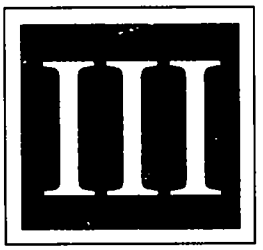

The Choice of the Proper Profit Objective

Bradley M. Smith

Abstract

The purpose of this paper is to examine the various profit objectives used in the development of a new product for a stock life insurance company. The predominance of rules of thumb that have been used for years is discussed, and a theoretical method that can be used in practice is introduced. The method recognizes the differences in the ownership of companies (that is, whether it is a stand-alone company or a subsidiary of a larger parent company with holdings in both insurance and noninsurance fields). Additionally, the differences in available resources within various companies are taken into account.

Introduction

There appears to be a lack of discussion within the actuarial profession as to what a reasonable profit objective is. Certainly within the Society of Actuaries examination syllabus there is discussion as to how to measure profitability, but little concerning when these different measures should be employed and what level these profit measures should reach to be at an acceptable level. Whether this lack of discussion is due to a preferred secrecy among companies or to a lack of theoretical development of what a reasonable profit objective is, this paper hopes to initiate discussion on this topic.

Certainly there is a predominance of rules of thumb concerning what the profit objective of a newly developed product should be. Two widely used rules are as follows:

Yield or return on invested surplus (ROI) = 15%;
Present value of book profits/Present value of premiums (GAAP profit margin) = 10%.

While the insurance industry and the economy, within which it operates, have changed greatly over the past decade, these profit objectives have not. The need for a theoretically developed profit objective that reflects the needs of a particular company seems fundamental to the ultimate success of that company.

Profit Objectives Examined

A stock company's profit objective should reflect the desire to maximize its current value. Assuming that this current value is calculated as the present value of future company earnings, the present value of book profits (which equals the present value of projected statutory surplus using the investment earnings rate as the discount rate) is the current value of the company. Since the reserve and the accounting method affect only the timing of recognition and not the ultimate level of earnings, the difference between the present value of GAAP earnings and the present value of statutory earnings or book profits is academic. Therefore, a company should attempt to maximize its present value of book profits. Maximization implies an upper boundary or constraint. If not constrained, the value would be unlimited or infinite. Since this is not the case, an examination of what is constraining the value must be made. The profit objective then can be defined as the present value of book profits per unit of limiting constraint. Issuing products that maximize this measure will maximize the total present value of book profits that a company, given its constraints, can produce.

Table 1 shows typical profit measures along with the company constraint that should dictate their use. Maximizing the present value of book profits per policy

implies that, given the company's current situation, the total present value of book profits is constrained, because, for whatever reason (limited agency force, administrative capabilities, mailing list), the company can issue only so many policies each year. The same theory holds for maximizing the present value of book profits per thousand dollars of coverage. Suppose that for whatever reason (agency force, markets, mailing lists), the company can issue only so much premium in a given period. In this case, maximizing the ratio of the present value of book profits to issued annualized premium for the period would maximize the total present value of book profits. If the present value of collected premiums is the constraint, maximizing the ratio of the present value of book profits to the present value of collected premiums (that is, the GAAP profit margin) is appropriate. If available statutory surplus is the constraint, maximizing the yield rate on invested surplus will maximize the present value of book profits.

TABLE 1

Profit Measure	Implied Limited Resource
Present value of book profit:	
Per thousand	Thousands of face amount
Per policy	Policies
Per issued annualized premium	Issued annualized premium
Per present value of premium	Present value of premium
Per limited resource	Limited resource
Yield rate on invested surplus (ROI)	Statutory surplus

Using the inappropriate profit measure when deciding which products to offer could lead to less than optimal results in maximizing the present value of book profits. Consider the following simple example.

Suppose that a company has a constraint on statutory surplus of $70 million and is capable of issuing only 10,000 policies during the calendar year. Two products, labeled A and B, have been developed with the following characteristics:

	A	B
Present value of book profits per policy issued	$200	$10
Yield rate on invested statutory surplus	24%	144%
Invested statutory surplus per policy issued	$ 50	$ 1

Since product B requires very little initial investment by the company, its yield rate is very high. If this company maximized its yield rate, it would issue 10,000 policies of type B and no policies of type A. It would have reached the issued policy constraint at that point, and the company's value would have increased $100,000. This value is much lower than the value that would have been obtained if the proper profit objective for this company had been used. Using the present value of book profits per policy issued as the profit objective, the company would have issued 10,000 policies of type A, thereby increasing the value of the company by $2,000,000. It would not become statutorily insolvent, since the total initial investment (drain on surplus) due to issuing this business is only $500,000. This example, however simplistic, illustrates the significant effect of using the wrong profit index for a particular company.

The determination of the limiting resource for a given company may be difficult. Mathematical methods can be used to solve for the distribution of business that will maximize the present value of book profits of policies issued in a period, provided that the constraints for that period can be quantified.

Nontraditional Limited Resources

As we have seen, the profit objectives in predominant use today (namely, yield rate, GAAP profit margin) assume that the limiting resources are statutory surplus and present value of premiums, respectively. These profit objectives may or may not be appropriate. Today such things as first-year commissions, data processing manpower, name lists for a direct-response company, or current assets and cash flow may be the actual limiting resource. The limiting resource is the one that prevents a company from increasing its value infinitely by issuing an unlimited number of profitable policies. It is not hard to imagine, for instance, that an agency force or a particular agent will work less hard once a certain compensation level in a particular year has been reached. If this is the limiting resource, maximizing present value of book profits per first-year commission dollar paid will maximize the total present value of book profits of policies issued within the year. The same theory holds true for any other traditional or nontraditional limiting resource.

