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STRATEGIC MANAGEMENT OF LIFE INSURANCE COMPANY SURPLUS

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ABSTRACT

In today's uncertain business environment, managing a life insurance company requires a much higher caliber of financial management than in the past. A company must be in a position to control its own destiny, rather than having its fate dictated by outside forces.

This paper outlines a framework for managing life insurance company surplus. Within this framework, a company can assess the attractiveness of various businesses for capital investment; plan the amount of investment in each business; control the actual amount of capital being used; monitor the return on that capital; and take prompt management action if results deviate significantly from plan.

With such a system in place, a life insurance company enhances its ability to achieve its strategic and financial objectives.

INTRODUCTION

Life insurance companies are faced with an increasingly uncertain world. Margins are shrinking and competition is intensifying, both from within and from without the life insurance industry. Interest rates often change more within a week than they used to change in a year. New marketing distribution systems are emerging, threatening to displace the traditional ones.

At the same time, the life insurance business has become riskier, and the margin for management error has become much smaller. On average, life insurance companies are much more leveraged today than in the past. One dollar of life company surplus supports more insurance risk than in the past. Additionally, for life insurance companies within holding company systems, much of this surplus may be supported by holding company debt. Premium margins today are much smaller. Interest margins are both smaller and more volatile. Also, significant mismatches between assets and liabilities are likely to arise even for companies which pay close attention to managing asset and liability cash flows.

Thus, given the smaller and more uncertain margins in today's products, it is more likely that adverse experience will critically impact surplus. Since life companies are more leveraged today, the same loss will have a more serious impact on the company's financial condition. A loss equal to 1

percent of assets might be equivalent to one-third of statutory surplus today, where the figure might have been 15 percent of surplus or less in the past. If half of surplus is borrowed through a holding company structure, a loss of 1 percent of assets could be equivalent to two-thirds of statutory surplus.

As if this were not enough, today's high interest rates mean that capital is more expensive. In an era where a risk-free borrower, such as the U.S. Treasury, must pay 11 or 12 percent for long-term capital, insurance companies are faced with a 15–20 percent after-tax cost for equity capital. Life insurance companies must earn a return on equity (ROE) at least equal to their cost of capital in order to remain viable over the long run.

Clearly, managing a life insurance company requires a higher caliber of financial management than in the past. Companies must be able to adjust quickly to changing financial conditions. Management must be able to determine the current profitability of every profit center. Every company must be aware of its cost of capital and should have a system in place to control the allocation of capital toward the most strategic and productive uses. When this is true, a life insurance company is in a better position to control its own destiny, rather than passively having its fate dictated by outside forces.

Sound strategic planning addresses these concerns. With such planning a life insurance company will enhance its ability to steer a course through the mine fields inherent in today's business environment and will be much more likely to achieve its strategic objectives.

STRATEGIC PLANNING

Every company needs at least a limited process for allocating capital, but going much beyond this in the early stages may be putting the cart before the horse.

"Capital budgeting" is a process for allocating capital to various activities. But to do this, it is necessary to have some idea of which activities might be the most attractive. And to know that, a company must have some form of strategic planning. So before enhancing their capital budgeting process, many companies should focus on improving their strategic planning process first.

Capital budgeting techniques can tell a company whether a given capital investment is likely to cover the cost of capital. But capital budgeting will not tell a company whether an activity is worth doing in the first place; only good strategic planning will do that. If an activity does not make good strategic sense, it is not worth the effort of making a cost-benefit analysis or looking at financing alternatives.

According to financial management textbooks, capital budgeting is a simple matter of ranking capital investments based on their expected rate of

return. The company then determines which investments will return at least the company's cost of capital and allocates funds to as many of these as possible. The main problem with this approach is that it results in a random group of projects with no clear strategic focus. The company will not progress toward its long-term objectives. To support the strategic direction of the company, it will sometimes be necessary to fund projects which return less than the company's cost of capital.

To make this clearer, look at the stages that a company might go through in becoming strategically managed. At first, there is generally no strategic planning. Financial plans are usually in the form of annual budgets, and these are developed as projections from historical results. There is generally no effective allocation of resources. At this stage, companies are usually organized functionally, making it difficult to determine how much capital and other resources might be devoted to various businesses.

As companies progress in their level of planning sophistication, they begin to do a limited amount of strategic planning. However, planning is mainly internally focused and still based on a functional organization. At this stage, financial planning may be in the form of long-range forecasts. Resource allocation is based on momentum. Most of the resources are allocated to the largest profit centers—the rich get richer. It is usually difficult for emerging profit centers to acquire resources.

As a company moves to the next stage, strategic planning becomes well-developed. Planning has an external focus and is concerned with developing a sustainable competitive advantage. Creative alternatives are considered in developing corporate strategy, and resources are allocated in support of the company's strategic direction. Thus, resources might be withdrawn from a large profit center which is judged to be relatively unattractive. At the same time, a very small, attractive profit center might receive a large percentage of the company's total resources.

This is where it makes sense to begin developing a capital budgeting process. Otherwise, a company may develop a strategic plan, only to find that it is not being implemented because resources are flowing to the wrong areas. Strategic planning is used as the basic tool to evaluate the attractiveness of each business unit for investment of corporate resources. A business is judged to be "attractive" if it can both achieve a sustainable competitive advantage and earn an ROE that equals or exceeds the cost of capital.

Finally, strategic planning becomes fully developed; competitive strategies become very sophisticated; and all elements of the organization are integrated toward developing and maintaining a sustained competitive advantage. Few companies have achieved this stage of strategic management, even including companies outside the insurance industry.

FINANCIAL PLANNING

Creating a Structure for Financial Planning

For a company involved in several businesses, it is necessary to determine the amount of company surplus that is devoted to each business. Ideally, businesses should be defined in a strategically significant way. For example, business units might be defined by type of customer, by marketing distribution system, or by geographic region.

One convenient technique for determining the amount of capital devoted to each business unit or profit center is using "required surplus formulas." These formulas define a measure of each major type of risk faced by the company and apply a factor to determine the amount of statutory surplus that should be held for that risk. The formula is designed to reduce the overall probability of company insolvency to a tolerable limit. The formula for a large U.S. stock life insurance company is shown in the appendix to this paper as an illustration of a typical formula.

The amount of statutory surplus devoted to each profit center can be determined by applying the company's required surplus formula to the risk measures for each profit center. When the formula is applied at several points in time, it is possible to see the amounts of statutory surplus that are flowing into or out of each profit center.

Only by coincidence will the total required surplus for all of the profit centers be the same as the statutory surplus of the company. The residual surplus, positive or negative, is maintained in an unallocated surplus account.

To be useful, it is necessary to convert the required statutory surplus for each profit center to a generally accepted accounting principles (GAAP) or similar accounting basis. For each product line, company surplus has been invested in acquisition costs and surplus strain. A statutory accounting basis will not include this investment.

GAAP required surplus is generally greater than statutory required surplus. On an oversimplified basis, GAAP required surplus is equal to (1) statutory required surplus, (2) plus unamortized GAAP deferred acquisition costs, (3) plus the excess of statutory benefit reserves over GAAP benefit reserves.

Another benefit of making this conversion is that a meaningful ROE can be computed for every profit center. GAAP earnings can be determined for each profit center, including investment income on the required GAAP surplus. GAAP-ROE can then be computed by dividing GAAP earnings by the required GAAP surplus for each profit center.

It is important to keep the limitations of the GAAP-ROE in mind. In any given year, the GAAP-ROE may or may not correspond to the internal rate

of return used in pricing a product, even if experience conforms exactly to the pricing assumptions. For example, under GAAP, some acquisition costs are nondeferrable and must be expensed in the first year. This tends to reduce the GAAP-ROE in the first year and to increase it in renewal years.

Another difference is that GAAP acquisition costs are amortized using an interest rate corresponding to the yield expected to be earned on the company's invested assets (e.g. 7 percent after taxes). On the other hand, in pricing calculations based on internal rate of return, a much higher rate of return is generally used, corresponding to the company's cost of capital (e.g. 15 percent after taxes). This can lead to a different pattern of profits and required surplus.

Finally, GAAP accounting includes the concept of "margins for adverse deviation." Margins are added to the assumptions for each of the various experience factors (mortality, morbidity, lapse, and so on) to provide for adverse experience. Conservative margins tend to cause GAAP profits to be deferred. As a result, GAAP-ROEs may be understated in the early years and overstated later on. Similarly, slim margins may cause GAAP-ROEs to be overstated in the early years and understated later on.

Before relying on conclusions based on GAAP-ROEs, the actuary should be aware of the extent to which the accounting basis may be distorting results. Often, these problems may be prevented by selecting GAAP assumptions which, in all years, produce a GAAP-ROE, which is reasonably close to the internal rate of return used for pricing.

Of course, these problems can be avoided by developing a separate accounting basis for management reporting. Stock companies generally have concluded that they can live with the problems inherent in GAAP accounting, perhaps with a few minor adjustments for management reporting. The additional benefits from developing a whole new basis of accounting are usually not worth the expense. On the other hand, mutual companies may wish to use gross premium valuation techniques, rather than GAAP accounting, since this can eliminate most of these problems.

The remainder of this paper will assume that a GAAP-ROE provides a fair representation of the internal rate of return actually being generated by any given profit center. In practice, the actuary will need to be alert to situations where this is not true and should advise management accordingly.

