force business has used up capacity.

Statutory Surplus (Including MSVR and Other Such Reserves): Statutory surplus held in statutory financials consists of capital, special surplus funds and unassigned surplus. This statutory surplus should be augmented by the Mandatory Securities Valuation Reserve and similar reserves set up for potential asset impairments and claims fluctuations for purposes of this discussion.

Vitality Surplus: What I call "vitality surplus" is the excess of the augmented statutory surplus over the contingency surplus needed for risks on in-force business. It is a revolving fund from which capital is drawn to provide new business drains and growth in marketing systems, for new administrative systems, new products, new lines, new subsidiaries and blocks of business, and for bolder underwriting and investment policy; into which net income (after stockholder dividends and FIT) flows; and from which increase in contingency surplus needed is subtracted. It thus represents the still available capacity of the company to improve, grow and undertake new risks. Its appropriate size can be determined only by projecting capital needs under a long range plan, subject to a minimum size appropriate to the least ambitious plan deemed reasonable and sufficient to allow the company to recover its vitality, should contingency surplus needed be largely dissipated by realization of heavy losses.

1.3 Overview of Contingency Surplus Needed for C-1, C-2 and C-3 Risks

The contingency surplus needed is defined as the amount which has a stipulated very small probability P of being dissipated at some future time by realization of one risk or a sequence of risks. In a well defined mathematical world, all plausible risk scenarios would be modelled and assigned specific probability distributions and then combined into an overall global model and distribution function, enabling a precise determination of surplus needed at various probabilities of ruin. One of these levels would then be selected by management as appropriate. In the real world, such a theoretically ideal approach is impractical. This suggests the theoretical approach only for the stochastic portion of the C-2 risk involving variations in total death claims amenable to classic ruin theory. Specific deterministic scenarios, with estimated probabilities of occurrence, would be used as surrogates for the ideal approach in all other areas.

C-1, C-2 and C-2 Risks: Contingency surplus needed for C-1 and C-2 risks can be estimated as outlined later in Sections 2 and 3. In most life insurance companies, the C-1 risk will be found to dominate the C-2 risk; however, the C-2 risk will be sizable in companies specializing in reinsurance, group life and health or long term disability. The C-3 risk is now under intensive study by the SOA Task Force on (C-3) Risk of Loss from Changes in Interest Rate Environment. The approach is deterministic utilizing interest rate scenarios, terminations and withdrawals as functions of product design and interest scenario, and IYM investment income analyses relating asset cash flow and liability cash flow. The theory is described in my previous Discussion Note with some early results

on GIC's in James Tilley's Task Force paper, also published in RECORD 7:4 (1981). C-3 risk surplus needed can become quite large relative to that for C-1 risk on GIC's with book value withdrawal guarantees and poorly matched assets. Studies of C-3 risk on other types of products are now under way. See Section 4.

For purposes of this paper, it is assumed that surplus needed on each individual risk is established at probability level P approximately (say .001).

Procedures: Contingency surplus needed cannot be determined with actuarial precision because it involves not only judgment of the many risks but also the attitude of management as to the level of probability of insolvency or of loss of solidity which management is willing to accept and be comfortable with. Also, since level of probability itself is difficult to estimate because of the complexity of the models of all possible futures, only magnitude levels of probability are feasible, i.e., approximately .01 or .001 or .0001. Thus, procedures used to measure each risk and the associated amounts of surplus needed can be simplified, consistent with such magnitude determinations.

The procedures should minimize actuarial mystery and should treat each risk independently for clarity. Once a determination of surplus needed is made for each risk, the results can then be combined with due attention to the supportive nature of surplus needed for different risks with varying degrees of correlation. Finally, available credits, e.g., reductions in policyholder dividends, group pension pass-throughs of risks to policyholders, available reserve destrengthening, etc., can be granted.

It is important that specialists (accountants, actuaries, economists, investment managers and lawyers) be called on to make estimates and determinations in their fields of expertise to assure quality and credibility. Only in this way can there be acceptance by groups of different interests. Above all, the work must be done in the simplest and clearest way so that each specialist and interested party can understand the process and the results. Adversary relationships must be recognized and smoothed from the beginning.

Contingency surplus needed for in-force business and the vitality surplus desirable for future growth and change should be determined to assure solidity, rather than just solvency. Solidity means that the company is assured of on-going vitality without serious permanent changes in present and future planned operations even if the risks at the level of the probability chosen are in fact realized in substantial degree.

1.4 Combination of Risks

Obviously, contingency surplus needed in total is not the simple addition of the surpluses needed for each specific risk. To determine the contingency surplus needed in total accurately, it would be necessary to have the distribution function for the sum of the losses from all possible risks, enabling one to say that there is a probability P that losses will exceed a contingency surplus of amount CS. As indicated above, this approach boggles the mind. Instead, there is a simplistic combinatorial method available as described in the earlier Discussion Note. It involves iterative application of the following formula:

$$S_{A+B}^2 = S_A^2 + S_B^2 + 2r_{A,B} S_A S_B$$

where A and B are risk combinations

S_A , S_B and S_{A+B} are Surplus Needed at probability level P

$r_{A,B}$ is the correlation coefficient between risk combinations A and B

By recognizing correlations within basic unrelated classes of risks (e.g., economic environments, mortality) and independence between such basic unrelated classes of risks, one can postulate the following reasonable iteration of the above formula: Surplus needed for C-1 risks is determined on scenarios involving very serious recession or depression. Certain C-2 risks, such as for group LTD and for individual non-can or guaranteed renewable disability income, have an $r = 1$ with C-1 risks. Hence surplus needed for C-1 risks is additive to surplus needed for such C-2 risks. Let the sum be S_a . C-3 risk, designated as b, is obviously

correlated with a. Suppose that $r_{a,b} = 0.5$.

$$\text{Then, } S_{a,b}^2 = S_a^2 + S_b^2 + S_a S_b$$

Now, let c, d, e ... be the remaining stochastic C-2 risks. These have an $r = 0$ with respect to the combined risk a + b. The surplus needed for

$$a, b, c, d, e \dots \text{ is then } S_{a+b+c+d+e}^2 \dots = S_{a+b}^2 + S_c^2 + S_d^2 + S_e^2 + \dots$$

Still remaining are the C-4 risks and the non-stochastic C-2 risks (e.g., cyclical group life and health risk and individual guaranteed renewable medical case risk). These are additive. Hence, the gross contingency surplus needed SN is as follows:

$$SN = S_{a+b+c+d+e+\dots} + S_{C-4} + S_{\text{Non-stochastic C-2}}$$

As noted later, because of the potentially large size of catastrophe risks not covered by reinsurance, some companies might prefer to treat such risks like C-4 risks. Finally, credits are subtracted from the gross SN to determine the net SN. As discussed later, this approach can be adapted to extend to major lines, minor lines and products.

1.5 Credits Against Contingency Surplus Needed

Contingency surplus needed is reducible by credits available at the time serious losses occur. Such credits include the following:

Reductions in policyholder dividends to the extent such reductions can be made without destroying company reputation and viability in the marketplace. Also, similar reductions in net income or stockholder dividends.

Pass-throughs to policyholders on IPG Group Annuities to the extent realistically applicable.

Destrengthening of annuity reserves to the extent of any conservatism introduced for FIT reasons.

Destrengthening of A&H claim reserves to the extent of any conservatism.

