

Varying ROE by Profit Center

Joseph H. Tan

In a recent Society of Actuaries' regional meeting, there was a discussion on an age-old actuarial problem. Within the same company, should the return on equity (ROE) target vary by profit center depending upon the risk of the profit center? For example, should company management demand a different ROE from the Group Health line than from the Ordinary Life line?

In various actuarial literature and discussions, several arguments for not varying the ROE target by profit center have been presented. The major ones are:

1. If the allocated required surplus of the profit center already reflects its associated risk, and such required surplus is a part of the basis for the profit center's net investment income allocation and is included in the denominator of the ROE formula, the profit center's ROE calculation implicitly reflects the risk of the profit center. In this case, there is no need to require higher ROE from the riskier profit center because requiring higher ROE would result in double counting. A uniform ROE target should therefore be used for all profit centers, if required surplus is included in the ROE formula.
2. Practical difficulties exist in determining the appropriate ROE target for each profit center. Establishing a uniform requirement seems practical since it avoids arguments from the various profit center managers regarding the appropriateness of the various ROE targets.

The author believes that the ROE requirement should vary by profit center and this article concentrates on providing counter arguments against the first point above.

Regarding the second point, while it is true that practical difficulties exist in determining the appropriate ROE targets for the various profit centers, they should not hinder management from exercising effective control and sound judgement. If management expects a higher return from an equity investment versus a bond holding due to equity's riskier nature, why should management not demand a higher ROE from a riskier profit center? Clearly, no indisputable technique exists for determining the various ROE targets. Assumptions, estimation, and sound judgement will be involved in establishing the various ROE standards. But such is also the case for various other management decisions; that is, assumptions, estimation, and sound judgement are used to arrive at some workable procedures or standards. For instance, assumptions, estimation, and sound judgment are used in: (1) Determining the required surplus for each profit center, (2) Allocating overhead, other fixed expenses, and taxes

to each profit center, and (3) Allocating the various assets and liabilities not directly associated with a profit center (e.g., home office building, tax and expense payable). For each, a perfect solution may not exist and yet practical, sound, and equitable procedures are applied.

Most actuaries would agree that return should be commensurate with risk and higher return should be expected from a riskier profit center. What is confusing is that if required surplus already reflects risk and is incorporated in the ROE formula, should the ROE target still vary by profit center?

Arguments Against Uniform ROE Despite the Existence of Required Surplus

In this section, we present arguments to show that ROE target should still vary by profit center, even if the profit center's required surplus reflects risk and is included in the profit center's ROE calculation. To simplify our discussion, we assume that each profit center sells only one product and will use the terms *profit center* and *product* interchangeably. Also, the following acronyms will be used:

TI stands for Total Investment. This is the company's total investment in a profit center, which includes the required surplus needed to support the profit center.

IERS stands for Investment Excluding Required Surplus, and equals TI minus required surplus.

The basic argument for uniform ROE across all profit centers is that required surplus already covers the profit center's risk, and thereby results in the same risk on the total investment for each profit center. That is, the larger required surplus of the riskier profit center reduces its risk, thereby making the risk of TI the same for all products.

The author disagrees with the above argument and will argue that it is unlikely that the risks of the resulting TI's of the various profit centers are the same.

Situation Without Required Surplus

To aid in the explanation, let us consider a simple example involving the Corporate area wanting to sell two one-year products. In real life, situations are more complicated but the arguments are essentially the same. Product B is considered riskier (i.e., more potential for income fluctuation and losses) than Product A. Without any required surplus provision, Corporate determines that it is reasonable to expect an average 15% return on IERS from Product B, versus 10% from Product A. For instance, a \$100 IERS on both Products A and B should *payback*, on the average, \$115 for Product B and \$110 for Product A, at the end of the year. The term *payback* will be used

to refer to the total amount received at the end of the year which equals the original principal plus the return on the principal. The \$5 average additional payback for Product B is deemed by Corporate to be an appropriate reward for Product B's riskier nature. Figure 1 shows the probability density function of payback for Product A and Product B. Note that we do not require that the R be normally distributed.