Determining the Cost of Capital

The company's "cost of capital" provides the best benchmark for evaluating the ROE from each profit center. The cost of capital is determined by calculating the cost of each source of capital and weighting the cost based on the company's mix of capital.

The cost of equity capital is calculated by adding a risk premium to the risk-free rate of return. The risk-free rate of return generally is based on the investment yield from U.S. government securities. This is because U.S. government securities generally are perceived to be free of default risk. Equity capital is long term in nature, and so the yield on long-term government bonds is the appropriate benchmark. Recently, this yield has been 11–12 percent.

The "risk premium" is based on the additional yield required by investors to compensate them for the risk of investing in the company's common stock. For the average common stock investment, studies have shown this return to be 5–6 percent. Various techniques are available to determine the specific risk premium that might apply to a given insurance company.

Putting these two factors together, the cost of equity capital for the average insurance company is likely to be in the 15–20 percent range.

The cost of debt capital can be determined based on the long-term interest rate at which the company could borrow based on its current credit rating. This might be 12 percent for a company with an Aa bond rating or 13.5 percent for a company with a Baa rating. Since interest on debt is tax-deductible, it is appropriate to use an after-tax rate. Since borrowing will normally take place through a holding company structure, a 46 percent tax rate is appropriate. So the cost of debt capital might be in the 6–7 percent range.

The cost of debt and equity capital can then be weighted to determine the company's overall cost of capital. For example, suppose an insurance company derives one-third of its capital from debt, at a cost of 6.5 percent, and two-thirds of its capital from equity, at a cost of 17 percent. The company's cost of capital is then 13.5 percent.

Similarly, formulas exist for determining the cost of capital derived from such sources as preferred stock, convertible bonds, leasing arrangements, reinsurance, and joint ventures. The company's overall cost of capital can be determined by weighting the cost of each source, based on the company's mix of capital.

A further adjustment may be needed to the extent a company incurs corporate expenses which are not allocated to the profit centers. For example, suppose a company incurs unallocated corporate expenses, after taxes, equivalent to 1.5 percent of capital. In the previous example, this would be added to the weighted cost of capital to produce a total cost of 15 percent.

Note that the cost of capital may change continually because of changes in external interest rates and the company's capital mix. But it is less confusing if managers can be given a fixed target which will not change for several years. This can be done by using projected long-term rates of interest and the company's long-term mix of capital to derive the company's cost of

capital for planning purposes. At any moment, the company's actual cost of capital may be above or below this level.

Concept of Economic Value

Financial planning should include, as an objective, the concept of increasing the economic value of the company. With the framework for financial planning just described, a company has the basic tools it needs to apply the economic value concept in financial planning.

For purposes of the following discussion, economic value will be defined as the present value of free cash flow, discounted using the company's cost of capital. Free cash flow is defined as the excess of the increase in a company's statutory surplus (before shareholder dividends) over the increase in required statutory surplus. Required surplus is based on the type of formula described previously.

In the absence of capital gains and other items which affect statutory surplus directly, free cash flow may be approximated by the excess of statutory earnings over the increase in required statutory surplus. Moreover, the previously described method of adjusting statutory required surplus to a GAAP basis allows free cash flow to be approximated by the excess of GAAP earnings over the increase in required GAAP surplus.

The GAAP definition of free cash flow is most useful for financial planning. The actuary can determine which product lines are generating cash flow by comparing the GAAP-ROE with the GAAP equity growth rate. The GAAP equity growth rate is calculated simply by dividing required GAAP equity at the end of the year by required GAAP equity at the beginning of the year. Multiyear ROEs and equity growth rates can be computed by geometric averaging.

A profit center is generating free cash flow if its GAAP-ROE exceeds its equity growth rate. It is consuming free cash flow if its GAAP-ROE is below its equity growth rate. And it is neither consuming nor generating free cash flow if its ROE and equity growth rates are equal.

According to the economic value concept, growth is desirable if the GAAP-ROE exceeds the company's cost of capital. Profit centers that meet this criterion are creating economic value. Growth is undesirable if the GAAP-ROE is below the company's cost of capital. Profit centers in this category are destroying economic value. Economic value is enhanced by emphasizing growth in profit centers that are expected to produce ROEs which will exceed the company's cost of capital.

Where the ROE falls below the cost of capital, the company should first explore ways of improving the ROE. If that is not possible, then the amount of capital flowing into these profit centers should be minimized. In many

cases, capital should be withdrawn, even to the point of divesting the profit center.

A low ROE can sometimes be tolerated in a profit center that is generating free cash flow. That is, although the ROE falls below the company's cost of capital, the ROE is greater than the equity growth rate for the profit center.

Most destructive to a company's economic value are the so-called cash sinks. These are profit centers in which the ROE falls below the company's cost of capital and also falls below the equity growth rate of the profit center. These profit centers are both consuming free cash flow and destroying economic value. Each dollar of free cash flow consumed by this type of profit center creates less than one dollar of economic value. A company's financial performance will be greatly enhanced if the financial planning process does nothing more than identify and minimize the impact of cash sinks.

A good argument can be made for varying the ROE criterion for profit centers based on an analysis of the relative risk of each profit center. In practice, this can be avoided by designing the required surplus formula in a way that equalizes the risks of each profit center relative to the others. Then the same ROE target can be used for all profit centers.

Financial Planning Process

To manage surplus, a process is needed to ensure that capital is being allocated to the most attractive areas.

A financial plan should be developed annually for each profit center. This should be more than a one-year plan. Beyond that, arguments can be developed for different planning horizons. Many companies seem to settle on a five-year plan as a convenient compromise between a planning horizon that provides a long-term perspective and, yet, is not so long that the whole exercise becomes questionable.

Even in a five-year plan, many of the numbers must be taken with a grain of salt. The numbers in the fourth and fifth years tend to be quite optimistic for most profit centers. Taking all profit centers together, the financial plan for the fourth and fifth years reflects the potential performance of the company if all profit centers perform near the upper end of their earnings potential.

The numbers shown in the first year of the financial plan become the financial objectives for the following year. In many companies, these numbers are also used to determine incentive compensation for the company's executives. So, the numbers shown in the first year of the company's financial plan tend to be conservative.

As a result of these various tendencies, the numbers shown in the second

and third years of the financial plan are often the best representation of the future financial performance of the company.

It should always be kept in mind that the five-year financial plan represents the future financial performance of the company under one of many possible scenarios. Since the financial plan is revised and rolled forward each year, there is the opportunity to update each year's projection annually, reflecting changes in the external environment. The financial plan for each profit center should include, at a minimum, the amount of capital each profit center plans to use annually and the ROE it expects to earn each year.

Typically, the first version of a company's financial plan will be unacceptable to company management for a variety of possible reasons. The plan may contemplate the use of more capital than is likely to be available in total. The plan may allocate too much capital to areas that are considered unattractive; or too little capital may be allocated to attractive businesses. Often the plan will generate an insufficient ROE for the company as a whole.

In any event, it is unlikely that the first version of the financial plan will be the final one in any given year. Management should allow enough time to generate and discuss at least two to four different versions of the company's financial plan before the plan is finalized.

This part of the process is important because it provides insights into the financial performance of the company that would not be possible otherwise. It also is more likely that problem areas will be uncovered and confronted. If too little time is allocated to this part of the process, it is likely that major problems will be swept under the rug with the time pressure to meet the planning deadlines and then forgotten until next year.

Because of the need to produce several different versions of the financial plan within a tight time frame, simplified financial models often work best. There is generally not enough time to develop multiple plans using elaborate computer models run on a mainframe computer. This can also be very costly. A compromise approach is to develop the first version of the plan from a mainframe computer model. The second and subsequent versions of the plan can be developed quickly using a minicomputer and electronic spreadsheet, based on modifying numbers produced from the initial version of the plan.

Example of a Financial Plan

The following example illustrates some of the considerations in reviewing a financial plan. In the example, the company consists of four profit centers, each with different ROEs and different equity growth rates. All of the company's equity is derived from paid-in capital and retained earnings, resulting in a cost of capital of 15 percent. The company wishes to maintain a policy of dividend payouts to shareholders equal to 3 percent of equity.

The company has combined the five-year financial plans of its four profit centers with the following results:

Profit Center	Five-Year ROE	Beginning Equity	Ending Equity	Change in Equity	Equity Growth Rate
A	20.3%	$ 48	$ 62	$ 14	5.1%
B	12.7	102	167	65	10.3
C	6.5	215	442	227	15.5
D	15.9	123	309	186	20.2
Total Company	11.4%	$488	$980	$492	15.0%

Several problems are apparent in the company's financial plan. First, the five-year ROE of 11.4 percent is below the company's cost of capital of 15 percent. Thus, over the five-year period, the company will be destroying economic value. Also, the company's growth rate cannot be supported by its earnings, especially given the dividend policy. In order to support a policy of paying dividends equal to 3 percent of shareholders' equity, the company cannot grow faster than 8.4 percent. This rate is derived by subtracting 3 percent from the ROE. Instead, the financial plan contemplates a growth rate of 15 percent per year.

At this point, it is worth reviewing the appropriateness of the allocation of capital among the profit centers. A number of conclusions are reached as a result of this analysis:

1. Profit center A is a small emerging business unit with a rate of return exceeding 20 percent. Yet it is receiving only a small percentage of the capital allocation. Since the ROE is far in excess of the company's cost of capital, economic value would be created by allocating more capital to this profit center.