1.6 Stochastic Model for C-1 and C-2 Risks

The Equitable has used a broad brush stochastic approach for the combined C-1 and C-2 risks (R. B. Link RECORD 3 (1977) pp. 162-167 and 956-960). Their stochastic model, now being updated, involves investment and insurance variations based on historical experience with spikes of unusual happenings and gives probabilities of insolvency and crisis at various levels of surplus. While this model does not have the detail and hence credibility of the deterministic processes suggested here, the sensitivity of the probabilities of insolvency and crisis to the different levels of surplus are well illustrated in the Link discussions. The conclusions of the Equitable were not inconsistent with those developed by me in one company using the techniques described herein.

2. Determination of Contingency Surplus Needed for the C-1 Risk

(Asset Defaults and Losses in Common Stock Market Values)

The C-1 Risk relates to the quality and distribution of invested assets. The deterministic approach to determination of surplus needed for losses related to asset defaults and to fall in market values of common stocks is as follows:

Very large C-1 risk losses can occur only in a serious long term recession or depression. A basic definition of such an economic episode is one which would require governmental assistance for the insurance business e.g., cash flow freezes, pegging of security values, Federal Reserve accommodation. Such an episode would destroy the solidity of many companies and the solvency of some companies. The appropriate level of C-1 surplus needed is that which would assure the solidity of a company so that the company would not be worse off than its best competitors with time available to recover its previous strong financial position. The probability P of such a scenario occurring might be established at, say, a level of .001. A corollary of this reasoning is that it is unrealistic to contemplate on-going current viability if surplus is held against worst occurrences, like nuclear war, which would change our economy beyond possible return to normalcy.

The design of such an economic scenario should be accomplished by a group consisting of an investment researcher, an economist and an actuary and should be acceptable by all interested parties. In my own work, I have used two scenarios:

- . A deflationary depression, like that of the 1930's.
- . An inflationary episode, with serious recession of 4-5 years, double digit inflation, tight money and widespread insolvencies, and high unemployment peaking at 12% and then decreasing. This is followed by less serious stagflation.

Investment officers are asked to analyze each security and parcel of real estate (or blocks thereof) in the investment portfolio so as to determine its probability and timing of default and the percentage and timing of

recovery on assets held at book, and to establish the maximum downside movement of the market value of common stocks held.

The C-1 surplus needed is the maximum accumulated capital losses plus income losses (after FIT savings) during the 4-5 year episode. Stock market recovery late in the episode probably should not be credited since stocks would probably already have been sold. Then, the C-1 surplus needed for each security and investment held at book value equals:

(Book value) x (Chance of default) x (1 - % recoverability)

Plus Income (after FIT) lost during period of default.

The C-1 surplus needed on common stocks equals:

(Market value) x (Potential market value decrease %)

Plus reduction in dividends (after FIT) during the episode.

The resultant C-1 surplus needed figures will vary from company to company and from year to year. Below are some entirely illustrative figures:

Invested Asset	C-1 Surplus Needed (As % Statement Value of Assets At Risk)					
	1976		1977	1978	1979	1980
End of:						
Scenario:	Deflation	Inflation	Inflation			
<u>Bonds</u>						
AAA, US Gov't	0	0	0	0	0	0
Cash Equiv.						
AA	.5	.8				
A	1.3	2.0	NA	NA	NA	NA
BAA	6.9	5.8				
Lower	<u>15.0</u>	<u>8.1</u>	—	—	—	—
Total Bonds	5.2	4.1	4.4	4.1	4.3	4.1
Comm. Mort.	4.5	2.3	2.3	2.2	2.3	2.8
Pref. Stocks	10.6	9.5	9.4	9.4	9.5	9.5
Comm. Stocks	60.0	45.0	35.0	33.0	35.0	22.0
Real Estate	<u>3.0</u>	<u>3.0</u>	<u>3.0</u>	<u>3.0</u>	<u>3.0</u>	<u>3.0</u>
Total Cap.Losses	7.7	5.5	4.9	4.3	4.4	4.1
Income Loss (after FIT)	<u>2.2</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.6</u>	<u>1.8</u>
Tot. C-1 Surplus Needed	9.9	7.1	6.4	5.7	6.0	5.9
(Policy Loans)	(0)	(0)	(0)	(0)	(0)	(0)

3. Determination of Contingency Surplus Needed for C-2 Risks (Premium Inadequacy, Other Than From C-1 and C-3 Risks)

3.1 Risk of Variation in Total Amount of Death Claims, Accidental Death and Dismemberment Claims, Release of Annuity Reserves by Death.

These risks are amenable to stochastic determination by classic ruin theory. They are independent of each other and all other risks, i.e., $r = 0$.

3.1.1 Death Claims on Life Insurance

. Collective risk theory: Distribution of death claims, less reserves released, by amount on each life dying are determined by analysis of actual claims during a year. Amounts in excess of retention are removed on each death. Spikes of very large claims are introduced into the distribution since such large claims are unlikely to occur in the exposure year. The distribution of the total losses in excess of the expected follows the Compound Poisson Distribution involving convolutions of the amounts of claims. This function can be expanded into the Edgeworth Series, whose terms involve derivatives of the Normal Distribution and moments of the distribution by claims by amount. The surplus needed can be derived by inverting the Edgeworth Expansion by the so-called Normal Power Expansion (Cornish-Fisher inversion of the Edgeworth Expansion). This process is described clearly in the British Institute of Actuaries text; Beard, Pentikainen, Personen, "Risk Theory", Halstead Press, John Wiley & Sons, New York, 1977, Chapters 3, 4 and 5.

. Individual risk theory: The distribution of exposures (face amounts less reserve less reinsurance) by amounts is determined along with the associated average age in each amount class. This may be hard to come by, but, if available, can be applied to an individual risk model or handled by the recursion formulas presented by H. H. Panjer in his paper in TSA XXXII (1980) pp. 523-546.

For a fixed probability level, C-2 surplus needed for this risk is roughly

proportional to $\alpha \sqrt{n}$ in dollars and to $\frac{\alpha}{m \sqrt{n}}$ as a % of claims, where

α^2 = second moment of claim amounts, m = average claim in dollars, and n = number of claims. Hence, the surplus needed varies considerably from company to company. However, purely as an illustration, in one large company with annual life insurance net death claims of about \$100 million, high average amount, and a retention of \$2 million, the C-2 surplus needed was 21% of gross death claims at the .0001 probability level on Ordinary. Group insurance death claims of about \$20 million produced a similar % figure, but when combined with Ordinary claims did not raise the overall dollar figure because of the added stability of the Group claims.

3.1.2 Accidental Death Claims and Group AD & D Claims

These are treated as in 3.1.1

3.1.3 Release of Annuity Reserves on Death

My experience is that it is difficult to establish the distribution of annuity reserve releases on death by amount or the distribution of exposures. In most companies, this risk is small relative to the

comparable life insurance risk. I have used a Normal Distribution of total reserves released in excess of expected with a standard deviation of $\frac{1}{\sqrt{n}}$ where n = number of annuitant deaths and $\frac{1}{\sqrt{n}} = Kx$ (average reserve released) where the multiplier K is at least 5, reflecting skewness in the distribution of amounts.

3.1.4 Level of Probability

While the combinatorial formulas in Section 1.4 call for a uniform level of probability P for all specific risks, here one should use P approximately equal to .0001 for meaningful measures of surplus needed, even though economic scenarios chosen for the C-1 and C-3 risks are likely to imply P at the level of .001 or higher.

Stochastic variation of total claim amounts as a % of expected claims on disability income and medical care coverages are insignificant relative to other risks on such coverages, discussed later, and can be ignored. (Note formulas above.)