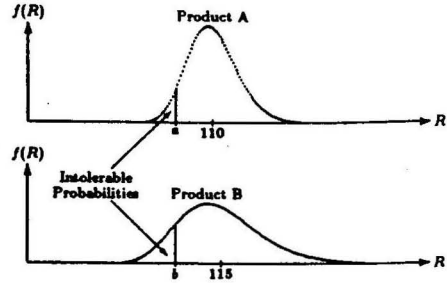


Figure 1: Probability Distribution of Payback on IERS

Since Product B is riskier and has more uncertain results, the spread of $f(R)$ is wider, and the probability of obtaining a loss and the magnitude of such a loss is greater as compared to product A. However, since Product B returns higher on the average, Corporate views the returns of the two products as equivalent. That is, the additional \$5 is deemed to be an appropriate reward for the extra risk of Product B.

Also shown in Figure 1 are points a and b . These are the minimum payback amounts that management will tolerate. The values of a and b can be equal or different. They can be negative, zero, or some positive numbers less than \$110 or \$115. Reasons for not tolerating values below a and b may include:

- Statutory insolvency,
- Apparent company insolvency or weakness in the public eyes, and
- The manager of the Corporate area may lose his job.

Whatever the reason, the manager of the Corporate area (or top management) determines that values below points a and b are intolerable and requires that before the products are sold, additional assets be set aside to guard against such intolerable occurrences. We will refer to such additional assets as required surplus, even though required surplus is often used to refer to assets set up for insolvency concerns only.

As seen in Figure 1, the probability of having intolerable values (i.e., the area under the probability curve with values less than a and b , respectively) is greater for Product B than Product A. This is due to the riskier nature of Product B.

Situation With Required Surplus

Assume Corporate determines that required surplus of \$10 is needed for Product B and \$5 for Product A. Also assume Corporate decides to invest required surplus in a risk-free investment earning a 5% after-tax yield. Figure 2 depicts the paybacks resulting from a total investment of \$110 in Product B and \$105 in Product A.

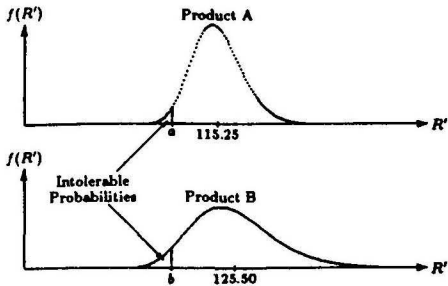


Figure 2: Probability Distribution of Payback on TI

Since required surplus is invested in a risk-free investment, the shape of the probability curve of R' , the payback for TI, is the same as that of R , the payback from IERS. The curves merely shift to the right by \$5.25 (5×1.05) for Product A and \$10.50 (10×1.05) for Product B because claim and persistency experience, actual expenses, and the investment experience of the product's IERS are not affected by the setting aside of assets equal to required surplus. For instance, it is just as likely for 200 policyholders to die with or without required surplus. That is, the occurrence of a product's C-1, C-2, and C-3 risks are not affected by its required surplus.

In reality, if required surplus is not invested in a risk-free investment, the shape of the probability curve of TI payback will change somewhat. Also, the C-1 and C-3 risks of TI will be somewhat different from those of IERS. However, those differences are quite immaterial unless required surplus is extremely large as compared to IERS.

Looking at Figure 2, we see that the probabilities of having intolerable values less than a and b , respectively, have been substantially reduced. Corporate is now comfortable with the magnitudes of such probabilities.

Table 1 summarizes the average rates of return of the

two products. Without required surplus, Corporate views

Table 1: Average Rates of Return

Item	Product A	Product B
IERS	\$100	\$100
Average Return on IERS	10%	15%
Risk Index of IERS*	2	3
Required Surplus	\$5	\$10
Composite Yield on TI	9.8%	14.1%

*This represents a relative measure of risk for the product. We assign a risk index of 1 for required surplus.

the average differential of 5% as appropriate. Based on our example, 4.3% ($14.1\% - 9.8\%$) should be the appropriate average return differential for TI. However, it can be argued that an appropriate average return differential for TI should be somewhat less than 4.3%. In reality, required surplus is often not invested in risk-free assets, thereby making the C-1 and C-3 risks of TI somewhat different than those of IERS. This will have a greater effect on Product B than A due to the larger required surplus of Product B. But, as argued earlier, the magnitude of such an effect should not be material unless the required surplus is extremely large compared to IERS. Hence, the appropriate average return differential for TI should be around 4% to 4.2%, but not 0%.