Hurdle Rate

There can be many varied limiting resources that constrain the value of a particular company. However, a company must be certain that a particular product has a

return on invested capital at least as great as the company's cost of capital. Only those policies that meet this constraint should be considered for issuance by the company. This cost of capital is generally referred to as the hurdle rate. The hurdle rate is the minimum after-tax yield rate that an acceptable product must have. For a product to be acceptable it is necessary that the present value of statutory book profits, using a discount rate equal to the hurdle rate, must be nonnegative.

If the hurdle rate is greater than the investment earnings rate, the present value of statutory book profits using a discount rate equal to the investment earnings rate may be positive, whereas the present value of statutory book profits using a discount rate equal to the hurdle rate would be negative for an unacceptable product. If this product was considered in an analysis of maximizing the present value of statutory book profits per limited resource, using the investment earnings rate as the discount rate, the analysis might lead to issuing policies with a return on invested capital less than the cost to the company of that capital. This problem can be eliminated by including in the analysis only those products with a yield rate equal to or greater than the hurdle rate or by calculating all present values using a discount rate equal to the hurdle rate instead of the investment earnings rate. The author prefers the former method. If the investment earnings rate is used to calculate the GAAP reserve factors, the present value of book profits divided by the present value of premiums (using the investment earnings rate as the discount rate) will equal the before-tax GAAP profit margin if all other assumptions used in the generation of GAAP reserve factors are realized.

The hurdle rate for a particular company reflects the weighted average of the cost of equity and the after-tax cost of debt. The theoretical risk-return curve is reflected by this hurdle rate through the return demanded by individual investors on their money for investing in insurance companies with the associated risks. The theoretical risk-return curve is formulated by individual investors, and this is translated into an associated cost of equity and cost of debt. Thus, whether the insurance company can successfully issue policies with a yield rate or return on investment at least as great as its hurdle rate will determine whether or not it should remain in the insurance business. The company then can quantify its constraints and calculate the distribution of products (satisfying the minimum hurdle rate requirement) that will maximize the present value of book profits for policies issued in the period.

For a stand-alone stock life insurance company that raises capital only by issuing stock, the hurdle rate would be equal to the cost of equity. The cost or return on equity (ROE) is measured as follows:

$$\text{Return on equity (ROE)} = \frac{\text{After-tax GAAP income for year}}{\text{GAAP equity at start of year}}.$$

If the insurance company is a stock subsidiary of a parent involved in a noninsurance business such as retail sales, the hurdle rate that the insurance company must meet is dependent upon the parent company's philosophy. This hurdle rate may or may not differ from the rate that would be required if the company were a stand-alone company, for the following reasons:

1. The parent may borrow money (issue bonds) to capitalize the insurance company. This debt would be reflected on the parent's balance sheet, and the after-tax cost of the debt would be used in the calculation of the hurdle rate. The cost of debt should be the marginal cost of debt, particularly if the parent is currently borrowing money. The cost of debt should be the cost of the next dollar to be borrowed as opposed to the overall cost of debt currently on the parent's books. If this is not done, the hurdle rate could be set at a level below which the money used to finance the product was borrowed.
2. The parent may set an overall hurdle rate for all subsidiaries within the family of companies. This hurdle rate would be the weighted average of the after-tax cost of debt and the cost of equity for the entire conglomerate. It would not take into consideration the different levels of risk undertaken on investing in different companies within the conglomerate. This may be an academic consideration if the subsidiaries in the conglomerate all engage in similar businesses or if they all represent investments at near-equivalent risk levels.
3. The parent may set a hurdle rate for each subsidiary that represents a return commensurate with the level of risk undertaken with investment in that particular subsidiary. This situation would be similar to that of a stand-alone insurance company.

The philosophy of the parent company's management would determine how the hurdle rate would be determined.

Mathematical Methods

Once the constraints limiting a company's value have been identified and quantified, mathematical methods can be employed to calculate the distribution of business that would lead to a maximization of the present value of book profits for the business produced within a particular year. The Simplex method can be used to calculate this optimum distribution. Since this method is well documented,[1] this paper will not attempt to define the workings of the method but will illustrate a few examples of its potential use. The numbers and constraints used in these examples are purely illustrative.

In the first example it is assumed that a company that markets its products through the mail has thirty different products that it can offer. Each has a present value of profits per policy of $2, and each produces a return on investment (yield rate) greater than the company's hurdle rate. The company has done market research and financial analysis and has determined the following constraints:

Maximum number or acceptances per policy (market saturation): 200,000
Maximum allowable first-year surplus strain: $2,500,000
Maximum allowable first-year cash-flow drain: $302,794
Maximum allowable mailing volume: 2,000,000

Exhibit 1 illustrates the distribution of business (policy types indicated by asterisks) that will maximize the present value of book profits given the above constraints, and also illustrates the results produced when each policy is issued. For example, Exhibit 1 shows that 200,000 policies of type 10 would have to be issued to produce the maximum projected present value of profits possible given the various constraints and parameters. Issuing these policies would produce a projected present value of profits of $400,000 (200,000 × $2.00), a projected first-year cash-flow drain of $72,000 (200,000 × $0.36), and a projected first-year surplus strain of $834,000 (200,000 × $4.17). The maximum projected present value of profits possible given the various constraints and parameters is $1,699,690. This distribution of issues would produce a projected first-year cash-flow drain of $302,794 and a projected first-year surplus strain of $2,499,988.

Exhibit 2, illustrating the second example, shows the distribution of business (see asterisks) that will maximize the present value of book profits if the maximum cash-flow drain is increased from $302,794 to $500,000 while all other constraints remain unchanged. It is apparent that the maximum present value of book profits is different under these circumstances ($2,715,224 versus $1,699,690). In Exhibit 1, 849,845 policies were issued. The cash-flow constraint was the limiting constraint. In that example the policies with the highest ratios of present value of book profits to cash-flow drain were chosen. This does not have to be the case, since surplus strain is a "competing" constraint as illustrated in the second example. The policies with the highest ratios of present value of book profits to cash-flow drain did not produce the single distribution of business that produced the largest total present value of book profits, since surplus strain is also a limiting constraint. In this instance, the actuary must be concerned with both ratios (present value of book profits/surplus strain and present value of book profits/cash-flow drain) in the pricing of new products. In both examples, however, any other distribution of business that fell within the company's constraints would have produced a smaller present value of book profits.