2. Profit center B is earning somewhat less than the 15 percent cost of capital. The equity growth rate of 10.3 percent is less than the ROE. So, this profit center is generating free cash flow. But this growth rate should probably be reduced if it is not possible to increase the profitability of this profit center.

3. Profit center C is the major problem area. Almost half of the company's capital is invested in this business. Yet, it is only earning a 6.5 percent ROE. Even worse, it is planning to grow at 15.5 percent per year. This profit center is destroying economic value rapidly. The company should reduce the growth of this product line while implementing a program to increase profitability.

4. Profit center D is earning slightly more than the company's cost of capital. Since the equity growth rate of 20.2 percent exceeds the ROE, this business unit is consuming free cash flow. But this is appropriate since this profit center is creating economic value.

Taking these observations into account, company management requested revised financial plans from profit centers A, B, and C. The combined results are as follows:

Profit Center	Five-Year ROE	Beginning Equity	Ending Equity	Change in Equity	Equity Growth Rate
A	20.3%	$ 48	$149	$101	25.4%
B	12.7	102	121	19	3.5
C	13.2	215	281	66	5.5
D	15.9	123	309	186	20.2
Total Company	15.0%	$488	$860	$372	12.0%

While this is probably not the final version of the company's five-year financial plan, it is a definite improvement over the initial version. The company's ROE is expected to be equal to its cost of capital. The equity growth rate of 12 percent is 3 percent less than the company's ROE. So the financial plan will support the company's dividend policy. Most of the company's retained earnings are being allocated to the profit centers that are earning the highest ROEs. Finally, the company has identified steps which should result in a much higher ROE for profit center C.

COMPANY ORGANIZATION

If a company is engaged in many businesses, it becomes difficult to manage strategically within a functional organization. This can be overcome to some extent if the financial planning process is organized around profit centers, as outlined. But if the profit centers do not correspond to organizational units, frustration may result. This is because accountability for financial results for a given profit center will tend to be diffused and will not reside with any one individual.

Assuming that profit centers are defined on a basis that is meaningful for strategic planning purposes, it may make sense to organize the company in the same way. When this is done, the profit centers are often referred to as strategic business units (SBUs).

Typically, each SBU is organized as a separate business and has its own management team which is held accountable for its performance. That management can then be compensated on the basis of the performance of the SBUs for which it is held accountable. While there may be a number of shared corporate services, SBUs can be billed monthly for the services that they use. Some companies allow SBUs the alternative of contracting for the same services from a third party.

Under this type of company organization, SBU management is given the task of developing financial plans for its business. The final financial plan is then negotiated between SBU and corporate managements as outlined.

This type of organizational structure gives many companies the best framework to evaluate the performance of each business unit and to control the allocation of resources based on the relative attractiveness of each SBU.

EVALUATING FINANCIAL PERFORMANCE

Commonly, SBUs will not be defined in a way that corresponds to company structure. In other words, several SBUs may operate within a single company. To monitor the use of surplus, management needs a way of allocating current surplus among business units. If the required surplus formula is defined simply enough, it can be applied to every business unit quarterly or monthly.

Once this is done, the amount of capital used by each SBU can be determined and compared with the financial plan. Also, the ROE can be determined for every business unit, and the variance from plan determined. Management can then monitor the financial performance of every SBU compared with the financial plan. This gives management the ability to react quickly if actual results begin to deviate significantly from plan.

SUMMARY AND CONCLUSIONS

The financial management process described in this paper gives company management the ability to assess the relative attractiveness of various businesses for capital investment; plan the amount of investment in each business unit; monitor the actual amount of capital being used and the return on that capital; and take management action during the year if results deviate signficantly from plan.

In implementing this process, a great deal of actuarial input is needed to develop financial plans and to assist company management in reaching the proper conclusions. Because this process is integrated with the company's strategic plans, the actuary must integrate his work effectively with management at several levels, as well as with personnel from a wide variety of functional and professional specialties. To do this, the financial planning actuary must acquire a broad business perspective. This enhances the probability that the company's financial plan will be a valid expression of the company's business plan and that it will properly reflect the financial tradeoffs inherent in that plan.

APPENDIX

EXAMPLE OF REQUIRED SURPLUS FORMULA

Lincoln National Life Insurance Company and Lincoln National Pension Insurance Company use a formula as a guide to managing the level of surplus

maintained in each company. Conditions change and perceptions of risk levels change. As a result, the target surplus formula needs to evolve and change over time.

Required Surplus Formula

The following is the required surplus formula currently used by Lincoln National:

1. Asset Depreciation (C1 Risk):
   - Short-term investments (0.5% of assets)
   - Bonds and mortgages (1.5% of assets)
   - Preferred stocks (2.5% of assets)
   - Real estate (5% of assets)
   - Common stocks (25–50% of assets, a function of the dividend yield of the Standard & Poor's 500 Index)
   - Other invested assets (5% of assets)

   NOTE: The minimum level of the asset depreciation component for any given product line is 1 percent of assets. Offsets may be applied where product design allows a full or partial pass-through of capital losses to the policyholder.
2. Pricing Inadequacy
   - Mortality
     — 1/4 of tabular cost of mortality, as shown on page 6 of statutory statement (Analysis of Increase in Reserves), adjusted by a five-year moving average of ratios of actual-to-tabular cost of mortality.
   - Morbidity
     — Group insurance—6 percent of equivalent premiums, less margins in claim reserve.
     — Individual insurance—25 percent of premiums.
3. Interest Rate Change (C3 Risk):
   - Percentage of cash values which varies as a function of the yield and average maturity of the underlying invested assets. The factor is reduced to the extent that the product design reduces interest rate risk.
4. General Contingency Loading (C4 Risk):
   - 1 percent of liabilities, excluding separate accounts and mandatory securities valuation reserve (MSVR).
5. Less: MSVR and other items in the nature of surplus.
6. Plus: Statutory market value of subsidiaries, excluding any excess of each subsidiary's statutory surplus over its target surplus.
7. Other: To the previous amounts, add any additional surplus needed to

meet state licensing requirements, or for marketing or other considerations.

Rationale Behind the Required Surplus Formula

1. Each type of invested asset was ranked by levels of risks. Common stocks were considered to be most risky; short-term investments were considered to be least risky.

The article "Common Stock Policy Related to Company Statutory Surplus," by Donald D. Cody (*RSA*, Volume 2, Number 1, page 263) presents relationships between price/earnings ratios and the risk of common stock losses. With this as a starting point, the following factors were developed as a function of the dividend yield of the Standard & Poor's 500 Index:

Yield	Factor
>6.90%	25.0%
6.90	27.5
6.10	30.0
5.50	32.5
5.00	35.0
4.55	37.5
4.20	40.0
3.90	42.5
3.65	45.0
3.40	47.5
<3.40	50.0

In establishing a factor for bonds and mortgages, investment losses for the past several recessions were reviewed. It was concluded that, even under far more severe economic conditions, the portfolio of bonds and mortgages was unlikely to depreciate by more than 1.5 percent. In arriving at this factor, investment experience from the Great Depression was also reviewed.

After establishing factors for the most and least risky types of investments, factors for preferred stocks, real estate, and other invested assets were developed based on their perceived level of risk and on actual experience during recent recessions.

Finally, the minimum asset depreciation factor for any given product line is 1 percent, regardless of the percentage of short-term investments held. Combined with the general contingency component of the formula, this sets a maximum degree of leverage equal to $50 of assets for every $1 of statutory surplus if assets and liabilities are perfectly matched. Since it is unlikely that assets and liabilities will be perfectly matched, the actual degree of leverage will typically be lower.

2. Surplus strain could be caused by increased mortality resulting from epidemics, floods, earthquakes, and other disasters. The most extreme event

of this type in recent history resulted from the 1918 influenza epidemic, during which the death rate in New York City rose approximately 33 percent.

The formula provides for 25 percent extra mortality. This recognizes a shift in the mix of in-force business to universal life insurance, as well as various forms of participating and experience refunding insurance. For example, universal life insurance provides the flexibility to increase mortality charges to the customer if mortality experience increases beyond levels contemplated in the original product design. Also, participating and experience refunding products provide the ability to share adverse mortality experience with customers.

The formula was also designed so that the mortality factor will adjust automatically as mortality experience emerges by using an average of mortality experience over the past five years. The five-year period represents a compromise. A longer period might prevent changes in mortality experience from being reflected on a current basis. On the other hand, a shorter period might cause target surplus to rise and fall due to normal experience fluctuations.

3. Substantial losses on group health insurance have occurred due to external factors such as inflation, health care utilization, changes in medical care, unemployment, economic conditions, and occasionally due to mispricing or poor underwriting. Such losses tend to be followed by years of substantial profits resulting from measures, such as rate increases and stricter underwriting, taken to correct the loss situation.

If the group health operation were housed in a separate operating subsidiary, it would be necessary to have enough surplus to maintain solvency through an entire underwriting cycle. This is an appropriate starting point. However, the group health operation is part of Lincoln National Life, where this product line, in effect, can operate at a surplus deficit during especially severe conditions, without endangering the solvency of the entire company. So, a lower factor is appropriate.

Based on an analysis of losses incurred during the troughs of past underwriting cycles, a factor of 6 percent of premiums was developed. This factor is applied to equivalent premiums, which adjust for the increasing amounts of business written under alternative funding arrangements whereby the employer holds most of the premiums and claim reserves.