3.2 Risks Fully Correlated with the Depression and Recession Scenarios

These C-2 risks have an $r = 1$ with the C-1 risks.

3.2.1 Non-can Disability Income, Guaranteed Renewable Disability Income, Group Long Term Disability Income, Ordinary and Group Waiver of Premiums

The deterministic approach applicable here is an actuarial determination of the losses developing as a result of unemployment and related strains on health over the 4-5 year inflationary or deflationary recessions chosen for the C-1 risk. There are three sources of loss:

1. Increase in open and unreported claims caused by a decrease in the recovery rates.
2. Increase in the number and persistency of new claims.
3. Increase in policy terminations, especially on healthy lives, with a decrease in premium income.

For guaranteed renewable disability income and group long term disability income, there is a credit:

4. Increase in premium rates, subject to delay and increased termination of policies, especially on healthy lives.

The objective of the actuarial estimations is to establish the accumulated losses, in excess of losses assumed in the actuarial reserves held over the 4-5 year episode, after which return to normalcy can be assumed.

The results are a function of premiums in-force and of open and unreported claim reserves. I am familiar with one test on non-can disability income with benefits running to age 65 on a line growing at 5% annually. Expressed as a percentage of premium in-force on a mature portfolio, the C-2 surplus needed was of the order of 75%. On reratable contracts, the corresponding percentage would be lower. For a group LTD line in one company, the figure was 50% of premium in-force. These figures, of course, have no necessary applicability to another company.

3.2.2 Expenses Subject to Inflation

To the extent that inflating expenses during the C-1 inflationary recession cannot be offset by reductions in policyholder dividends or by absorption in net income, surplus needed should be estimated by deterministic methods.

3.3 Risks on Coverages with Short Claims Periods and Reratable Premiums (Group Medical and Dental and Individual Medical Coverage)

These risks tend to be cyclical or sporadic and are not stochastic in the usual random sense. Surplus needed, as determined as described below, should therefore be added numerically to the surplus needed for all other risks after combination of such risks. (See Section 1.4)

These coverages are issued to small, medium and large groups, to trade and professional association groups, to MET groups, and individually in various markets. Results of anticipatory rerating can be determined by type of group, class and policy design from historical experience. No doubt, the variations in gains and losses will be cyclical, differing by type of group, class and policy design. Assuming on-going underwriting action similar to the past will indicate a level of maximum loss as a percentage of premium, and this maximum loss might be taken as a basic measure of C-2 surplus needed.

However, on-going success in anticipatory rerating (especially on Major Medical with deductibles, coinsurance, and few inner limits or on MET groups) should not be taken for granted, as indicated by recent sudden increases in claims due to changes in Medicare and Medicaid hospital reimbursements. For each type of group, class and policy design, a sudden, plausible, sizable change in loss ratios can be hypothesized with an appropriate delay in putting premium increases into effect and attendant lapses. The C-2 surplus needed on this basis would be the aggregate of losses over the delay period. It might even be prudent to allow for two such happenings before financial recovery. If this determination is greater than the basic measure, noted above, it should be adopted. Naturally, any stop loss reinsurance would reduce such C-2 surplus needed.

Individual medical care insurance on retired lives is very sensitive to possible, substantive Medicare changes, and specialty companies should have C-2 surplus needed against expenses of winding down administration, changing administration, producing a new product, and allowing for any claims losses net of reserve releases.

3.3 Catastrophe Risks

These risks are theoretically entirely independent of each other and all other risks and hence with $r = 0$. However, because of their potentially very large cost in the absence of adequate reinsurance, some companies may prefer to hold an additive surplus needed.

Catastrophes to be recognized include epidemics, accidents (for which reinsurance is usually carried), earthquakes, and nuclear accidents. Measures of C-2 surplus needed beyond reinsurance can be made by deterministic techniques. The experience of the 1918 influenza epidemic

is available. I am familiar with an estimate of the death, disability and medical care claims and the real estate, mortgage and bond losses caused by an 8.6 Richter scale earthquake along the San Andreas fault in the Los Angeles area in a company with some \$5 billion of assets: \$25 to \$50 million, largely investment losses. Naturally, this result reflects the concentration of insurance and investments.

The characteristic of this risk is that on a supportive combination basis, using $r = 0$ with other risks, the effect on total C-1-2-3 surplus needed is small. Yet, if the risk occurs, the effect on surplus is very large. Reinsurance, if it is available, is an answer. Otherwise, we should be sure that the vitality surplus is large enough to permit surplus recovery after a period of deferring growth plans. Or, if preferred, rather than using an $r = 0$ combination with other risks in the total surplus needed, the combination can be made using $r = 1$, resulting in a straight addition to the surplus needed for all other risks.

3.4 Various Other C-2 Risks

These would include such risks as ignorance of expected claims on novel coverages, new government regulations, unwise concentration of risk by market or product, and actuarial pricing and underwriting errors. These are not amenable to estimation and are of a nature which suggests that vitality surplus should be large enough to enable the company to expose itself to such risk-taking.

4. Determination of Contingency Surplus Needed for the C-3 Risk (Changes in Interest Rate Environment)

As noted previously, details of the theory and procedure for this determination are covered in my previous Discussion Note in RECORD 7:4 (1981), and early results for GIC's appear in James Tilley's paper, accompanying the Discussion Note. This Section provides some highlights and updates some recent findings by the SOA Task Force on the C-3 Risk.

4.1 Basic Theory

The underlying force behind the C-3 risk is the interplay of asset cash flows (a_t) and liability cash flows (l_t) at future time (t) from assets held and liabilities in-force at the valuation date, time (0), where

a_t = interest, dividends, rent, maturities, repayments, prepayments

$A_0 = \sum_1^{\infty} v^t a_t$ = "market value" of assets at time (0), excluding policy loans

l_t = claims, withdrawals, policy loan payments, policyholder dividends, expenses, taxes, less premiums, less policy loan repayments, less policy loan interest

$L_t = \sum_1^{\infty} v^t l_t$ = "gross premium" reserve at time (0), less policy loans

$a_t - l_t$ = net cash flow at future time (t) = funds available for investment (+) or required to be borrowed within company (-) = "asset slab" in IYM system

$$S_0 = \sum_1^{\infty} v^t (a_t - l_t) = A_0 - L_0 = \text{"market value" surplus at time (0)}$$

In the classic Redington immunization theory notation, lengths, or durations, of assets and liabilities are defined as

$$D_1^A = \sum_1^{\infty} t v^t a_t \quad \text{and} \quad D_1^L = \sum_1^{\infty} t v^t l_t$$

where (v) is at the generated IYM rate in the total fund at each time (t).

If $D_1^A < D_1^L$, C-3 risk exists, i.e., S_0 decreases, when new money rates are falling (downside risk). This risk dynamically increases further because of asset calls.

If $D_1^A > D_1^L$, C-3 risk exists, i.e., S_0 decreases, when new money rates are rising (upside risk). This risk dynamically increases further because of disintermediation of liabilities.

In summary, C-3 risk increases in a downside interest movement when assets are shorter than liabilities and in an upside interest movement when assets are longer than liabilities. In some volatile high interest environments with upside and downside movements, it turns out that the C-3 risk is at its worst.