EXHIBIT 1
OPTIMIZATION OF PROFITS (SIMPLEX METHOD)
(MAXIMUM PROFIT = $1,699,690)

Policy Type	Present Value of Profits per Policy	First Year		Maximum Number	Optimum Number	Percent of Maximum
		Cash-Flow Drain	Surplus Strain			
1.....	$2.00	$.40	$6.52	200,000.0	.0	.0%
2.....	2.00	.40	.05	200,000.0	.0	.0
3.....	2.00	.37	9.36	200,000.0	.0	.0
4.....	2.00	.45	2.76	200,000.0	.0	.0
5.....	2.00	.41	8.59	200,000.0	.0	.0
6.....	2.00	.38	2.79	200,000.0	.0	.0
7.....	2.00	.40	9.53	200,000.0	.0	.0
8.....	2.00	.42	5.07	200,000.0	.0	.0
9.....	2.00	.42	1.23	200,000.0	.0	.0
*10.....	2.00	.36	4.17	200,000.0	200,000.0	100.0
11.....	2.00	.41	7.03	200,000.0	.0	.0
12.....	2.00	.41	4.37	200,000.0	.0	.0
13.....	2.00	.42	1.08	200,000.0	.0	.0
14.....	2.00	.40	7.67	200,000.0	.0	.0
15.....	2.00	.41	1.00	200,000.0	.0	.0
16.....	2.00	.41	4.42	200,000.0	.0	.0
17.....	2.00	.40	3.45	200,000.0	.0	.0
18.....	2.00	.37	2.98	200,000.0	.0	.0
19.....	2.00	.40	7.58	200,000.0	.0	.0
20.....	2.00	.42	3.39	200,000.0	.0	.0
*21.....	2.00	.35	3.31	200,000.0	200,000.0	100.0
*22.....	2.00	.36	.56	200,000.0	200,000.0	100.0
23.....	2.00	.40	5.74	200,000.0	.0	.0
24.....	2.00	.38	4.86	200,000.0	.0	.0
*25.....	2.00	.35	2.03	200,000.0	200,000.0	100.0
26.....	2.00	.38	1.15	200,000.0	.0	.0
*27.....	2.00	.36	9.75	200,000.0	49,844.9	24.9
28.....	2.00	.39	8.65	200,000.0	.0	.0
29.....	2.00	.41	4.92	200,000.0	.0	.0
30.....	2.00	.41	3.68	200,000.0	.0	.0
Maximum.....	.....	$302,794	$2,500,000	2,000,000.0	.....	.....
Used.....	.....	$302,794	$2,499.988	849,844.9	.....	.....
% used.....	.....	100%	100.0%	42.5%	.....	.....

EXHIBIT 2
OPTIMIZATION OF PROFITS (SIMPLEX METHOD)
(MAXIMUM PROFIT = $2,715,224)

Policy Type	Present Value of Profits per Policy	First Year		Maximum Number	Optimum Number	Percent of Maximum
		Cash-Flow Drain	Surplus Strain			
1.....	$2.00	$.40	$6.52	200,000.0	.0	.0%
* 2.....	2.00	.40	.05	200,000.0	200,000.0	100.0
3.....	2.00	.37	9.36	200,000.0	.0	.0
4.....	2.00	.45	2.76	200,000.0	.0	.0
5.....	2.00	.41	8.59	200,000.0	.0	.0
* 6.....	2.00	.38	2.79	200,000.0	125,537.7	62.8
7.....	2.00	.40	9.53	200,000.0	.0	.0
8.....	2.00	.42	5.07	200,000.0	.0	.0
9.....	2.00	.42	1.23	200,000.0	.0	.0
*10.....	2.00	.36	4.17	200,000.0	32,074.3	16.0
11.....	2.00	.41	7.03	200,000.0	.0	.0
12.....	2.00	.41	4.37	200,000.0	.0	.0
13.....	2.00	.42	1.08	200,000.0	.0	.0
14.....	2.00	.40	7.67	200,000.0	.0	.0
15.....	2.00	.41	1.00	200,000.0	.0	.0
16.....	2.00	.41	4.42	200,000.0	.0	.0
17.....	2.00	.40	3.45	200,000.0	.0	.0
*18.....	2.00	.37	2.98	200,000.0	200,000.0	100.0
19.....	2.00	.40	7.58	200,000.0	.0	.0
20.....	2.00	.42	3.39	200,000.0	.0	.0
*21.....	2.00	.35	3.31	200,000.0	200,000.0	100.0
*22.....	2.00	.36	.56	200,000.0	200,000.0	100.0
23.....	2.00	.40	5.74	200,000.0	.0	.0
24.....	2.00	.38	4.86	200,000.0	.0	.0
*25.....	2.00	.35	2.03	200,000.0	200,000.0	100.0
*26.....	2.00	.38	1.15	200,000.0	200,000.0	100.0
27.....	2.00	.36	9.75	200,000.0	.0	.0
28.....	2.00	.39	8.65	200,000.0	.0	.0
29.....	2.00	.41	4.92	200,000.0	.0	.0
30.....	2.00	.41	3.68	200,000.0	.0	.0
Maximum.....	.....	$500,000	$2,500.000	2,000,000.0	.....	.....
Used.....	.....	$500,000	$2,500,000	1,357,612.0	.....	.....
% used.....	.....	100%	100.0%	67.9%	.....	.....