Statutory claim reserves for group health insurance are typically maintained on a basis which includes a margin for adverse experience. The formula recognizes that this margin is available in the event of very adverse claims experience. Accordingly, the formula includes an offset for margins held in the claim reserve.

4. Lincoln National Life no longer writes individual medical expense business directly. So the individual health factors of the formula apply mostly

to disability income insurance and some reinsured medical expense insurance. Experience with the disability income business is cyclical and tends to follow trends in unemployment. When unemployment is high, disability claims increase; when unemployment is low, disability claims decrease and recoveries occur. A review of experience during the Great Depression years indicates that claims were about double those of normal times. This suggests surplus to absorb one year's excess morbidity on disability income business, or approximately 50 percent of premiums. The formula uses a factor of 25 percent, reflecting product design changes and a shift in the mix of business away from the riskier coverages.

Conditions, which result in such extreme excess disability claims, may persist for several years. However, as long as this business comprises only a small percentage of the total business of a company, this risk alone is not likely to endanger the company's solvency. Also, a repeat of the extreme conditions experienced during the Great Depression is highly unlikely.

5. The interest rate change component is based on dynamic factors. For each product line, the applicable factor depends upon the yield and average maturity of the underlying invested assets. The factor may be lowered as a result of product design which reduces interest rate risk.

For example, consider an individual annuity product where the policyholder may withdraw funds on demand without a significant surrender charge. If assets are invested in one-year maturities yielding 10 percent, no additional surplus would be required for interest rate risk. If the average maturity of assets is increased to three years, additional surplus equal to 2 percent of assets would be required. The target surplus level would rise to 5.5 percent at a five-year average asset maturity and would continue to increase as funds are invested in longer maturities. At a 15-year average maturity, the target surplus level would rise to 8.5 percent of assets.

Looking at a portfolio of assets with a five-year average maturity, the factor would fall from 5.5 percent to 4.3 percent if the underlying investments yielded 12 percent instead of 10 percent. The factor would fall further to 3 percent if the investments yielded 14 percent.

As an example of product features which reduce interest rate risk, consider a product which provides for the cash value to be paid out in five annual installments, with the first installment paid out immediately. In the first year, two installments would be paid out. After that, it may be assumed that interest rates would return to more moderate levels, and management actions would be taken to restructure assets and liabilities. Accordingly, for contracts with this feature, it may be appropriate to use 40 percent of the factors which would apply if all of the cash value were payable immediately upon demand.

The factors are recomputed annually based upon averages of interest rates over the past five years. Again, this represents a compromise between re-

flecting recent experience, while preventing required surplus levels from rising and falling due to experience fluctuations.

6. The general contingency factor of 1 percent of liabilities is intended to cover unanticipated contingencies and contingencies which are of a nonspecific nature, such as normal business risks.

7. The MSVR and other contingency reserves held above the line are considered to be appropriate offsets to the target surplus formula. The critical test in determining whether an item should be considered as an offset is whether the liability item could be released in the event of asset depreciation, pricing inadequacy, or interest rate change. For example, deficiency reserves are not considered to be an appropriate offset to the formula, since these reserves are not released in the event any of these contingencies occur.

8. The statutory market value of subsidiaries is added to the formula to prevent surplus from being counted more than once. The required surplus formula is applied to each company separately. The affiliate adjustment serves the function of a consolidating adjustment when combining the surpluses of companies in an affiliated group. If there is excess surplus in a subsidiary, the excess is recognized as part of the owning company's available surplus.

9. In addition to the target surplus generated by these considerations, it may be necessary to add surplus to meet state licensing requirements. Marketing considerations may also dictate a higher surplus amount.

DISCUSSION OF PRECEDING PAPER

VINCENT J. GRANIERI:

Mr. Kischuk is to be congratulated for exploring the complex area of strategic and financial management of insurance company surplus. One can appreciate the difficulty in applying the techniques to practical business situations. My commentary focuses on a number of strategic issues raised in the paper. The subheadings are from the original paper.

Determining the Cost of Capital

I disagree with the author's statement, "The company's 'cost of capital' provides the best benchmark for evaluating the ROE from each profit center." This is a common misconception. The weighted-average cost of capital for the profit center in question is the proper benchmark.[1] This figure will reflect the specific risk factors relevant to the profit center itself whereas the overall corporate cost of capital reflects those risk factors of the company as a whole. A high-risk profit center will be placed at an advantage relative to a low-risk profit center if the corporate cost of capital is used as a "hurdle rate." Take the example of a multiline company with a corporate cost of capital of 15 percent. Two of its many profit centers, A and B, have the following characteristics:

Profit Center	Stage	Risk Level	Growth	Cost of Capital
A	Mature	Low	Low, Stable	10%
B	Emerging	High	High, Erratic	25%

Two items should be noted. First, the cost of capital is calculated based on the risk inherent in each profit center as if it were an independent and distinct entity. Second, the term *risk level* is used in a broad sense to describe the profit center as a whole; it does not refer to a narrower concept such as volatility of insurance claims. Assume both profit centers wish to expand operations. They submit their respective plans to corporate management. Assume management does not have enough resources to accept both proposals. Through economies of scale, profit center A's plan will yield 12 percent ROE. Profit center B's plan yields 22 percent ROE. Using the

[1]Assuming that the profit center engages in projects of similar risk levels and surplus needs.

corporate cost of capital (15 percent as a hurdle rate, corporate management will accept only project B. Because project B does not yield a return commensurate with the risks inherent in the project while project A's return exceeds the risk-adjusted return requirement, using corporate cost of capital has led management to a suboptimal decision.

The argument should be taken one step further. In the preceding example, the cost of capital for each project was calculated as if each were an independent company. This adds to the complexity of the already difficult task of setting the cost of capital, but it leads to better decisions. I would also suggest that companies strive to calculate the ideal cost of capital versus actual cost of capital in strategic financial management. This is not to say that unattainable efficiencies or sales volumes be projected. Indeed, the operating projection should be as realistic as possible. With repect to the financial aspects, however, a profit center should not be rewarded or penalized for financial circumstances (over which it has no control) that affect the cost of capital calculation. Ironically, it is paramount in strategic financial management to separate the strategic decision (accept/reject a project) from the financing.

Let us return to the multiline company of the previous example. Assuming actual corporate surplus is less than the sum of required surplus for each line, if corporate management allocated the difference (required surplus-actual overall corporate surplus) back to each line and used this lesser amount (actual surplus) for strategic decision-making, the following could occur.

A profit center's actual cost of capital (based on actual surplus) would be less than its ideal cost of capital (based on the sum of required surplus for each line) because surplus resides in the denominator of the ROE calculation. It would then be possible for a project to qualify under the actual cost of capital hurdle while falling short under ideal. Use of actual cost of capital results in something other than merit helping the project over the hurdle. In this case, it is the good fortune of the profit center to be part of a multiline company.

The situation can reverse itself. If a multiline company has a great financial disadvantage, the actual cost of capital may be artificially high, and worthwhile projects will be spurned unless their return exceeds their ideal cost of capital plus the cost of the financial disadvantage. Excessive debt, for example, could raise actual cost of capital above ideal cost of capital.

Concept of Economic Value

This section proved to be most challenging and intriguing due to the nature of the typical insurance product. Whereas a producer of capital goods (one which is able to obtain adequate product liability insurance) often receives

revenue and delivers the product (releasing it from further liability) within a short time period, the life insurer often receives premiums and carries liability for many years. This leads to intangible reserves carried as liabilities. Different reserving techniques can result in different surplus amounts, causing one to wonder about the true meaning of surplus for life insurance companies. ROE measures for traditional industries seem to have a more firm concept of equity than do those for the life insurance industry. Even so, there are those who propose that ROE be further adjusted to reflect such things as replacement cost in order to be meaningful. The difficult question arises; what exactly does GAAP ROE tell us about life company performance? Fortunately, this question is beyond the scope of the paper.

Ignoring the issue of defining a proper ROE benchmark (which was discussed at length previously), what is the proper managerial decision for a profit center which cannot meet the target? Mr. Kischuk believes that companies may be tolerant of this if free cash flow is being generated. It is important to realize that, in this situation, management is accepting returns which are not commensurate with the risk undertaken. In the long run, this could place the company at a competitive disadvantage.

The author's last paragraph in this section seems straightforward at first. Mr. Kischuk states that "a good argument can be made for varying the ROE criterion for profit centers based on an analysis of the relative risk of each profit center." I heartily agree, as explained previously. Then he asserts that by adjusting required surplus so that all profit centers are at similar risk levels, all profit centers can utilize the same ROE target. Certainly this concept has intuitive appeal. At the same time, we must ensure that no distortions are introduced by this streamlined methodology. When applying the concept of target ROE, it may be helpful to return to the basic definition of ROE, earnings divided by equity.

Assume the denominator in the ROE expression is held constant. Then, in setting ROE targets, required earnings will vary directly with the risk inherent in the project (or profit center). Therefore, two profit centers with similar risk profiles will require similar returns.

If the numerator were constant, however, the situation is more complex. In most industries, there is little or no choice as to the level of equity that is required to operate a business. The capital intensity of a business defines the total assets required to compete, and the financial markets define the allowable range of debt-to-equity in obtaining necessary capital. The capital-intensive widget producer (assume widgets are low growth, low risk, low ROE) cannot decide to reduce capital allocated to the widget profit center, bringing target ROE up to a predetermined level. Similarly, a high-ROE profit center would not wish to be allocated excess capital in order to bring ROE targets down, because the extra capital would not be needed and could

not be utilized efficiently. The bottom line is that capital needs do not necessarily bear a direct relationship with risk levels.