4.2 Real Life Situation in Statutory Financials

Moving to the real life situation of statutory financials with assets at book value, statutory reserves and fixed dollar guaranteed cash withdrawal and loan values, it turns out that the profit (loss), ΔS_t , from C-3 risk can be expressed simplistically as the following per unit of issue, postulating that surplus $S_{t-1} = 0$, i.e., accumulated assets are set

equal to reserves at the beginning of each year.

$$\Delta S_t = -P_{t-1} \left[(V_{t-1} + P_t) (i_t - i_t^*) + (V_{t-1} + P_t) (\bar{i}_t - i_t) - \right. \\ \left. q_{t-1}^w (V_t - C_t) \right]$$

Where V_t = reserve

P_t = net premium

i_t = reserve interest rate

\bar{i}_t = interest rate credited in policyholder dividend, in excess interest on Universal Life and deferred annuity, or to GIC's

i_t'' = IYM interest rate (after FIT) generated by the action of new money rates and rollover rates on the (+ or -) investment year asset slabs, whose size and sign reflect the dynamics of the asset and liability cash flows along the interest rate scenario

P_{t-1} = persistency factor

q_{t-1}^w = termination or withdrawal rate, excluding policy loans, the effects of which are reflected in i_t'' like asset swaps

The surplus needed for C-3 risk is the fund required to provide for the above losses at each future duration (t) along the scenario path. Profits are allowed as credits so long as the fund at a future date is sufficient to provide for net losses thereafter along the scenario path. The fund at maturity of all liabilities must be sufficient to pay for any losses during the runout of the (+ and -) IYM structure asset slabs. The interest rate credited to the surplus needed fund is that generated by the IYM fund. Surplus needed so determined is sufficient to cover capital losses caused by forced sales of securities in the absence of borrowing capacity within the company.

The above formula shows the following:

- . It applies to both upside and downside interest movements and to mixed situations.
- . The dynamics of the IYM rate (i_t'') are fundamental, whether i_t'' decreases because of rollover and reinvestment of short assets in a declining interest environment, or because of disintermediation of liabilities in a rising interest environment. In either event, declining i_t'' can fail to support \bar{i}_t , the required interest on reserves, or it may not provide investment earnings sufficient for crediting \bar{i}_t in policyholder dividends, excess interest on Universal Life and deferred annuities, or guaranteed interest on GIC's.
- . The last term in the formula is a credit for surrender charges. If the surrender charge is based on a market value adjustment, which is essentially the present value of all losses due to the reduction in i_t'' caused by the withdrawal, the loss is reduced to zero. However, book value surrender charges are only palliatives in some plausible scenarios.
- . The reserve basis is reflected.
- . Omitted are the gains and losses arising from the loading less expenses, amortization of acquisition expenses, mortality profits, corresponding policyholder dividend factors, and profit charges in dividends. The SOA Task Force on C-3 Risk incorporates these in its calculations. We are determining assets needed (ignoring reserves) along interest scenario paths, recognizing all factors and finally determining surplus needed as the excess of assets needed over reserves.

The surplus needed for the C-3 risk is that required for the "worst scenario" among all plausible scenarios where the "worst scenario" has a probability (P) of occurring, the level of P (.01, .001?) being that deemed appropriate by management. (In today's environment, the "worst scenario" at P = .001 or even .01 could be pretty bad!)

4.3 Implications

1. Study of the above formulas enables a listing of the important variables affecting C-3 risk. The SOA Task Force on C-3 Risk recognizes them as follows:
 - . Interest Scenarios: upside, downside, mixed (cap, cup), historical, future
 - . Product design
 - Investment type: GIC, Universal Life deferred annuity
 - Insurance type: conventional non-par and par life, indeterminate premium
 - Guaranteed interest rates: book basis maturity and voluntary withdrawal values; market basis maturity and voluntary withdrawal values; 5%, 6%, 8% and variable policy loan interest rates
 - . Disintermediation (q^W_{t-1} and policy loans) as a function of product design, interest rate credited, new money rate, and sophistication of market
 - . Length and mix of asset configurations relative to length and type of liabilities which they support. Optimal matching of asset cash flows with liability cash flows across plausible interest scenarios.
2. On investment types, like Universal Life and deferred annuity with book basis voluntary withdrawal values sold in sophisticated markets, surplus needed for C-3 risk is expected to be quite large unless assets are kept permanently quite short even when the yield curve is positive. Indexing to a short term security index, to a long term security index, or to the larger of the two, of course, increases the surplus needed. In any case, the necessity of keeping the interest rate credited high during upswings in new money rates, despite the level of interest earned, so as to control terminations, will cause losses, even in the absence of indexing. There may be a problem of running fast with new sales and credits higher than earned in order to stand still!
3. If the punitive FIT charges against conventional par life insurance were relieved or equalized with the treatment of excess interest as a non-dividend, and commissions were equalized, the current advantage of long range cost illustrations on Universal Life would largely disappear, especially as more companies adopt modified IYM dividend credits. Nevertheless, unless guaranteed cash and loan values are removed from par life insurance, short assets would also appear to be

necessary on such conventional life insurance sold in sophisticated markets, absent provision for sizable surplus needed. Naturally, the variable policy loan interest rate design will alleviate the problem but by no means remove it.

4. There is a danger that life insurance companies will no longer be a source of long term funds, except on contracts without guaranteed voluntary withdrawal values, such as variable life insurance, IPG group annuities and immediate annuities, because of the extent that capacity is used up by surplus needed. Possibly, the availability of long term securities with new-money-based interest payments assuring market value near par would help.
5. Development of C-3 risk surplus needed for blocks of various designs of GIC's on a spread of plausible interest rate scenarios appears in James Tilley's discussion note in RECORD 7:4 (1981). He shows that, for a company with a typical spread of historical GIC designs using an intelligent investment policy for selecting changing configurations of short and medium-long term securities, surplus needed for C-3 risk in excess of reserves on the 1980 NAIC Model Valuation Statute can be minimized. However, he illustrates that for a company with a block of GIC's with voluntary withdrawal values on a book basis using unintelligently designed asset configurations, the surplus needed in excess of the reserves on the 1980 NAIC Model Valuation Statute was up to 11% of the reserve. It is notable that both upside and downside risks are significant on GIC's because of the high interest rate guarantees. GIC's currently rarely incorporate book basis voluntary withdrawal values, and this should relieve the strain of higher reserves otherwise required by the model law and the higher additional surplus. Mr. Tilley's paper should be read for its details and its description of the sort of computer model needed to test the results of different scenarios, asset configurations and product designs.
6. Not mentioned in this survey of C-3 risk is the short term potential loss arising from failure to realize cash flow anticipated for forward commitments of take-downs and from forward commitments on GIC contracts. Surplus needs to be set up additional to that discussed here against these potential losses.
7. The 1980 NAIC Model Valuation Statute was designed on the basis of the background theory recited in this section. However, there was an understanding that, when current research is completed, valuation actuaries would give opinions as to the good sufficiency of reserves held for normal variations and of surplus existing for plausible additional variations, taking account of asset cash flows versus liability cash flows.
8. Actual or notional segmentation of the general account, separate accounts or specialized companies for various types of product may be desirable to assure conforming asset configurations. Coordinated investment and product policies are necessary.

4.4 On-going Research

The above comments are my interpretations of the research of the SOA Task Force on C-3 Risk to this time. As our work proceeds, we should be able

to quantify the points so that managements and regulators can judge the extent to which company capacity has been committed to C-3 risk by asset policy and product design policy.