Conclusion

Assuming that a stock insurance company's primary objective is to maximize its current value, products should be priced so as to maximize the total present value of book profits. In order to accomplish this, the appropriate profit objective for the company must be determined. This objective should be to maximize the present value of book profits per unit of limiting constraint. The limiting constraint is the constraint that prohibits a company from issuing an unlimited number of policies within a particular period. This constraint can be determined by quantifying the company's constraints and using the Simplex method to determine the distribution of business that will maximize the total present value of book profits. The results of such an analysis will show the company's primary constraint and any other competing constraints. Any new products that are developed can be added to the population of products that may be offered by the company. The total present value of book profits will be larger with the addition of a product that is priced to maximize the present value of book profits per limiting constraint ratio.

Acknowledgment

The author would like to thank Regina McDermott and Faming Ju for helping to crystallize the thoughts presented in this paper.

Discussion of Preceding Paper

Harry Ploss

Mr. Bradley Smith is to be congratulated for writing a timely paper on an important subject. An organization should set a profit objective consistent with its resources and mission. Maximum long-term profits can be achieved only by optimally using the company's scarcest resources.

Mr. Smith's profit maximization model can easily be extended to include specified resources purchased from the marketplace when the company currently has insufficient resources. For example, the hurdle rate should exceed the cost of raising new surplus for a surplus-hungry company. Surplus can be increased by reinsurance, issuing new stock, issuing surplus notes, or other methods approved by the insurance department.

Administrative capacity can be purchased from service bureaus when they charge less than affordable maintenance-expense assumptions. This can be done either to improve efficiency or to expedite administration of profitable business that can be sold now. Many companies have thrived despite back-office problems because they took advantage of a very profitable marketing opportunity. Perhaps the scarcest resource for most companies is a profitable marketing opportunity.

Most companies find that each product has an optimal level of production. When production is too low, administrative expense ratios are too high and market demand is unsatisfied, Production can profitably expand. When production is too high for market demand, either inventories build or marketing cost (commissions, price discounts, advertising, etc.) rise to unprofitable levels. By the methods of calculus, the point of maximum profitability occurs when the marginal profitability of increased production is zero.

An agency force or mailing list becomes less profitable per marketing dollar as solicitation intensifies. The agent's motivation to make money decreases once he has met his needs. The list of prospects become less responsive upon more intense solicitation. This illustrates the law of diminishing returns. The profit, utility, and production functions are, nonlinear.

Mr. Smith's model of profit, a linear programming "simplex," can be expanded to include purchased resources at the market rate in addition to owned resources. Production and profit are often nonlinear functions of resources, and his theory also can be extended to optimally using marginal resources.

James P. Walsh

I enjoyed reading this paper and congratulate the author for his efforts. I would like to restate, in linear programming terminology, the problem presented in the section of the paper entitled "Profit Objectives Examined." The objective function for this problem is as follows: Profit = $200\ Q_A + 10\ Q_B$, where Q_t is the number of policies of type t issued. There are four constraints:

1. The first constraint is the total number of policies that may be issued: $Q_A + Q_B \leq 10{,}000$.
2. The second constraint is the statutory surplus constraint: $50\ Q_A + Q_B \leq 70{,}000{,}000$.
3. $Q_A \geq 0$.
4. $Q_B \geq 0$.

Each of the above constraints defines a region of possible Q_A and Q_B values. The intersection of these four regions constitutes the set of feasible solutions. The graph is shown in Figure 1. Since the number-of-policies constraint region is a subset of the statutory-surplus constraint region, the latter region is not constraining in this problem.

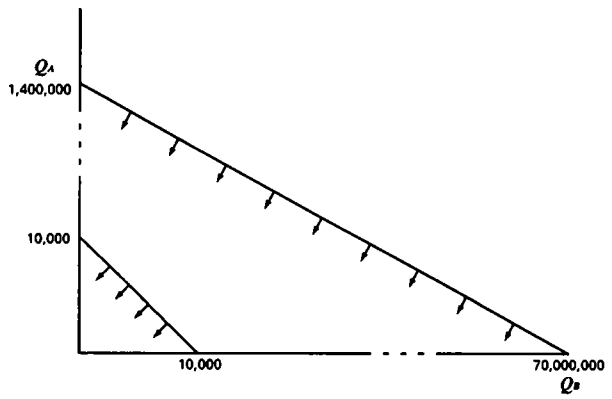

Figure 1

The objective function defines an infinite number of isoprofit lines. Some of these lines are shown in Figure 2. Each isoprofit line represents the combination of policy issues that yield a fixed amount of profits. For example, the isoprofit line that goes through the points (0, 25) and (500, 0) represents all possible combinations of Q_A and Q_B that yield a total profit of $5,000.

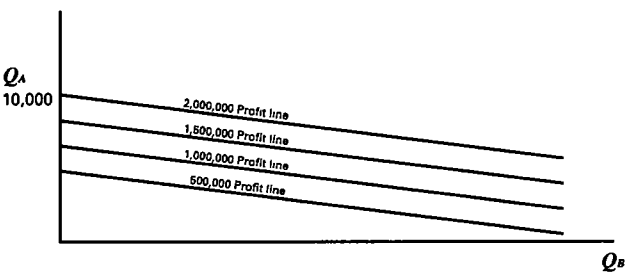

Figure 2

The problem now boils down to this: What point in the feasible solution region lies on the greatest isoprofit line? Comparing, the feasible region (Figure 1) with the set of isoprofit lines (Figure 2) shows that the point is (0, 10,000)—that is, when 10,000 policies of type A are issued. At this point the total profit is $2,000,000 ($200 × 10,000).

The graphic method can be used for a two-dimensional problem such as this one. The author shows how the simplex method may be used for higher dimensions in his paper.