Based on our analysis, under what circumstances is it appropriate for Corporate to demand a uniform rate of return on TI for Products A and B? These circumstances, with corresponding counter arguments, are:

1. Corporate views it appropriate to demand the same return on IERS from both products.

This can be discarded because we started with the premise that various products have different risks that require varying returns on IERS.

2. The magnitude of required surplus is large enough to reshape the probability function so that the resulting functions are the same for various products.

As argued earlier, the possibility of having required surplus of such magnitude is remote. Also, even if unusual reshaping of the probability function did take place, it would only be by coincidence that the resulting distributions would be identical. Hence, Corporate should generally demand ROE on TI to differ by product.

3. Required surplus works in such a way that the left hand tail of the probability distribution is shortened. Examples of such distributions for Product B are shown in Figure 3 and Figure 4.

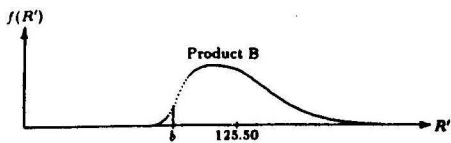


Figure 3: Probability Distribution of Payback on TI

In Figure 3, the left hand tail of the probability curve is reshaped so that the probability of intolerable values occurring is small enough to be deemed acceptable by Corporate. However, such a situation is not likely to occur by merely setting up required surplus. Instead, it could occur if:

- The product is redesigned to reduce risk,
- The guarantees offered by the product are reduced,
- Investment strategy is changed to reduce risk,
- Risk is reduced by actions taken by management based on strategic or financial planning.

In Figure 4, the probability of having intolerable values is eliminated. However, the distribution shown

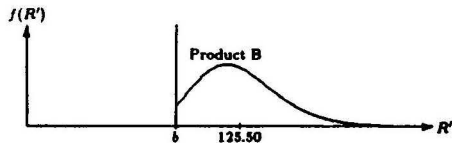


Figure 4: Probability Distribution of Payback on TI

in Figure 4 will not result by merely setting up required surplus, since that will only shift the distribution to the right. This distribution could occur if government (or some independent third party) agrees to pay losses below point b , and hence, assures Corporate that intolerable values will not occur. Under such an arrangement, it is conceivable that Corporate will not demand an additional return from a riskier product. That is, from Corporate's viewpoint, the risks of the two products have effectively been reduced (and maybe made equal) by the government guarantee. Note that this is quite different from merely setting up required surplus. Under the latter, Corporate still has to pay for losses below b .

In summary, we have argued that if Corporate believes that it is appropriate to demand a higher return on IERS

from a riskier profit center, then demanding uniform ROE on TI is generally inappropriate.

Further Research

Having argued for varying ROE by profit center depending on risk, the next question then is "what are the appropriate ROE's on TI for the various profit centers?"

If we know the appropriate ROE's on IERS for the various products, then the appropriate ROE's on TI of the various products can easily be determined. The ROE on TI is simply the weighted return on IERS and required surplus if we assume required surplus is risk-free. In reality, required surplus is not entirely risk-free and hence the weighted return should be adjusted somewhat. The amount of the adjustment would depend on the degree of risk and magnitude of IERS and required surplus.

What are the appropriate ROE on IERS for the various products? This is a difficult question requiring more lengthy discussion and further research. The procedure for deriving the appropriate ROE on IERS could include:

- Evaluating the actual performance of the various profit centers in the past,
- Using a similar set of assumptions as was used in deriving the required surplus of the various profit centers, and
- Factoring in management's assessment of the profit center's risk, because risk evaluation is subjective and risk tolerance is management's decision.

Maybe some readers can contribute various ideas in this area.

Summary

This article presents arguments for varying the return on equity target by profit center depending on risk. It concludes that even with the presence of required surplus (which reflects risk) in the ROE formula, the ROE target should still vary by profit center. A direct extension of this conclusion is that the pricing internal rate of return target should vary by product depending on the product's riskiness.

It is hoped that this article will encourage further discussion and research in the area of appropriate ROE expectations for the various product lines. The determination of appropriate ROE targets is an important requirement for effectively managing an insurance company.