5. Contingency Surplus Needed by Major Line, Minor Line and Product

Companies have solidity only as a whole, and they can become insolvent only as a whole. Thus, overall company contingency surplus needed and desirable vitality surplus are paramount. Nevertheless, at the planning level, the dynamics of contingency surplus needed and of vitality surplus by major line, minor line and product within lines can be enormously useful in answering such questions as these:

- . Does the net income of a major line, a minor line or a particular product within a line cover the annual increase of capacity utilized (i.e., increase in contingency surplus needed) and additionally contribute some increase to the company's still available capacity (i.e., vitality surplus)?
- . Some products, because of competitive pricing by other insurance companies, intermediaries, or direct investment, cannot provide for their utilization of company capacity. This indicates speculation with company surplus. Are there reasonable expectations of large profits on a range of high probability scenarios sufficient to warrant this speculation? Is there sufficient vitality surplus in other lines and products to enable this speculation? Is growth of more stable lines being inhibited by utilization of available capacity by such speculative products?
- . Are asset cash flows and liability cash flows matched appropriately to minimize C-3 risk on various products, especially investment type products, in the face of the spread of plausible interest rate scenarios? Would segmentation of the general account permit better policy for investment and product design?

It is, therefore, desirable to determine contingency surplus needed line by line and for different products within lines. To accomplish this, company assets, invested assets, surplus, reserves, premiums, dividends, expenses, pass-throughs, IYM investment income, FIT, etc., must be determined or allocated line by line and by important products within lines. Contingency surplus needed can then be determined in the same categories. The combinatorial formulas in Section 1.4 are appropriately applied to make the total company surplus needed consistent with such surpluses by line and product.

Each year the net income, after FIT and policyholder dividends, by line, subline and product is reduced by the increase in contingency surplus needed for the line, subline and product to determine the contribution (+ or -) to company vitality surplus. A running account is kept of the surplus attributed, the contingency surplus needed and the (balancing) vitality surplus for the line, subline and product. The managers of those lines and products with negative contributions to vitality surplus or negative accumulations of vitality surplus can be asked to justify their operations and to take steps to produce acceptable projected results and financial position.

Naturally, these procedures have a relationship to policyholder dividend formulas. Group insurance and group pension dividend scales have traditionally been designed to see this relationship. The generalized dividend financial structure and generalized contribution dividend formula for ordinary business in my recent TSA paper, "An Expanded Financial Structure for Ordinary Dividends" (Preprint August 7, 1981) were designed to assure more direct unification with surplus policy, among other objectives. There is an explicit factor for amortization of issue expenses and for profit. The structure also explicitly includes unamortized issue expenses (like the similar GAAP asset) and the amount of surplus intrinsic to the dividend financial structure. The dividend factors this results in can be tied directly and understandably to surplus policy in a manner not so clearly available in the traditional contribution theory dividend formulas based on actuarial models and 3-4 factors.

6. Contingency Surplus Needed for Insurance Subsidiaries

The realities of the Internal Revenue Code and new types of par, non-par and cross-breed products, especially investment types and variable, non-guaranteed premium types requiring matched investment policy and adjustable premiums or interest credits, have led mutual companies to proliferate subsidiaries. Such subsidiaries necessarily have stand-alone financial and marketing characteristics. There is very little in the literature as to appropriate surplus policy for each subsidiary and for the overall family.

It seems clear that there must be uniform policy as to determination of surplus needed for C-1, C-2 and C-3 risks applying to the parent and each subsidiary. Combination of surplus needed for specific risks would appear available only within each subsidiary; similarly, any credits should be likewise restricted.

For purposes of this discussion, I assume that the equity value of each subsidiary is deducted from the assets of each major line of the parent ratably according to the ownership share of each such line. It is then possible to make a determination of surplus needed and vitality surplus for each subsidiary by techniques described in Section 5.

Consider the resultant vitality surplus. Its size and sign (+ or -) depends on the size of surplus (including MSVR) of the subsidiary, which in turn depends on the capitalization and handling of net income of the subsidiary. A number of questions immediately surface:

1. Where should surplus be held?

- . Should surplus held in the subsidiary be greater than, equal to or less than contingency surplus needed? In other words, should vitality surplus be positive, zero or negative?
- . If vitality surplus is to be negative, what is the largest deficiency to be permitted?
- . If vitality surplus is to be positive, how large should it be allowed to grow before recapture by the parent? What is the FIT

loss on such recapture? Should such potential FIT loss be recognized in the equity value held in the parent's books?

- . What is the minimum size of vitality surplus compatible with the stand-alone posture of the subsidiary? Minimal or negative vitality surplus in a subsidiary would appear to imply that the parent stands ready with additional capitalization as needed.
2. How much larger is the surplus needed in the overall family due to the existence of subsidiaries? In other words, how much vitality surplus is invested in subsidiaries, and how rapidly will it be returned?
3. Subsidiaries represent investments of participating policyholder funds. Can net income gains from subsidiaries be reflected in dividends to policyholders without recapture by the parent?

7. Planning for Growth

This Discussion Note is intended primarily to treat contingency surplus needed with some discussion of the utility of vitality surplus. cursory reference has been made to the dynamics of projections of contingency surplus needed and resultant vitality surplus. For long range planning, analysis of projected vitality surplus is central.

I would draw attention to the discussion by Michael E. Mateja of Aetna on "Effective Use of Capital", in RECORD 7:1 (1981) pp.69-78, underlining the opposing effects of conservative contingency surplus needed and emphasizing solidity, and vitality surplus available for growth and profit on a going concern basis. Also, Dale S. Hagstrom's current paper "Insurance Company Growth" in TSA XXXIII (1981) discusses in great detail theoretical decision criteria involving C-1-2-3 risks (his buffer surplus and my contingency surplus needed) and other risks (my vitality surplus). Mr. Hagstrom notes that, subject to surplus constraints, management decisions should be made to maximize net worth defined very broadly as the sum of capital, unassigned surplus, MSVR and similar contingency reserves, the present value of future profits from business in force, and the present value of future profits from future business to be sold by the current agency force.

The above Discussion Note provides a track with through-put for determining Dale's buffer surplus measures. The dynamics of my vitality surplus incorporate the ingredients of his expenditures and book profits, as well as changes in buffer surplus. My decision procedures have similarity to his, but are more elementary and perhaps more immediately applicable.

I would commend Dale on the thoroughness of his paper. It touches most competently on every aspect of the procedures for producing efficient growth. The paper is seminal in nature, suggesting approaches and views which can be adapted by actuaries to their own preferred approaches. His basic objective is to maximize net worth, subject to the constraint of available surplus. Net worth is defined as capital, unassigned surplus, MSVR and similar reserves, plus the present value of future profits from in-force business, plus the present value of future profits from future

sales produced by the existing marketing organization. Reflected in the two present values is the efficiency and productivity of the company as a whole. I presume, also, that buffer surplus and changes therein would be deducted respectively from surplus and from present values in determining net worth. This objective applies to both stock and mutual companies, and I draw little distinction between stock and mutual companies for planning purposes. An obvious distinction is that stock companies have the advantage of stockholders' pressure for healthy growth, while mutual companies need a surrogate force to make them grow efficiently.

This surrogate force can be a well defined surplus policy tied into a unified dividend financial structure as set forth rather simply in my Discussion Note and with much additional finesse in Dale's paper. Without such a force, mutual company decisions are in danger of developing as emotional responses to arguments made by powerful marketing organizations, which always have been the prime movers in mutual companies.

Dale's profitability index (R) is an interesting measure. Conceptually, it is simple. In practice, it would involve all the complications of determining the internal rate of return and adjustments for volatility, timing and extent of risk. It is useful primarily for deciding among options, rather than an overall approach involving reratings to optimize the use of surplus. Dale has listed the difficulties.