The insurance business is different. It is not clear what levels of equity (capital and surplus) are required, due to the nature of the business. Therefore, there are a number of opinions about required equity levels. Theoretically, the insurance company sets its equity based on risk analysis, a similar process to assessing the numerator of the ROE expression. Higher levels of insurance risk generally mean higher required surplus levels.

This would seem to support the author's statement because it should not matter then whether the insurance company performs the risk adjustment in the numerator (by requiring higher returns) or denominator (by holding additional surplus).

However, there are some important questions that remain. First, how does capital intensity affect the insurance industry? For the author's statement to hold, required surplus formulas must reflect not only risk, but capital intensity. There are different levels in different products or lines of business. The extent to which capital intensity varies among products and lines must be considered in performing the adjustment to equity suggested by the author.

Second, does required equity take into account future growth? Required surplus has been defined in many ways. The concept of safety surplus (the amount required for the existing insurance risks) versus vitality surplus (the amount required if the company is to grow) is key. If required surplus quantifies only risk levels inherent in the present book of business, it ignores growth needs. If growth needs are significant, they must also be considered when adjusting the denominator.

The foregoing discussion points out the need to utilize a broad definition of risk and not restrict the definition to consider only insurance risk. When doing so, we are faced with the difficult task of quantifying and trading off different types, as well as different levels, of risks.

Finally, aside from the issue of whether it is feasible to adjust equity to bring ROE in line with a predetermined measure, is the question of what may be lost by doing so. Given a table of profit centers, ROE targets, and other financial information, one is able to determine a great deal about the characteristics of the business. An ROE-based strategic management system that implicitly adjusts so that risk levels of different profit centers are equal may defeat the purpose of developing such a system, i.e., to assemble the proper information to make useful decisions.

I conclude that empirical studies of this issue are necessary. It seems that the author's statement has some validity. I submit, however, that this adjustment may be as difficult, or perhaps more difficult than the traditional practice of varying ROE targets by profit center.

Example of a Financial Plan

I close with a brief comment on the author's example. Profit center A is presented as a small emerging business unit with high ROE. The author concludes that since ROE is far above company cost of capital, profit center A should be allocated additional capital. Based on my previous discussion, this is not necessarily the correct conclusion. Profit center A may be a high-growth, high-risk entity that may be a bad investment even if it earns a high ROE relative to the company as a whole.

I thank Mr. Kischuk for presenting a much needed broader perspective. He has challenged all of us to think more carefully about the strategic aspects of our profession. I am confident that this will be a popular article because it deals with an important subject that is likely to remain at the forefront for many years.

DAVID N. INGRAM:

This paper provides an excellent summary of the corporate role in the financial management of a life insurance company. The description of the four stages of strategic financial management is particularly helpful in determining the relationship between where we are and where we would like to be.

In general, the methods described by Mr. Kischuk will produce good financial results for a company. Theoretically, at least, these methods can be altered slightly to produce "optimal" results. The alteration would be to move from using averages for cost of capital and ROE to using marginal rates.

With regard to cost of capital, a process of averaging costs from debt, equity, and other sources is described to obtain the cost. Two ways of determining marginal cost of capital have been described in financial literature. The first is to look at the current lowest cost of obtaining additional capital. If there are possibilities within the company of achieving a better ROE (after deducting the costs) with this additional capital, then obtaining that capital would improve the profits of the company. If that marginal cost is lower than the average cost or lower than the cost of one component of current capital, consideration should be given to refinancing.

The second method is to look at the opportunity cost within the company. The cost of capital would be set at the best marginal return that the company could obtain with additional capital. Use of this rate would change the nature of the evaluation of opportunities from the "economic value" concept to an "optimal value" concept.

Return on equity would also be measured *marginally* to be compared to the marginal cost of capital. *Marginal* is defined within the scope of the acceptable options. If the options are selling $15 million of a product or $20

million of the same product, then the marginal ROE for this product would be calculated with the expected expenses, investments, mortality, and lapse experience of the $5 million of sales. If the options are to sell a product or not, marginal ROE would include all direct experience expected of the product.

As mentioned, these are theoretical concepts. Indiscriminate application to financial management of a company could produce frequent and disruptive reallocations of capital based on small differences in forecasts of ROE and cost of capital.

A change in Mr. Kischuk's suggested financial planning process could help introduce more "marginal" thinking. Each profit center could be asked to provide a range of plans, offering several different levels of surplus usage. The job of the corporate financial planner is to select the blend of alternatives which maximizes the company's performance in total. Included in this consideration would be the possibility of obtaining additional capital through debt, equity, reinsurance, or other means.

Another important point to note is that expected ROEs are bound to be different for different levels of surplus usage by a profit center. Profit centers may be operating under an "economy of scale" situation where increased volume would increase the rate of profits or in a "diminishing return" situation where increased volumes could only be achieved at lower rate of profit or at the cost of further capital expenditures to move to new markets.

The following is an example using four profit centers with three scenarios for each profit center. Scenario 1 is cash out (i.e., no further investment), scenario 2 is low growth, and scenario 3 is high growth. Profit centers E and F are assumed to be in an "economy of scale" situation, G and H in a "diminishing return" situation. Any additional capital needed is assumed to be obtained at a cost of 18 percent. Uninvested capital earns 6 percent. The corporate financial planner can then select a combination of these scenarios to produce a desired result. Scenario 4 is one such combination where five-year earnings are $100 more than the next best scenario.

I would also like to comment on risk adjustments to profit center ROE criteria. Mr. Kischuk suggests that risk adjustment can be made through the required surplus formula. We have used required surplus to provide for catastrophic losses which would threaten company solvency. This is certainly one risk for which adjustment should be made. The risks associated with volume fluctuations and earnings variability are not included in our required surplus formula since they threaten profitability, not solvency. These risks should be considered in making adjustments to profit center ROE criteria. Volume fluctuations result from variances of sales and in-force levels which do not result in immediate changes to fixed costs. Earnings variability results from experience fluctuations which are not anticipated in pricing.

SCENARIO 1

CASH OUT

PROFIT CENTER	FIVE-YEAR ROE	ENDING EQUITY	PERCENTAGE ENDING EQUITY	CHANGE IN PROFIT CENTER EQUITY	FIVE-YEAR EARNINGS	CHANGE IN CORPORATE EQUITY	EQUITY GROWTH
E	2.0%	20	2.8%	(28)	3	31	−16.1%
F	6.0	60	8.4	(52)	27	79	−11.7
G	14.0	100	14.0	(115)	113	228	−14.2
H	−1.0	0	0.0	(123)	(3)	120	−100.0
Profit center total . .	8.1%	180	25.1%	(318)	140	458	−18.4%
Corporate . .	6.0%	536	74.9%	536	78	536	100.0%
Total company	7.5%	716	100.0%	218	218	536	7.5%

SCENERIO 2

LOW GROWTH

PROFIT CENTER	FIVE-YEAR ROE	ENDING EQUITY	PERCENTAGE ENDING EQUITY	CHANGE IN PROFIT CENTER EQUITY	FIVE-YEAR EARNINGS	CHANGE IN CORPORATE EQUITY	EQUITY GROWTH
E	7.0%	62	7.2%	14	19	5	5.25%
F	11.0	121	14.0	9	64	55	1.56
G	12.0	281	32.4	66	144	78	5.50
H	15.0	200	23.1	77	113	36	10.21
Profit center total . .	12.1%	664	76.6%	166	339	173	5.9%
Corporate . .	6.0%	203	23.4%	203	29	203	100.0%
Total company	11.7%	867	100.0%	369	369	203	11.7%

SCENARIO 3

HIGH GROWTH

PROFIT CENTER	FIVE-YEAR ROE	ENDING EQUITY	PERCENTAGE ENDING EQUITY	CHANGE IN PROFIT CENTER EQUITY	FIVE-YEAR EARNINGS	CHANGE IN CORPORATE EQUITY	EQUITY GROWTH
E	20.3%	214	26.8%	166	97	(69)	34.84%
F	15.0	272	34.1	160	124	(36)	19.42
G	9.5	467	58.5	252	143	(109)	16.78
H	13.5	334	41.8	211	129	(82)	22.11
Profit center total . .	13.0%	1,287	161.2%	789	492	(297)	20.9%
Corporate . .	18.0%	(489)	−61.2%	(489)	(191)	(489)	100.0%
Total company	9.9%	798	100.0%	300	300	(489)	9.9%

SCENARIO 4

COMBINED SCENARIO

PROFIT CENTER	SCENARIO	FIVE-YEAR ROE	ENDING EQUITY	PERCENTAGE ENDING EQUITY	CHANGE IN PROFIT CENTER EQUITY	FIVE-YEAR EARNINGS	CHANGE IN CORPORATE EQUITY	EQUITY GROWTH
E	3	20.3%	214	22.1%	166	97	(69)	34.84%
F	3	15.0	272	28.1	160	124	(36)	19.42
G	1	14.0	100	10.3	(115)	113	228	−14.2
H	3	13.5	334	34.5	211	129	(82)	22.11
Profit center total . .		14.3%	920	95.1%	422	463	41	13.1%
Corporate . .		6.0%	47	4.9%	47	7	47	100.0%
Total company		14.2%	967	100.0%	469	469	47	14.2%

E.S. ROSENBLOOM*:

This interesting paper touches on many aspects of surplus management. This discussion will concentrate on one point—the financial plan for allocating capital for each profit center.