Robert L. Collett

This paper is both interesting and important. As Mr. Smith notes, there has been too little discussion about what constitute reasonable profit objectives for insurance policies. The most important contribution of the paper is its attempt to relate profit objectives to constraints that the company faces. Mr. Smith is correct to seek the limiting constraints, and his identification and discussion of nontraditional limited resources is interesting and useful.

Given his identification of corporate return on equity as a very important objective, I was surprised at the lack of discussion about the relationship (which exists, at least in theory) between policy return on investment and the corporate return on equity or capital. He seems content to discuss a hurdle rate and concludes that it is necessary and sufficient for the policy return to exceed the hurdle rate. After that, he goes on to other profit criteria. I find the idea of trying to decide how profit objectives may be chosen without fuller consideration of this point to be insufficient.

It is difficult to talk about proper profit objectives without more extensive consideration of risk. The author does not acknowledge the need to evaluate the particular risks being assumed before an adjusted hurdle rate can be selected. These risks, which certainly will vary by product, ought to be important considerations in the choice of the proper profit objective.

After reading the paper, it was my overall conclusion that, despite its title, it really is not about choosing the proper profit objective. It is about optimizing sales among a mix of products having differing profit margins. It seems to be an article not principally about pricing but rather about marketing strategy.

Vincent J. Granier

The author's discussion of hurdle rates raises a critical issue that must be resolved before making a decision regarding the introduction of a new insurance product. This issue relates to the nature of risks inherent

in various potential products and, therefore, the returns commensurate with the undertaking of such risks. If risk levels and types of risks encountered in different products are similar (that is, introducing product B instead of product A will not affect the aggregate risk/return profile of the insurance company), the overall company cost-of-capital is an appropriate hurdle rate. However, if risk levels and types of risks vary significantly by product, use of a company cost-of-capital will lead to erroneous decisions with regard to investments in new products. Those products with lower risk levels may fail to clear the hurdle despite having expected returns commensurate with their risk levels. Products having extremely high risk levels will be judged favorably because their expected returns are greater than the hurdle rate; yet they may not be capable of earning a fair return based on risk levels.

The rapid emergence of new and different products in the industry suggests that studies of the levels and types of risks in various products should be undertaken to aid the decision-maker. The basic relationship between annuities and life insurance implies that different types of risks are contained in each. Given the dissimilarities in underlying mortality tables, the seller of annuities risks better-than-expected mortality experience, while the seller of life insurance risks the opposite. The risk of unfavorable rulings regarding the tax status of universal life or wraparound variable annuities is not present in other products. Therefore, risk levels may not be similar across all products.

Provisions that transfer risk to other parties outside the insurance company also affect risk levels of products. Products with front-end loadings or termination charges that protect the company from the costs of poor persistency may not be in the same risk category as products that do not have such provisions. Interest-rate-sensitive products and fixed-rate products deal with interest rate risk differently. If more of the risk of fluctuations is passed to the consumer, the company bears less risk. If these differences are significant, they will affect the cost-of-capital to be used when analyzing the merits of potential new products.

The process of choosing a product from a list of potential products using hurdle rates can be very complicated. Hard data are often scarce and qualitative information must be expressed quantitatively. A finance text-book can describe the details of using cost-of-capital to discount cash flows. The analysis ultimately rests on the accuracy of sales projections and the discovery of a proper "ideal capital structure" and risk profile from which to find the cost-of-capital.

Sales levels, having direct impact on the bottom line, are a key area of concern. Prognostication in this area is somewhat tenuous, yet efforts must be made to give best estimates.

Finding the ideal capital structure for an insurance product is a formidable task. A manufacturing concern can more easily uncover a company selling a product that is similar to its proposed new product. In the ideal situation, the "twin" company sells only the "twin" product. In this way, the twin's structure can be analyzed and adjusted toward the ideal.

In an insurance environment, it is nearly impossible to find a company whose sole product is a clone of the proposed product and is sold in amounts similar to those anticipated for the new product. Thus it is important to find a suitable measurement of risk for the product that can be used to develop the ideal capital structure. It is helpful to try to express risk in terms of beta from the capital asset pricing model.

Mullins feels that insurance companies have a beta around 1.3.[2] This represents the weighted average of all companies' risk profiles. A company's beta may deviate from this figure, depending upon its particular product portfolio. A company's beta represents the weighted-average risk profile based on the products that the company offers. Each product then carries with it a risk level that can be represented by a beta, which may or may not be similar to the company or industry beta.

The author recognizes that a life company subsidiary may have the hurdle rate dictated from the parent. The following will deal with the three situations presented in the paper (by number):

1. Using the marginal cost of debt as a hurdle rate can lead to distorted results, because the marginal cost of debt may or may not reflect the true risk of the project. Let us examine two conglomerates. Conglomerate A has very little debt, while Conglomerate B is high leveraged. The companies are alike in every other area. The marginal cost of debt for Conglomerate A will be lower than that of Conglomerate B (assuming efficient capital markets). If these Conglomerates' insurance subsidiaries are contemplating the release of similar new products, the possibility exists that Conglomerate A will make a decision to go ahead, based on its hurdle rate, while Conglomerate B will decide against the project. Conglomerate B's insurance company is being punished for the actions that led to Conglomerate B having a high level of debt. Unless the marginal cost of debt is entirely reliant on the specific project, it is not a proper hurdle rate.

This leads to a general rule of thumb. The financing decision should be separate from the go/no-go decision. An exception to this occurs when the financing would not be the same across all projects. For example, if investment in Project A were coupled with favorable financing due to a special situation and all other projects would not qualify for the favorable financing, it is proper to reflect the favorable situation in analyzing the alternative. Clearly, this situation does not occur in the conglomerate example above. Since the marginal cost of debt is the same for all projects, financing should not enter the decision. The project's unique risk characteristics should serve as the guide for determining the proper hurdle rate.