For decision making, marginal approaches are necessary and sufficient and average approaches are incorrect and misleading. In other words, in Yes / No or Alternative 1 / Alternative 2 situations, the effects on surplus, on net worth or on index R should be differential effects reflecting only changes caused by each decision. Marginal concepts omit overhead expenses invariant to the decision. A proper decision enhances margins available for both overhead expenses and for surplus enhancement.

Dale expresses concern as to effects of his decision tree, especially relating to price optimization, on equity principles underlying the contribution theory of dividends. At one of yesterday's sessions, I presented a paper on a generalized dividend financial structure and formula on the contribution principle, of which the conventional 3-factor dividend formula is an approximation. Dale's concerns can be related to the implications of his surplus theory on three factors of my formula: the overhead ingredients of the expense functions, the profit charge factor and the factor providing for credits from or charges to company surplus extrinsic to the dividend financial structure. With reasonable rules as to uniformity, these factors can and should reflect Dale's objectives. The health and growth of the corporation is a necessary objective, necessitating that narrow equity objectives be broadened within reasonable constraints of uniform application. Great care must be exercised that such determinations be made on an overall company surplus policy basis and not capriciously to meet a market position not earned honestly. A generalized dividend formula with all specific operating factors, like mine, enables easy communication of such determinations to management.

In particular, I can contemplate a sensible allocation of overhead expenses more lightly to classes in highly competitive markets, so long as overhead is covered overall. I can also contemplate support of dividend

interest credits from corporate surplus over temporary periods where needed to assure persistency, although there should be plans to charge later for this subsidy when, and if, feasible. Indeed, the SOA Task Force for C-3 Risk tests for surplus needed for C-3 risk on par life insurance recognize this type of subsidy as the major source of loss, since the dividend scale used is otherwise a complete pass-through of IYM effects. In other words, I can find little objection to the kind of deviations from the basically retroactive contribution theory of dividends as suggested by Dale. Indeed, such deviations taken with the viability of the company in mind are highly desirable as long as they are not capricious and are made clear in the Actuary's Report to management.

Non-par contracts, like GIC's, and subsidiaries formed to market contracts like Universal Life and individual deferred annuities are investments made on behalf of the participating policyholders of a mutual company. Profits and losses from such investments ought to be factors in the generalized dividend formulas. This view injects an interesting line of reasoning, which I will not pursue, except to note that surplus dedicated to such investments ought to produce profits like other investments.

MR. ROBERTSON: I will be focusing primarily on the last two topics of the program agenda - managing and monitoring profitability and growth. I will begin by discussing the question of how one objectively measures the performance of a company.

Each January, Forbes Magazine publishes what it refers to as its "yardsticks" of performance. These are the measures that are most frequently used to evaluate the performance of publicly-held businesses.

Of the "yardsticks", probably the most important is return on equity [Chart 3]. Two other key measures are growth in revenues and growth in earnings per share [Chart 4]. There are different ways of measuring this growth. Forbes uses five-year averages so as to avoid the distorting effect of a given year being unusually high or low.

Another measure which is occasionally used is the annual increase in stock value [Chart 5]. It would probably not be appropriate to consider this a performance measure. It is more a measure of investors' perceptions of expected future performance. More precisely, it is the change in the investors' perception of expected future performance. For example, American General is a very fine company. But, its stock market performance means primarily that investors think more highly of the company now than five years ago, and this may reflect disenchantment in the past.

This type of analysis can and probably should be conducted on a product line basis as well. For example, consider group life and health. Chart 6 compares profit margins and premium growth for several of the leading group insurance writers. This comparison suffers some because it uses published data and, therefore, does not adjust for movement of group cases to alternative methods of funding. But, it does illustrate the technique.

These performance measures have been primarily developed for use in comparing stock insurance organizations. What about mutual companies? Similar measures are certainly directly applicable. Many product line

CHART 3
PERFORMANCE MEASURES

Return on Equity

<u>1977-1981 Average</u>		<u>12 Mos. Ended 9/81</u>	
U.S. Fidelity & Guaranty	25.0%	INA	32.0%
General Reinsurance	22.8	General Reinsurance	20.1
Aetna Life & Casualty	20.9	Aetna Life & Casualty	17.9
INA	20.1	American General	15.7
St. Paul Companies	19.7	Transamerica	15.3
American General	19.0	Connecticut General	15.2
Transamerica	18.5	USLIFE	14.8
Safeco	18.2	Travelers	13.5
Travelers	17.0	Capital Holding	13.7
Connecticut General	16.8	St. Paul Companies	13.0
USLIFE	16.4	U.S. Fidelity & Guaranty	13.0
Continental Corp.	14.6	Jefferson Pilot	12.7
Jefferson Pilot	13.8	Safeco	12.0
Capital Holding	13.7	NLT	10.9
Lincoln National	13.1	Lincoln National	10.7
NLT	11.3	Continental Corp.	7.7

Source: FORBES, January 4, 1982

CHART 4
PERFORMANCE MEASURES

Annual Growth: 1977-1981 vs. 1972-1976

<u>Total Revenue</u>		<u>Earnings per Share</u>	
General Reinsurance	17.5%	U.S. Fidelity & Guaranty	27.4%
INA Corporation	15.8	General Reinsurance	26.2
Aetna Life & Casualty	15.3	INA Corporation	25.0
U.S. Fidelity & Guaranty	14.9	Aetna Life & Casualty	24.2
Safeco	13.7	Safeco	23.1
St. Paul Companies	13.6	Transamerica	22.6
Lincoln National	13.0	American General	22.0
Connecticut General	12.2	Travelers	20.4
USLIFE	12.1	St. Paul Companies	18.4
American General	11.5	Continental Corp.	17.4
Transamerica	11.2	Connecticut General	15.4
Continental Corp.	10.8	Lincoln National	14.1
Travelers	10.5	Jefferson-Pilot	11.7
Jefferson-Pilot	10.4	Capital Holding	11.4
Capital Holding	10.0	USLIFE	10.9
NLT	8.9	NLT	8.8

Source: FORBES, January 4, 1982

CHART 5
PERFORMANCE MEASURES

Annual Increase in Stock Value 1977-1981

American General	26.7%
Transamerica	17.8
Aetna Life & Casualty	13.5
General Reinsurance	11.8
INA Corporation	8.8
St. Paul Companies	7.9
Connecticut General	7.3
USLIFE	5.8
Travelers	5.4
U.S. Fidelity & Guaranty	5.3
Safeco	4.4
Lincoln National	3.2
NLI	.3
Continental Insurance Corp.	-8
Capital Holding	-1.1
Jefferson-Pilot	-4.8

Source: FORBES, January 4, 1982
Closing prices as of 11/18/81

CHART 6
PERFORMANCE MEASURES

Group Life and Health Insurance

Company	1980 Market Share	1978-80 Profit Margin	1978-80 Prem. Growth
Prudential	11.5%	1.2%	11.8%
Metropolitan	7.7	1.1	2.7
Aetna	7.5	3.0	5.6
Travelers	6.8	3.1	1.0
Equitable	6.4	.5	2.6
Connecticut General	4.6	4.6	-4.4
John Hancock	2.5	.7	-3.3
Continental Assur.	2.1	1.0	4.5
Trans. Occidental	2.1	1.7	4.5
Lincoln National	1.8	2.6	1.8
Provident L & A	1.7	5.0	-7
New York Life	1.7	-.1	6.1
Pacific Mutual	1.6	.7	21.2
Bankers Life	1.6	5.3	8.3
Mass. Mutual	1.3	.5	2.2
General American	1.1	1.5	8.6

comparisons, such as are used for group life and health, are directly applicable. Revenue growth can also be compared.