The allocation of capital to profit centers can be viewed as a portfolio selection problem. However, instead of determining what fraction of the portfolio should be in a given security, the problem considered is dividing the capital between various profit centers.

The paper uses the ROE for each profit center. However, the paper treats ROE as a predetermined number. A more general approach would be to treat ROE as a random variable. If this is done, portfolio selection techniques can be used in the allocation of resources to profit centers.

Portfolio selection techniques seek portfolios that provide the maximum rate of return for a given level of risk and the minimum level of risk for a given rate of return. Such a portfolio is called an efficient portfolio.

The first and most famous of the portfolio models was developed by Markowitz [2]. The Markowitz method equates the rate of return with the expected rate of return and the risk of the portfolio with the variance of the portfolio. Since both the expected ROE and the variance can be calculated for a portfolio of profit centers, the Markowitz model can be applied to the allocation of resources to the profit centers of a company.

The Markowitz model would find an efficient allocation of assets by solving a quadratic program. The decision variables for this quadratic program would be defined by

x_i = the fraction of assets allocated to profit center i.

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In the portfolio selection problem there are usually no restrictions on the x_i's except for x_i being between 0 and 1. However, in the allocation of assets problem, a company would have a fairly narrow range for possible values of each x_i. Defining

a_i = the minimum fraction of assets that can be allocated to profit center i

and

b_i = the maximum fraction of assets that can be allocated to profit center i

each x_i will be restricted by

$$a_i \leq x_i \leq b_i.$$

Over such a narrow range the expected ROE for a profit will be constant. Therefore defining

R_i = the expected ROE for profit center i,

V_i = the variance of the ROE for profit center i,

and

C_{ij} = the covariance between the ROEs for profit centers i and j

$$(i \neq j)$$

the company's expected ROE, R_P, is given by

$$R_P = \sum_i R_i x_i,$$

while the variance on the company's ROE, V_P, is given by

$$V_P = \sum_i V_i x_i^2 + \sum_{i \neq j} C_{ij} x_i x_j.$$

An efficient allocation of assets can be found now by solving, for a t between 0 and 1, the quadratic program

$$\text{Maximize } t R_p - (1-t) V_p$$

Subject to

$$\sum_i x_i = 1,$$
$$a_i \leq x_i \leq b_i \text{ for all } i$$
$$\text{and all } x_i \geq 0.$$

As t varies between 0 and 1, all efficient allocation of assets can be found. With $t = 1$, the allocation with the highest ROE is obtained. With $t = 0$, the allocation with the lowest risk or variance is obtained.

A disadvantage of the Markowitz model is the requirement of estimating the means, variances, and covariances of the ROEs. However, the model allows the consideration of both expected ROE and risk in the allocation decision.

A more complete discussion of portfolio theory and its application to actuarial problems can be found in the paper by Frost [1].

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WILLIAM SCHREINER:

Mr. Kischuk's paper contains excellent observations on organizational tendencies in the absence of structured financial planning and identifies key issues that must be confronted. I hope it will encourage others to contribute to the literature on managing the financial resources of an insurance company. This is vital work which would benefit greatly, in my opinion, from the application of actuarial techniques.

After thinking about the implications of the approach outlined in the paper, I began to wonder whether the paper put too much faith in accounting models rather than in economic substance. The reader may miss the paper's important caveat that an accounting basis, presumably either statutory or GAAP, may distort the results of one's analysis. Perhaps more importantly, the paper muddies key issues by speaking of "surplus" when "capital" is meant.

It is counterproductive to talk, as the paper does, of surplus as though it were a real quantity capable of being invested. In fact, surplus is a fictional quantity that has no economic substance. Surplus is merely the arithmetic result of subtracting the nominal value of liabilities, determined in accordance with a particular accounting model, from the nominal value of assets, determined in accordance with the same accounting model. Thus, for a given block of life insurance business and assets, surplus changes its value according to the accounting model used and even according to the philosophical idiosyncrasies of the particular company preparing the financial statement.

One does not need surplus to operate a business segment; one needs assets—capital. First, cash is needed to get the business started; then assets are accumulated to meet the business's obligations; then at the end of the game, if successful, the business has assets left over. During the game, the interim values placed on whatever the accounting model chooses to call assets and liabilities (and, consequently, the organization's "surplus") are of no economic moment. They may have political significance, but if the paper is correct that the objective of financial planning is to increase the economic value of the company, I believe that an economic value based planning effort would ignore (at least initially) statutory or GAAP or other derived surplus increases and would concentrate on valuing the actual cash flows of the company. (Note that the negative example given in the paper is termed a cash sink, not a surplus sink. Traditional ordinary life insurance historically has been a notorious surplus sink, but a cash geyser.) Similarly, such a planning effort would ignore so-called return on accounting-model-based equity and concentrate on measuring the ultimate return on out-of-pocket investments. The paper indicates that this is what financial management textbooks prescribe. I suspect that the reason ROE has become popular in nonactuarial circles is that it is relatively easy to calculate. Actuaries, however, are equipped to do more sophisticated and useful analysis and could apply their skills to this important area with great benefit.

The fundamental issue in financial planning for an insurance company is the balancing of optimization of economic value and avoidance of regulatory or investment community pitfalls. Capital allocation decisions would follow directly from actuarial analysis of cash flows if regulatory and marketplace issues were not present. Such issues add an additional layer of complexity to the evaluation of insurance company financial decisions. The most useful answers are to be found, first, by recognizing the inherent unsuitability of using accounting model items such as "earnings," "surplus," and "equity" as primary analytic tools and, second, by testing cash-flow economic-value analysis against regulatory or other external constraints.

ELIAS S.W. SHIU:

Because of the wild interest rate fluctuations in recent years, C-3 risk has become a dominant factor in determining surplus allocation. Thus, it seems appropriate to supplement this interesting paper with a technical discussion on immunization theory and the amount of surplus required to offset C-3 risk.

A classical actuarial tool for dealing with C-3 risk is F.M. Redington's theory of immunization [6]. On page 8 of the *Exposure Draft on Life Insurance Company Valuation Principles* published by the Society on

April 10, 1986, it is stated that the Macaulay-Redington duration is "a measure widely used by financial managers of investment funds and is now fundamental in C-3 risk analysis in life insurance companies." Redington's work has been extended by Fisher and Weil [1], who wrote that the reduction in risk provided by a duration-matching strategy is "so dramatic that . . . a properly chosen portfolio of long-term bonds is essentially riskless." Unfortunately, recent empirical research has shown that duration-matching strategies do not work too well. Indeed, Gultekin and Rogalski [3] reported that:

> despite the flood of articles and commercial programs claiming superiority for particular measures of duration, the measures studied were virtually indistinguishable empirically. In fact, none of them did much better than simple maturity in explaining bond returns, and all duration measures are inferior to simple factor models. These results are in sharp contrast to the claims made by authors about various duration measures. . . . Interest rate movements have been such that immunization strategies based on duration would not have worked. Duration-based immunization programs do not appear to warrant the resources spent on them.

Similarly, Ingersoll [4] wrote:

> We review the Fisher-Weil findings and report substantially different findings when a similar test is performed on the quoted bond prices in the CRSP Government Bond File. . . . In repeating the Fisher-Weil immunization tests on quoted bond prices, we found that immunizing through duration matching did nowhere near as well as they report. On an absolute scale we found the remaining risk to be larger by a factor of 10. On a relative scale we found that duration matching could not consistently beat the more naive scheme of maturity matching.

In view of these statements, let us now examine carefully the mathematics of immunization theory. Consider a simple case such as a GIC which has only one liability outflow and is funded by a stream of cash inflows $\{C_t\}$. Given a force-of-interest function $\delta(\cdot)$, the value of the cash flows $\{C_t\}$, evaluated at time τ, is

$$\sum_t C_t \cdot \exp\left[\int_t^\tau \delta(s)\, ds\right].$$

To simplify writing, define

$$c_t(\tau) = C_t \cdot \exp\left[\int_t^\tau \delta(s)\, ds\right].$$

Let T denote the duration of the cash flows $\{C_t\}$, i.e.,

$$T = \sum_t t c_t(0) \,/\, \sum_t c_t(0).$$

Assume that the single liability outflow is to occur at time T and is of amount

$$V(\delta) = \sum_t c_t(T).$$

Note that, for each τ,

$$T = \sum_t t c_t(\tau) \,/\, \sum_t c_t(\tau). \tag{1}$$

If the force-of-interest function changes from $\delta(\cdot)$ to $\delta(\cdot) + \epsilon(\cdot)$, the value of the cash flows $\{C_t\}$ at time T becomes

$$V(\delta+\epsilon) = \sum_t C_t \cdot \exp\{\int_t^T [\delta(s) + \epsilon(s)]\, ds\}$$

$$= \sum_t c_t(T) \cdot \exp[\int_t^T \epsilon(s)\, ds].$$

I am assuming that the cash flows $\{C_t\}$ are not affected by the interest rate shock. The question is how $V(\delta)$ compares with $V(\delta+\epsilon)$ or, equivalently, how the ratio $V(\delta+\epsilon)/V(\delta)$ compares with 1.