2. This alternative is analogous to using the life company cost-of-capital for individual projects, only on a larger scale. The author correctly identifies the possible shortcomings of this method, using the same approach that we have taken when analyzing the possible shortcomings of applying a company cost-of-capital to individual projects.
3. Again, the company cost-of-capital may be very appropriate for the company as a whole, but misleading when applied to individual products.

Donald R. Sondergeld

I found this paper quite interesting. I suspect that most life insurance companies are not efficiently using all of their free surplus. Companies that have more investment options than available surplus should find the techniques of the paper useful in selecting a strategy that will maximize the value of the company.

I do have a few questions and comments. First, should there be a family of hurdle rates that vary by the time period over which the investment is made, rather than a single hurdle rate? It seems to me there should be. Next, on the basis of the thoughts in Alastair G. Longley-Cook's paper on the return on shareholders' equity (also contained in this volume of the *Transactions),* it seems to me the minimum rate of return should be adjusted upward for the "variability" in the expected earnings or return. Finally, should not the objective be to maximize the market value of the company rather than its book value?

Let me expand on the latter question. Consider a one-year policy that has negative cash flow of $1,000 at the beginning of the year, and $1,150 positive cash flow at the end of the year. Assume there is no reserve requirement, surplus is earning 10 percent on a book basis, and there are no taxes. Assume further that the market value of bonds is 50 percent of book value at the beginning and end of the year. Under these conditions, a surplus of $2,000 is needed to generate the $1,000 of cash necessary to write the policy. Should the company issue the policy?

If the policy were not written, the $1,000 market value of this $2,000 of book surplus at the beginning of the year would increase to $1,200 by the end of the year. The market value would increase from $1,000 to $1,150 if the policy were written. On a market-value basis, 20 percent is better than 15 percent. Which alternative is to be preferred?

This general subject of the economic choices faced by managers making capital budgeting decisions is not new. I conclude my comments by listing a number of articles related to this subject.

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Claude Y. Paquin

It should be noted, that Mr. Smith's comments appear to be applicable to insurers that officially seek to make a profit, that is insurers owned by stockholders. Furthermore, though the paper purports to suggest how insurance products should be "priced" by actuaries, what it really seems to suggest is how insurers should go about selecting products to be offered or marketed.

The problems discussed in the paper are admittedly complex. The paper provides food for thought, but seems to do us a disservice by suggesting that the selection of proper profit objectives has not heretofore received the thoughtful attention of actuaries. (One might incidentally note the proscriptions of the Sherman Act and other federal antitrust laws, which may not be completely alleviated by the McCarran-Ferguson Act: these matters receive at least some attention in the Society of Actuaries examination syllabus. Surely, actuaries can appreciate the legal as well as the practical need for some degree of discretion with respect to pricing disclosures.)

If I could make but one point in my discussion of Mr. Smith's paper, it would be that there is more to setting profit objectives than actuarial mathematics.

Before I reach that point, though, I must record my disagreement with some of the author's statements. Mr. Smith states that "the reserve and the accounting method affect only the timing of recognition and not the ultimate level of earnings." I spent many pages in a previous paper (*TSA*, XXV, 459-84) demonstrating that (1) the reserve and the accounting method affect not only the *timing* but also the *amount* recognized as profit from a given source (such as a newly issued policy) and (2) the difference between the present value of (projected) GAAP earnings and the present value of (projected) statutory or book earnings is zero (*TSA*, XXV, 479, and 482). However, this difference is zero (or, as the author puts it, "academic") only when the discounting interest rate is the same as the investment earnings rate. When one switches to a "hurdle rate" in the discounting process, the difference may not be so academic, and the author's decision to attempt to maximize the present value of book profits becomes open to question. (Note also that the standards chosen for determining the statutory reserve will affect corporate income taxes, and thus net profits. Hence, statutory reserve standards do affect profits.)

Before examining profit objectives (expressed in mathematical terms), let us examine the nature of profit. In our society, profit is a reward for risk-taking as well as for providing a service. In providing what they provide, insurers generally have more "at risk" than the initial "surplus strain" upon which they seek to receive the traditional return on investment (ROI) or hurdle rate. (Sometimes too, some products or services entail no "surplus strain.") Hence their profit objectives should take more into account than the cost-of-capital. While the "limiting constraint" concept is an interesting one, it is too constraining. As everyone knows, maximum profits can be achieved, in the short run, by providing minimum salaries, substandard working conditions, and other deplorable practices such as the development of insurance products of dubious social utility. In the long run, responsible corporate behavior that takes into account humane (but nonquantifiable) values is more likely than mathematical methods alone to maximize the present value of profits.

I realize, of course, that quality (like so many other things) is difficult to quantify. Actuaries generally consider profit objectives as factors in pricing insurance products. In my own actuarial practice, I have advocated the principled use of risk charges and service charges (over and above the expected claim cost or service cost) for what the insurer provides. (See, for example, "Current Concepts of Product Development," *Best's Review*, October 1969.) I have felt that selling agents often provide sound advice and motivation, intangibles for which they deserve compensation (by commissions, fees, or both); but note that the insurer that may have provided advanced underwriting services through the preparation and dissemination of educational materials may deserve compensation (for that service) along with the agent. Much of this is difficult to quantify at all, let alone with precision. One must, however, realize that insurers sell more than a product: they often sell a large measure of education (as well as security and investment-management services).

It is not improper, in my view, to translate the overall financial results of an insurer into a return on equity (ROE), but, like many things in life, that resulting figure must be taken with a grain of salt (and viewed long-term). It would be dangerous, in any event, to try to build ROI's and ROE's unthinkingly into the pricing of disparate "products" that include different elements of risk and of service. It should be noted, too, that insurers do not always "sell" what they want to sell: the public

"buys" what it wants to buy, and the insurance-buying public is wisely not always motivated to buy what comes at the lowest price.