There are problems in comparing return on equity and profit growth among mutual companies. If before-dividend profits are used, the comparisons may simply measure the extent to which companies build margins in dividend scales. If after-dividend profits are compared, a company's performance can be affected by the timing of a change of dividend scale. Also, financial results are generally available only on a statutory basis which can be distorted by changes in new business activity, reserving standards, and other factors. Nevertheless, over time, mutual company profits must be adequate to generate sufficient surplus to support growth, and therefore, there is validity to comparing mutual company profitability, after dividends, and on a statutory basis, provided a sufficiently long time span is used for the study.

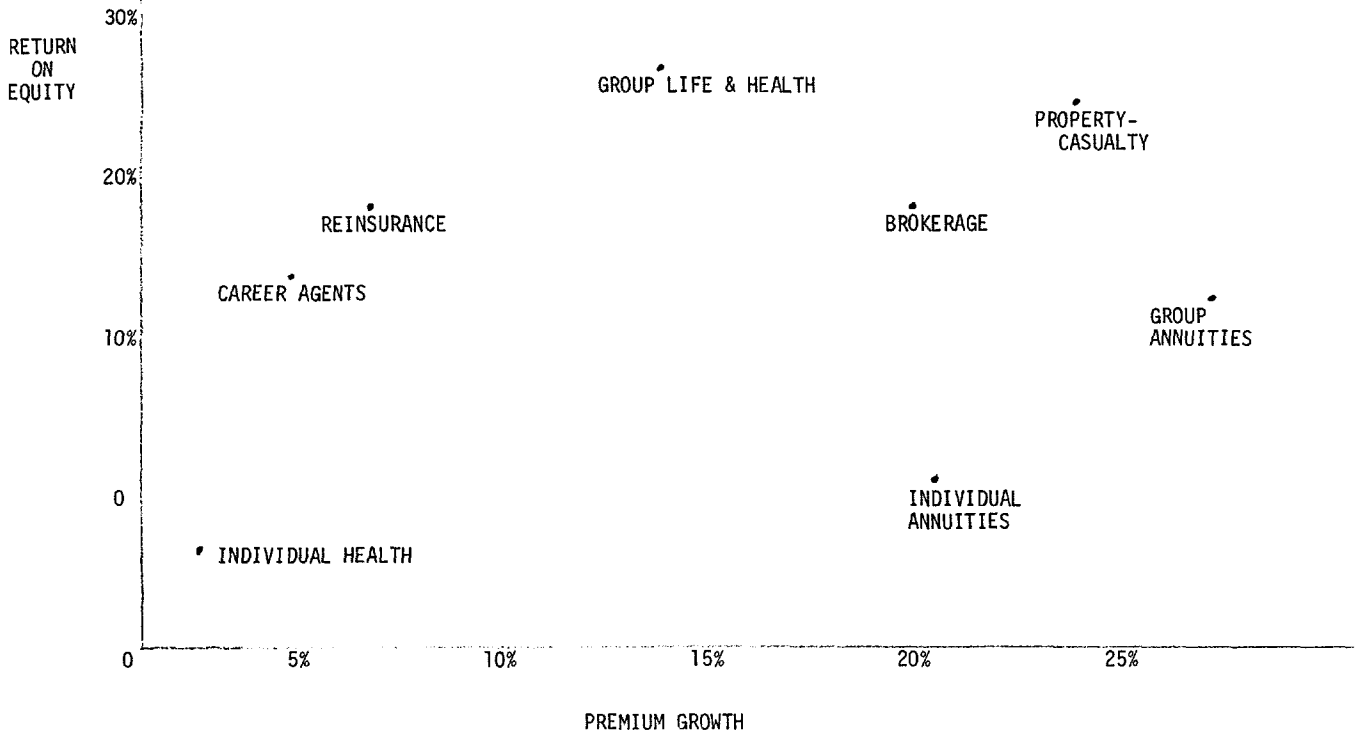
Let me now turn to the third program topic, "How are companies managing profitability and growth?" Chart 7 is the classic strategic planning model. This will illustrate some of the concepts Dale presented in his paper. I have taken an organization that is operating in eight different areas. For those eight different operations, I have plotted return on equity against premium growth. The organization is hypothetical, and the analysis is intended to be illustrative.

It is useful to divide the chart diagonally into those in the upper left half, which have a return on equity greater than the rate of premium growth, and those in the lower right, that have return on equity of less than premium growth. Those businesses in the upper left are producing profits at a faster rate than they are growing. If we presume that surplus requirements tend to be proportional to premiums, these businesses would be generating capital which can be used for stockholder dividends or other purposes. Those businesses in the lower right section are users of capital because they are growing faster than they are generating profits. One element of strategic planning is to have enough businesses in the upper left half to provide surplus needs for dividends and for businesses of the lower right. If businesses in the lower right predominate, the company will have to obtain additional capital.

It is also useful to divide this chart into four quadrants. Those in the upper right are the high performing businesses. They are businesses with high profits and high growth. We would all like more of these. Businesses in the upper left quadrant are highly profitable but have relatively low growth. These are the businesses that provide the earnings to develop other businesses. A common strategy for many of these businesses is to "milk" the profits from them for the benefit of those businesses with stronger future prospects.

The businesses in the lower right exhibit high growth but low profits. They will be consumers of capital. The company will adopt a strategy with these which will depend on the reason for the low profitability. If it is because the business is new and it can be expected to develop into a high profit company, the company may be willing to continue to permit aggressive growth. On the other hand, if the future profit potential is not significantly improved, the company may question why these businesses should be allowed to grow. Changes in strategy might involve pricing,

CHART 7



marketing plans, or other matters to change the profitability, even if they adversely affect growth potential.

Businesses in the lower left quadrant would appear to have little to offer. Unless a program can be developed to change the performance of such businesses, they might represent candidates for elimination.

Of course, this is not the only approach companies are taking to strategic management, and it is not applied as simply or as rigidly as I have suggested. But, the concept is a basic one. Evaluate each of the company's businesses in terms of its profit and growth potential. Depending on a company's position in this matrix, different strategies, and probably even different styles of management, will be appropriate.

In my introductory comments, I illustrated how stock companies were allowing surplus levels to decrease at a rapid rate [Chart 2]. Since my company is one of the leaders in this (if leadership is the proper term), let me explain why. Consider the companies which have relatively high surplus levels and those with relatively low surplus levels. Now consider how those companies have performed by the yardsticks presented earlier--return on equity [Chart 3] and profit growth. The companies that have produced the best performance are generally those that have relatively low surplus levels. This makes some sense. If return on equity is the ratio of earnings to equity, those with lower equity will perform better. Notice also on the return on equity chart [Chart 3], that the companies tend to be grouped according to the types of business they are in. At least over this last period, property-casualty companies have performed best, the group life and health companies have done about average, and the individual life companies have done the worst. Individual life insurance has been a low-profit business. Consequently, companies that can do so have been taking capital out of their life insurance operations and employing it elsewhere with the expectation of earning a higher return.