Define

$$f(t) = \exp[\int_t^T \epsilon(s)\, ds].$$

Then

$$V(\delta+\epsilon) - V(\delta) = \sum_t c_t(T)[f(t) - 1]. \tag{2}$$

Assuming that the function f is twice differentiable, we have, by Taylor's formula with integral remainder or by integration by parts,

$$f(t) = f(T) + (t - T)f'(T) + \int_T^t (t - w)f''(w)\, dw. \tag{3}$$

Since

$$f(T) = 1$$

and

$$f'(T) = -\epsilon(T),$$

equation (2) becomes

$$V(\delta+\epsilon) - V(\delta) = -\epsilon(T)\sum_t c_t(T)(t - T)$$

$$+ \sum_t c_t(T)[\int_T^t (t - w)f''(w)\, dw].$$

By the weighted mean-value theorem for integrals, there exist numbers $\{\zeta_t\}$ such that

$$\sum_t c_t(T)\left[\int_T^t (t - w) f''(w)\, dw\right] = \sum_t c_t(T)\left[f''(\zeta_t)\cdot\int_T^t (t - w)dw\right]$$
$$= \sum_t c_t(T)\cdot f''(\zeta_t)\cdot(t - T)^2/2.$$

Since the cash flows $\{C_t\}$ are positive, the numbers

$$\{c_t(T)\cdot(t - T)^2/2\}$$

are also positive. Thus, there exists a number m, lying between the minimum and maximum of $\{f''(\zeta_t)\}$, such that

$$\sum_t c_t(T)\cdot f''(\zeta_t)\cdot(t - T)^2/2 = m\sum_t c_t(T)\cdot(t - T)^2/2.$$

By applying the Darboux Theorem [7, Theorem 5.12] or by assuming that f'' is continuous, we know that there is a number ξ for which

$$f''(\xi) = m.$$

Hence,

$$V(\delta + \epsilon) - V(\delta) = -\epsilon(T)\sum_t c_t(T)(t - T) + f''(\xi)\sum_t c_t(T)(t - T)^2/2. \tag{4}$$

By equation (1),

$$\sum_t c_t(T)(t - T) = 0. \tag{5}$$

Thus, (4) simplifies to

$$V(\delta + \epsilon) - V(\delta) = 1/2f''(\xi)\sum_t c_t(T)(t - T)^2. \tag{6}$$

Equation 6 gives the profit or loss of the duration-matched portfolio caused by the interest rate shock $\epsilon(\cdot)$. As $f''(\xi)$ may be negative, (6) shows that a duration-matched portfolio is really not *immunized* against all interest rate fluctuations. This is one of the reasons for the previously quoted Gultekin-Rogalski and Ingersoll findings. Equation 6 can be extended to the case of multiple liabilities; see [8].

Let me now present an expression equivalent to (6). Using (5), we have

$$\sum_t c_t(T)(t - T)^2 = \sum_t c_t(T)t^2 - T^2\sum_t c_t(T).$$

Define

$$K = \sum_t t^2 c_t(0) \,/\, \sum_t c_t(0)$$
$$= \sum_t t^2 c_t(T) \,/\, \sum_t c_t(T).$$

The term K is called *convexity* in the finance literature. Dividing (6) by the term $V(\delta)$, we obtain a simple formula expressing the relative change in value due to the interest shock $\epsilon(\cdot)$:

$$[V(\delta+\epsilon)/V(\delta)] - 1 = 1/2f''(\xi)(K - T^2). \tag{7}$$

On comparing the right sides of (6) and (7), we are reminded of the statistical formula

$$\text{Var}(X) = E(X^2) - [E(X)]^2. \tag{8}$$

Fong and Vasicek [2, p. 1543] define

$$M^2 = \sum_t (t - T)^2 c_t(0) / \sum_t c_t(0).$$

Thus, we have an equation analogous to (8):

$$M^2 = K - T^2.$$

To use (6) or (7) to determine the surplus needed to offset C-3 risk of the duration-matched portfolio, we need to evaluate $f''(\xi)$. Unfortunately, the point ξ depends on $\epsilon(\cdot)$ and on $\{c_t\}$, and we do not know what the next interest rate shock $\epsilon(\cdot)$ would be. However, Fong and Vasicek [2] have proved the following elegant inequality:

$$[V(\delta+\epsilon)/V(\delta)] - 1 \geq - \text{x}1/2SM^2, \tag{9}$$

where

$$S = \text{Maximum } [\epsilon'(\tau) \mid \tau \geq 0].$$

A simple proof of (9) can be found in [5]. By "guestimating" S, we can use the quantity $\frac{1}{2}SM^2$ as a benchmark for setting up a required-surplus formula for the portfolio.

The preceding does not discuss strategic management of surplus, which is the theme of the paper. However, before one can manage surplus strategically, one needs to be able to estimate how much of it is required.

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DONALD R. SONDERGELD:

I have been involved with this subject for many years and found the paper quite interesting. The return on total capital planning objective was discussed in my 1982 paper on "Profitability As A Return On Total Capital" in *TSA* XXXIV. Also, the concept of earnings being a uniform percentage of surplus was discussed in my 1974 paper, "Earnings and the Internal Rate of Return Measurement of Profit" in *TSA* XXVI. The purpose of this discussion is to expand a few items brought out in the paper.

My first point relates to GAAP required surplus, which is simply statutory required surplus plus all GAAP adjustments. On a simplified basis, the author suggests approximating GAAP adjustments for financial planning purposes as the "unamortized GAAP deferred acquisition costs plus the excess of statutory benefit reserves over GAAP benefit reserves." I would suggest that this simplified basis also be adjusted downward by "deferred taxes," which can be large. My company then uses all of the actual GAAP adjustments for financial reporting purposes for each profit center.

The author mentions that GAAP ROEs may or may not correspond to the internal rate of return used in pricing a product. That result is due not only to the GAAP assumptions, but also to the GAAP accounting method and the fact that the GAAP adjustments are not based on the concept of statutory required surplus (which my company also uses in developing an internal rate of return when pricing a product).

Although the author correctly cautions the actuary that the GAAP accounting basis may distort GAAP ROEs when compared with the internal rate of return used for pricing, he states that often these problems may be prevented by selecting GAAP assumptions which produce GAAP ROEs that are reasonably close to the internal rate of return. Although we try to accomplish that result at my company, I think "often" might be better stated as "occasionally." An accounting method, called the Internal Rate of Return

Method of Accounting (IRRMA) described in my 1974 paper referred to earlier, produces earnings that are a uniform percentage of surplus—but it is not GAAP.

The author states that financial planning should include, as an objective, the concept of increasing the economic value of the company. I agree and have felt that the management science subject of capital budgeting decisions should be required in the syllabus for our actuarial examinations. For those interested in this subject, I would refer them to eleven articles listed on page 383 of my discussion of Bradley M. Smith's paper, "The Choice of The Proper Profit Objective" in *TSA* XXXV.

Mr. Kischuk provides us with certain definitions:

1. Economic Value = Present value of free cash flow, discounted using the company's cost of capital.
2. Free Cash Flow = Increase in total statutory surplus (before dividends to stockholders) less the increase in required statutory surplus.

How is the investment in one or more years of new business handled? I presume as a reduction in free cash flow. And, over what period is this present value calculation made? If it covers many years, it is important to remove the investment income earned on free surplus each year before projecting the next year's statutory surplus. Otherwise, interest on interest will be incorrectly discounted.

This is easy to illustrate: Assume a company has no business on the books, no required surplus, and $10,000 of free statutory surplus on which it assumes it can earn 12 percent after tax. Further, assume that 12 percent happens to be the cost of capital rate.

	Approach A		Approach B	
t	Surplus	Change in Surplus	Surplus	Change in Surplus
0	10,000		10,000	
1	10,000	1,200	11,200	1,200
2	10,000	1,200	12,544	1,344
3	10,000	1,200	14,049	1,505
...	...	...	...	...

$$\text{Present Value of A} = \frac{1{,}200}{1.12} + \frac{1{,}200}{(1.12)^2} + \frac{1{,}200}{(1.12)^3} + \cdots$$

$$= 1{,}200 \sum_{1}^{\infty} \left(\frac{1}{1.12}\right)^t = \frac{1{,}200}{.12} = 10{,}000$$

$$\text{Present Value of B} = \frac{1{,}200}{1.12} + \frac{1{,}200(1.12)}{(1.12)^2} + \frac{1{,}200(1.12)}{(1.12)^3} + \ldots$$

$$= 1{,}200 \sum_{1}^{\infty} \frac{t}{1.12} = \infty$$

In the preceding example, the economic value of the company has not increased. It remains at $10,000 if Approach A is used, but we incorrectly assume we have increased the economic value by an infinite amount if Approach B is used.

In fact, if we assume we can earn 9 percent forever and use 12 percent as the cost of capital, then the

$$\text{present value under Approach B} = \frac{900}{1.09} \sum_{1}^{\infty} \left(\frac{1.09}{1.12}\right)^t$$

$$= 900 \div .03 = 30{,}000.$$

Using Approach B incorrectly implies a 20,000 dollar increase in economic value. Using Approach A, $900 \div .12 = 7{,}500$, which correctly produces a 2,500 dollar decrease in economic value.

This reinvestment subject was elaborated on in Pierre Choinard's discussion of S. David Promislow's paper, "A New Approach To The Theory Of Interest" in *TSA* XXXII, in James W. Lawson's discussion of David S. Lee's paper, "A Conceptual Analysis of Nonparticipating Life Insurance Gross Premium and Profit Formulas" in *TSA* XXXI, and also in Samuel H. Turner's paper, "Actuarial Appraisal Valuations of Life Insurance Companies" in *TSA* XXX.