One must never forget to look beyond the "mathematics" of the situation. That is true with choosing a proper profit objective too.

(Author's Review Of Discussion)

Bradley M. Smith

The stated purpose of this paper was to initiate discussion on the choice of an appropriate profit objective given a particular company's available resources. I am encouraged by the written response this paper has received and would like to thank each of the individuals who contributed a written discussion. Additionally, I have discussed this paper orally with many individuals who for various reasons did not submit their comments in writing. I also would like to thank these individuals and encourage more discussion on this topic, as neither the paper nor the discussions following it represent the final word on this topic. Only through continued discussion and openness can we, as a group of professionals, develop a theoretically sound and defensible, yet practical, approach to defining both the form and the level of the profit objectives used to develop the products we offer.

Mr. Harry Ploss points out that seemingly limiting resources may be purchased in the marketplace at a cost that is within the assumptions used in the product development process. In such a case, the resource would no longer be considered to be a limiting resource. I agree with his comment that the scarcest resource for many companies may be a profitable marketing opportunity. However, if this is the only limiting constraint felt by the company, it would certainly undertake every marketing opportunity with a positive present value of profits in order to maximize its current value.

Mr. James P. Walsh uses the graphic method to solve the two-dimensional example stated in the paper. His illustration illuminates what takes place when solving a problem of higher dimensions (such as the one presented later in the paper) using the simplex method.

Mr. Robert L. Collett points out the paper's lack of discussion about the relationship that exists between policy return on investment and the corporate return on equity. The unstated assumption (mistakenly so) in the paper is that there should not be a great imbalance in the amount of resources available within a particular company. In other words, the production level should not be at a level that is dictated by just one resource. The resources of a well-managed company will all point to a general level of production that will drain each of these resources to their appropriate limit. Excess resource that does not yield marginal production is of little use to a company. If this theory is practiced in determining the amount of equity held by a company (as opposed to being returned to its stockholders through dividend distributions), the production generated by the other resources within a company will be such that most of the stockholders' equity will be used to finance the production of new business. If this is the case, the return on equity should approach the underlying return on investment produced by issuing insurance policies.

Mr. Collett's comment concerning the difference between choosing the proper profit objective and optimizing sales among a mix of products having different profit margins points out the need for a bridge between the pricing of a new product and the marketing strategy to be employed when offering that product. It seems that this is one topic rather than two separate and distinct topics. If offering a new product does not increase the current value of the company (defined in the paper as the present value of future company book profits), it should not be developed by the company. This is particularly important in light of the comment by Mr. Ploss concerning the scarcest resource for many companies being a profitable marketing opportunity.

Mr. Vincent J. Granieri correctly points out, as does Mr. Collett, the flaws of using a hurdle rate for a particular product that does not reflect the particular risk characteristics of that product as opposed to the particular risk characteristics of a parent company, a subsidiary, or a stand-alone company as a whole. Once a company has embarked on a particular marketing strategy and has made this strategy public, the marketplace will set the hurdle rate implicitly, by demanding a certain return on equity for the enterprise as well as by requiring a certain return on money borrowed by the company. However, this process may be slow (implying an inefficient marketplace), and, as both Mr. Granieri and Mr. Collett imply, the actuary must attempt to reflect any risk differential brought about when embarking on a new marketing strategy or when simply releasing a newly developed product. This seems to be a

different, although certainly related, topic, which the paper did not presume to address.

Mr. Granieri briefly discusses the quantification of risks of different products by use of a beta coefficient. The development of such a coefficient would be of interest to me and would certainly go a long way toward reflecting different risk levels inherent in different products in the pricing and product development process.

Mr. Granieri gives "a general rule of thumb," which states that the financing decision should be separate from the go/no-go decision. He points out that one insurance subsidiary of a highly leveraged conglomerate may decide not to release a particular product or line of products (embark on a marketing strategy) similar to those offered by a subsidiary of a less leveraged conglomerate. Presumably the highly leveraged conglomerate would have a higher hurdle rate due to its increased marginal cost of debt. I agree that the insurance company subsidiary is being punished for the actions that led to the conglomerate having a higher level of debt. However, whether this punishment is justified or not is related to the increased risk undertaken by the subsidiary of the highly leveraged conglomerate when offering this new line of products because of the increased debt level of its parent. Certainly the risk undertaken when offering a particular product may not be independent of the capital structure of the company offering that product.

Mr. Donald R. Sondergeld asks "whether there should be a family of hurdle rates that vary by the time period over which the investment is made, rather than a single hurdle rate." He suggests that there should be, and I agree. The marginal cost of debt, which is used to determine the hurdle rate, would be different depending on the length of the financing arrangement. It also seems that the return on equity demanded by the stockholders or potential investors in the company would follow the yield curve, and therefore, the length of the investment would affect the calculated hurdle rate.

Mr. Sondergeld also reiterates the comment made by others, with which I agree, that the hurdle rate should be adjusted within a particular company for the "variability" of a product's expected earnings or return. In other words, the hurdle rate for a particular product should be adjusted (upward or downward) for the difference in risk that offering the product represents versus the overall risk of the otherwise continuing operations of the company.

Mr. Sondergeld presents us with a question and an example to help clarify the question. The question is, "should not the objective be to maximize the market value of the company, rather than its book value?" The problem is summarized in the chart below:

Action	Valuation	Beginning of Year (Investment)	End of Year (Return)	Percent Return
Keep bonds	Market	$1,000	$1,200	20%
	Book	2,000	2,200	10
Sell insurance	Market	1,000	1,150	15
	Book	2,000	1,150	Negative

In this example it appears obvious that the company would not sell insurance (which yields a 15 percent market return and a negative book return) but would keep the bonds (which yields a 20 percent market return and a 10 percent book return). In this example there is no need to address the question of which valuation basis we should use to make the decision; both give the same answer, keep the bonds.