Consider what this is suggesting for the long term. For many years, the life insurance business has been allowed to grow faster than the capital supporting it. That cannot continue indefinitely. At some stage, life insurance will need to begin attracting capital. It will only do so when it becomes more profitable. Alternatively, companies in the business will have to increase their profitability in order to support continued growth. Thus, there is some reason for optimism that the individual life insurance business may be entering a time when it will be less competitive. Perhaps the moderator of a panel such as this ten years from now will be presenting a chart like Chart 2 but it will be upside down, with the life insurance companies on top.

MR. JOSEPH H. DOWLING: We have done similar studies to the ones being done here for our clients, but, because our clients are not generally well versed in actuarial terms, we have done it on a much more pragmatic basis. The material that has been presented here will probably help what we have been trying to do.

Let me first of all state while chart 3 is still on the screen that if you did a 1974 comparison, the column on the right would have been upside down. Dick is absolutely right, capital flows where capital can make money, and,

like all lemmings, capital has flown to the last profit margin place, not the new profit margin place.

Let me make some comments, though, that bother me and that also might augment some of the things the panelists have said. First, we did a study of the mutuals, not trying to compare them for some sort of relative race track, but trying to look at them for their ability to perform their social role. The suggestion was made that if you look at a company and compare the growth of its net worth account to its growth rate, you have a credible measure. Let me suggest that a 4% growth in premium company cannot survive on a 4% growth in surplus. We inflation adjusted the net worth account for the mutual companies studied and were surprised to see one company had lost 70% of the purchasing power of its net worth account over the current President's term in office. Surplus is designed to buy things, whether it is to buy agents, buy machines, paper, new products or so forth. It is not adequate solely to have your net worth account remain stable relative to the growth in premium. You have to at least match the decline in the purchasing power of the dollar.

Second, we managed the takeover of the Richmond Corporation several years ago, and our client asked us to look at the investment changes going on in the insurance business. One of the problems with a historic study is that unless you go back and adjust for the quality of the investment account, you can fool yourself. We rated where we could every new investment for thirty companies over a ten year period of time. There was a downgrading in the investment portfolio of approximately one grade over the ten years. A spiraling situation seems to have been created. Investment guarantees were made on Guaranteed Investment Contracts (GIC's) that could not be kept by triple A's, and so investments were made in single A's. There was no charge made for the additional investment risk. Companies matched each other, and the next step was investment in double B's with no charge in the products for the additional investment risk.

In looking at this type of study, it does not make any sense to talk about the quality of the portfolio if your market value is 60% of your book value, unless you have adequate working capital. Many companies have inadequate working capital, particularly if you examine the business mixes, GIC rollovers, etc.

Another point, particularly with respect to GIC's, is that there is a fair amount of difference in reserve quality, and there has not been sufficient attention paid to this aspect. If you take Dick's original chart [Chart 1] which showed the ratio of surplus to net worth for selected mutual's and invert that chart to produce what we call a leverage ratio or the leverage of debts to equity, and consider them as banks, you would find that a half dozen of the top twenty mutuals would be on the watch list of the Federal Reserve and one mutual that would have been closed last year. The problem is not one that is coming, the problem is one that is here.

Also, reviewing the quality of the numbers, there are three areas that concern us right now. One is the fact that dollars arising out of Section 820 transactions are being reflected in surplus accounts. As Section 820 unwinds, some of that money may be paid out. So surplus levels may not be as strong as indicated. We have a very serious problem here in not only the 820 area, but also related to Phase 3 taxes and other deferred taxes which are not shown in the annual statement. A true approach to

looking at your surplus account would be to consider real liabilities, and some of those real liabilities are the tax liabilities.

Return on equity is a very important measure to those of us who make our living analyzing companies, but it is return on equity versus leverage. In the last ten years, we have watched virtually a doubling of leverage with the same return on equity being maintained. As leverage builds up, return should go up. We have right now, however, unlike other businesses, dedicated net worth accounts as compared to net worth accounts that could move. If you are out making bolts and you find out you cannot make enough money on bolts, you very probably will take your net worth account and move it to make something else. Maybe you will make computer machines or computer games. Unfortunately, some of our mutual companies have the attitude that they are an insurance company right or wrong, and that capital does not move into other areas.

With respect to Dick's comparison of the fire and casualty companies versus the life companies, the numbers are correct on a retrospective basis, with 1977 to 1981 being the singular most profitable period of time in the history of the property/liability business. I think if you look at comparisons from here on out, you will see a different picture. The ROE has been helped in the casualty industry by bad stock market performance. If the market doubles, the net worth account return will double in some of these companies, but the return on investment will go down so that those numbers are somewhat misleading.

Finally, there have been 170 insurance companies bought or sold in the last eight years. In fact, there are only 160 stock companies left. The people who own life insurance stock have decided there are better places for their investment. When someone is willing to pay two times book or some similar high number they say, "Why not? We can go out and do better things with our money." I think it is a criticism of all of us that they can.

MR. ALBERT K. CHRISTIANS: Your chart suggests that money is going to be shifting between different types of business. Does this indicate that a company should not attempt to survive unless it is in all those lines of business so that it can shift its money to a more profitable area as those emerge?

MR. ROBERTSON: I think several things are possible. A company can buy into one of these businesses, and many of us have. Many of the mutual companies have bought into other areas of the business, although the reasons are not all financial for doing so. In many cases, there are marketing or other considerations. Another possibility is that a company will be bought and its surplus will be moved for it out of the insurance operations into the resources of the acquirer. Another thing that might happen is that a company will simply grow out of its excess surplus. And that, in some cases, has been happening. One observation is that those companies with the high surplus ratios generally tend to be the ones that are most talked about as being candidates for acquisition. If a company will not put its funds to work productively, someone will do it for them. Of course, that will not happen in a mutual company environment, but some of the same problems are there.

MR. ABRAHAM HAZELCORN: I would like to hear some comments as to the possibility of conversions of mutual companies to stock companies. Governor Carey appointed an executive commission, the Hyman Commission, and one of the things they have addressed seriously is the conversion of mutual life insurance companies.

MR. CODY: The reason that conversion of mutual companies has been mentioned is the lack of easy availability of new capital. Mutual companies have allowed their method of operation and pricing, usually in competition with each other, to go to a level which does not allow them to retain earnings properly. It is not just competition with other intermediaries that is causing this, it is competition with each other. I do not know if this presages a conversion of sizable mutual companies to the stock basis for this reason alone. I would like to think that operations could be readjusted.

MR. ROBERTSON: This came up in yesterday's session on diversification. I think the pressures toward building diversified financial organizations are probably as significant a reason for the demutualization concept as others. It would not be hard to do. All it would really take under the current environment is for a mutual company to offer publicly the shares of its downstream holding company, and I would not be surprised to see it happen.

MR. DOWLING: If you cannot run a mutual with mutual money, there is no reason to presume you can run a company with stock money. If you have grown out of your surplus by being aggressive and profitable, then you can attract investment dollars. But if you have grown out of your surplus by indolence and a less than attractive management situation, you are going to die. The purpose of capitalization is not just to get capital to the people who use it but to take capital away from the people who foul it up.

MR. ROBERTSON: One theme that has developed during our discussion has to do with the question of what is going to happen to the mutual companies. I have talked a lot about the stocks. The problems that the mutual companies are facing from a financial perspective are the same ones that we stock companies are facing. Many of the tools for managing them work well in the stock environment but not as well in a mutual environment and that is going to create a problem. If the management problems are present in both types of companies, and if the stock companies have the tools for dealing with them and the mutual companies do not, the stock companies are going to be better managed. I think the answer is more likely that the mutual companies are going to develop the tools, and many of them are. They may not be quite the same, but they will have some similarities.