In the tables in the section of the paper titled "Example of a Financial Plan," there were four profit centers labeled A, B, C, and D, and their results produced a total company result. Another example might have included a fifth profit center called corporate. Presumably a holding company structure was used, which supplied or removed free surplus, so each profit center had the exact amount of required surplus, and there was no free surplus in the company.

Consider the following chart:

	Profit Centers Required Statutory Surplus	Profit Centers GAAP Adjustments	Free (or Corporate) Surplus	Total Surplus
Statutory Surplus	W	0	X	$W+X$
GAAP Adjustments....	0	Y	Z	$Y+Z$
GAAP Surplus...	W	Y	$X+Z$	$W+X+Y+Z$

In the discussion of economic value, the author suggests that free cash flow (defined as ΔX) can be approximated by the "excess of GAAP earnings over the increase in required GAAP surplus," i.e., $[\Delta (W+X+Y+Z) - \Delta (W+Y) = \Delta (X+Z)] = \Delta X + \Delta Z$. This is fine only if the ΔZ's are not significant. That depends on which GAAP adjustments are allocated to the product lines or profit centers that develop required surplus and which are not (i.e., allocated instead to a corporate line of business).

The author states that a profit center is generating free cash flow if its GAAP ROE exceeds its equity growth rate. Another way of saying the same thing is that a profit center is generating free cash flow if its GAAP earnings plus the increase in required statutory surplus are less than its statutory earnings, that is, if $\Delta (W+Y)$ is negative for the profit center. This is demonstrated in the following, which relate to a specific profit center.

$$
\begin{aligned}
{}_{t}W &= {}_{t-1}W \\
&\quad + \text{change in Required Statutory Surplus} \\
{}_{t}Y &= {}_{t-1}Y + {}_{t}\,\text{GAAP Earnings}^{*} \\
&\quad - {}_{t}\text{Statutory Earnings}^{*} \\
({}_{t}Y + {}_{t}W) - ({}_{t-1}Y + {}_{t-1}W) &= {}_{t}\text{GAAP Earnings} \\
&\quad - {}_{t}\text{Statutory Earnings} \\
&\quad + \text{change in required Statutory Surplus.}
\end{aligned}
$$

*For the profit center, excluding interest on Required Statutory Surplus.

Examine the preceding equations. ΔW does not represent earnings on required statutory surplus, but the change in required statutory surplus. It is also important to note that ΔY does not represent GAAP earnings for the profit center. Future GAAP earnings equal future statutory earnings for a product in any profit center at time 0, or at issue. However, required GAAP surplus $(W+Y)$, at any point in time, equals future statutory earnings, minus future GAAP earnings plus statutory required surplus for the product. Therefore, the change in GAAP required surplus, $\Delta(W+Y)$, in the current year equals GAAP earnings plus the change in required statutory surplus minus statutory earnings.

Required GAAP surplus was also defined as Equity for each profit center. If we look at the second example in the paper, we see that $(488)(1.12)^5 = 860$, which means $(488)(.03)(1+1.12+\ldots 1.12^4) = 93$ was paid out to the holding company, as the ROE was 15 percent and the equity growth rate was 12 percent. The equity growth rate was less that the GAAP ROE for profit centers B and C, and greater for profit centers A and D. This means

that the additional surplus needed to finance growth for profit centers A and D, which was not generated by A and D, was exactly produced by profit centers B and C. There was no need for a capital contribution from the holding company, which received the desired 3 percent as a dividend.

The required statutory surplus formulas used by my company, Hartford Life, were outlined at a panel discussion, "Product Line Capital Allocation," and are shown in the 1985 *Record*, Volume 11, Number 2, page 629.

(AUTHOR'S REVIEW OF DISCUSSION)

RICHARD K. KISCHUK:

Management of life insurance company capital is still in its infancy compared to most other industries. One of my hopes in writing this paper was that it would stimulate additional discussion and research that will advance the state of the art. The discussions of this paper are a major step in that direction.

Mr. Granieri has focused on one of the most controversial aspects of managing insurance company surplus: Should ROE targets vary by profit center depending upon relative risk? There are good arguments on either side of this question. As a practical matter, it is difficult to vary ROE targets by profit center, especially if management's compensation is tied to ROE. Without a good explanation of how a profit center's ROE target is determined, management will tend to view it as arbitrary and may have difficulty becoming motivated to achieve it. Perhaps the same could be said about explaining variations in required surplus by profit center, but for some reason this seems to be easier.

As Mr. Granieri points out, this problem is not unique to the insurance industry. A company's overall cost of capital provides a benchmark for use in financial decision-making. In order to vary ROE targets by profit center, it is necessary to reach a judgment for each profit center as to whether it is more or less risky than the company average. The business environment is changing so rapidly today that retrospective risk measures are not necessarily a good indicator for the future. Moreover, it is not easy to compare profit centers where the nature of the risk differs significantly. It is difficult to argue, for example, whether universal life insurance is inherently more or less risky than group health insurance.

One advantage of required surplus formulas is that they can be used to combine the financial impact of different combinations of risks. Moreover, surplus formulas can be modified subjectively to reflect prospective changes in risks facing each profit center. However, this is not an exact science either.

I agree with Mr. Granieri that there are trade-offs in varying surplus formulas and ROE targets by profit center. Neither is an exact science, and this is an area where further research is needed.

Mr. Granieri comments on the situation where a profit center is earning a low ROE but is developing positive cash flow. There are several reasons why management might be willing to tolerate this situation. First, management should place higher priority on profit centers that are earning a low ROE and also consuming capital. Since management cannot solve all problems at once, it should place highest priority on those situations that are having the greatest adverse impact on economic value.

Second, it may not be feasible to withdraw capital from a profit center all at once. Management may have to make the best of a bad situation and withdraw capital over a period of years.

Finally, in evaluating withdrawal from a product line, management may see that it would have to reallocate overhead expenses to other product lines. In that case, ROE may be viewed as satisfactory on a marginal cost basis. There are obvious pitfalls, of course, if this rationale is taken too far.

Mr. Granieri comments on the concept of safety surplus versus vitality surplus. My paper was written from the perspective that a company can earn a sufficient ROE to cover future growth needs. However, companies do uncover opportunities where a large surplus investment may be needed beyond normal growth needs. An example would be the need to make a large acquisition. In the case of stock companies, especially those in holding company structures, capital can be raised in a variety of ways. This is not true of mutual companies, so there may be a need for mutual companies to hold "vitality surplus."

Mr. Ingram outlines a marginal cost of capital approach to making capital allocation decisions. This is a valuable analytical approach which illustrates the use of scenarios in financial planning. A key point here is that life is even more complex than might have been implied in my paper, since ROE can vary by growth rate, depending upon whether a profit center is operating under an economy-of-scale or diminishing-return situation.

Dr. Rosenbloom has given a concise summary of the Markowitz model. In fact, this model was a major influence on my thinking, leading up to this paper. Dr. Rosenbloom's discussion is therefore a valuable addition. This may point a direction for others to follow in resolving some of the controversial issues identified in the other discussions.

Mr. Schreiner addresses the problem of reconciling different accounting bases in developing a financial planning system. I have chosen statutory surplus as the primary definition of *capital* because statutory accounting determines the point at which cash flow becomes available for dividends or reinvestment in other profit centers.

I believe this is a very important concept because statutory accounting is relevant to economic value and competitiveness. Since cost of capital generally exceeds the after-tax interest rate that can be earned on reserves, redundant statutory reserves (e.g., deficiency reserves) tend to reduce the economic value of a life insurance company. Moreover, in competing for savings with other industries, such as banks or savings and loans, redundant reserves make it more difficult for life insurance companies to be successful.

In light of these tradeoffs, regulators and valuation actuaries should be aware that, while statutory reserves need to be conservative, overly conservative reserves can be harmful to the viability of companies and the industry.

Dr. Shiu discusses mathematical techniques for quantifying the amount of surplus needed to offset the C-3 risk. As Dr. Shiu indicates, before one can manage surplus, one needs to be able to estimate how much surplus is required. This discussion is therefore very relevant to the topic of the paper. While some of the parameters must be estimated subjectively, Dr. Shiu's discussion presents a mathematical framework which looks like a promising approach to practical measurement of the C-3 risk.

Mr. Sondergeld makes a number of good points. First, he suggests that GAAP deferred taxes be taken into account. I have mixed feelings on this. Deferred taxes, as currently defined by GAAP, are not too meaningful. Perhaps this will improve if a version of the liability method is adopted in the future. At any rate, given the current state of the art, it is not clear whether including deferred taxes is an improvement or not at the profit center level. A compromise approach would be to use a liability approach to deferred taxes for financial analysis purposes.

I agree that it is difficult to develop GAAP assumptions which produce GAAP ROEs that are reasonably close to the internal rate of return. Whether the term *often* is more appropriate than the term *occasionally* depends upon how much of a difference is acceptable. I agree that IRRMA, as developed by Mr. Sondergeld, provides a superior accounting method for this purpose.

The balance of Mr. Sondergeld's discussion is very helpful in clarifying some of the points in the paper, and in looking at them from a different perspective.

Again, I would like to express my appreciation to Mr. Granieri, Mr. Ingram, Dr. Rosenbloom, Mr. Schreiner, Dr. Shiu, and Mr. Sondergeld for their excellent discussions. Not only do they enhance and expand upon the paper, but they point the way for further research which I hope will be undertaken.