If the example is changed slightly, so that the bonds return 5 percent on a book basis the chart changes as follows:

Action	Valuation	Beginning of Year (Investment)	End of Year (Return)	Percent Return
Keep bonds	Market	$1,000	$1,100	10%
	Book	2,000	2,100	5
Sell insurance	Market	1,000	1,150	15
	Book	2,000	1,150	Negative

This example presents a conflict over which valuation basis to use. If we decide to maximize book value, we would decide to keep the bonds (a 5 percent return being greater than a negative return). If we decide to maximize market value, we would decide to sell insurance (a 15 percent return being greater than a 10 percent return).

To answer the question originally asked, I believe the objective should be to maximize market value rather than book value of the company. In the above example, the company would choose to sell insurance instead of keeping the bonds. To do otherwise is to have decisions based on accounting rules rather than fundamental business principles. At the end of the year you could presumably buy back the bonds; although the valuation basis would obviously be different, the amount of real

assets owned would be greater. Critics of using the market valuation basis rather than the book valuation basis for measuring profitability would point out the danger of significant statutory surplus drain. However, the problem with holding assets on the balance sheet in excess of their current market value is one of accounting for profitability (or unprofitability), and this is not a sound basis upon which to base fundamental business decisions in most cases.

In a separate discussion with Mr. Sondergeld, we realized a current terminology problem plaguing our profession. Although it is not directly related to this paper or its discussion, I would like to define what I feel to be the difference between profit (or book profit) on a block of business (which emerges as a level percentage of premium on a GAAP basis if experience is as was assumed in the development of the GAAP reserve factors) and earnings (or net gain from operations) on a block of business (which does not emerge as a level percentage of premium on a GAAP basis). Earnings (or net gain from operations, denoted by *NGO)* on a block of business is the arithmetic difference between the surplus (denoted by *S*) generated from the block of business at the end of the year and the surplus generated from the block of business at the beginning of the year:

$$NGO_t = S_t - S_{t-1}.$$

Profit (or book profit, *BP)* on a block of business is the difference between the surplus generated from the block of business at the end of the year and the surplus generated from the block of business at the beginning of the year accumulated at the investment earnings rate to the end of the year:

$$BP_t = S_t - S_{t-1}(1 + i_t).$$

The difference between earnings and profit is therefore interest on the prior year's surplus generated from the block of business:

$$NGO_t - BP_t = S_t - S_{t-1} - [S_t - S_{t-1}(1 + i_t)] = i_t S_{t-1}.$$

Claude Y. Paquin states the paper "seems to do us a disservice by suggesting that the selection of proper profit objectives has not heretofore received the thoughtful attention of actuaries." On the contrary, I feel and the paper states that there has been "a lack of discussion within the actuarial profession as to what a reasonable profit objective is." Our ability and willingness to focus our combined intellect on a problem has rarely, if ever, been questioned. However, our ability and willingness to communicate our thoughts and conclusions to outsiders has been questioned in the past.

As stated previously in this discussion, the selection of products to be offered or marketed to the public seems to me to be more a part of the pricing process than a separate and distinct topic. Possibly the phrase "how to price products that are to be offered or marketed to the public" is appropriate.

Mr. Paquin felt the need to record his disagreement with some of the statements in the paper. However, I found no area where technical disagreement was necessary, since the use of the investment earnings rate as the discount rate when comparing the present value of future GAAP earnings to the present value of future statutory earnings was stated. Additionally, it was apparent that this paper dealt with figures before federal income tax, and I readily recognize that "the standards chosen for determining the statutory reserve will affect corporate income taxes." Additionally, the statutory reserve basis chosen will affect the pre-tax return on investment earned on the product.

Mr. Paquin states, "Hence their [an insurance company's] profit objectives should take more into account than the cost-of-capital." I agree wholeheartedly. In fact, I believe this is the whole point of the paper. Limiting resources, other than capital, must be considered in the product-development/marketing-strategy decision. He continues, "As everyone knows, maximum profits can be achieved, in the short run, by providing minimum salaries, substandard working conditions, and other deplorable practices such as the development of insurance products of dubious social utility." The paper never addresses the maximization of profits in the short run, and in fact the method stated in the paper will maximize long-run and not necessarily short-run profits on a GAAP and statutory accounting basis. Mr. Paquin goes on to say "that insurers do not always sell what they want to sell: the public buys what it wants to buy." If this is in fact the situation, I fail to see how under GAAP accounting, which purports to reward the selling company for producing more profitable business, short-run GAAP profits can be maximized by developing "insurance products of dubious social utility," which presumably the public would not want nor buy.

Mr. Paquin states, "In the long run, responsible corporate behavior that takes into account humane (but nonquantifiable) value is more likely than mathematical methods alone to maximize the present value of profits." Although I do not agree that "humane" and

"nonquantifiable" are synonymous, the purpose of the paper was not to support irresponsible corporate behavior that "unthinkingly" uses mathematical methods in its product development/marketing process. If the paper comes across as such, my apologies are offered. Certainly, if the history of business has taught us anything, it is that the long-term continued success of any enterprise requires it to address its social responsibility when setting its corporate strategy.

In conclusion, I would like to reiterate my thanks to those who took the time to reply in writing. I hope that their comments along with my reply will stimulate further discussion on this topic.

End Notes

1. Stephen G. Kellison, *Fundamentals of Numerical Analysis* (Homewood, Ill.: Richard D. Irwin Inc., 1975), pp. 335-45.
2. David W. Mullins, Jr., "Does the Capital Asset Pricing Model Work?" in *Financial Management,* by Dwight B. Crane, ed. (New York: John Wiley & Sons, 1983).