Milliman Research Report

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Milliman

# Universal life insurance with secondary guarantees:

## Pricing and financial reporting considerations

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## INTRODUCTION

In 2007, the research report *Secondary Guarantee Universal Life: Practical Considerations* was published, discussing product risks, pricing considerations, risk management, and reserve financing solutions. Since that time the universal life secondary guarantee (ULSG) insurance market has continued to grow and evolve. As the market has matured, additional ULSG-related topics are worth exploring to extend discussion of the ULSG product. This report covers topics including the relationship of internal rate of return (IRR) to return on equity (ROE), the American Institute of Certified Public Accountants (AICPA) Statement of Position (SOP) 03-1, stochastic projections, sources of profit, cost of the secondary guarantee, and C3 Phase III.

The Life Actuarial Task Force (LATF) of the National Association of Insurance Commissioners has recently exposed for comment a statement regarding the calculation of statutory reserves under Actuarial Guideline XXXVIII (AG38). We do not intend to speculate on any further action by LATF regarding AG38 as it was not a focus of this report. However, we have been involved in a considerable amount of consulting work regarding AG38 issues and will continue to follow industry developments. If necessary, we will update this research report in the future.

## EXECUTIVE SUMMARY

Universal life products with long-term secondary guarantees have been sold since the late 1990s. This report explores several aspects of ULSG products from a pricing and financial reporting perspective.

A common question in pricing is why the GAAP ROE is not equal to the statutory IRR. This relationship has been explored in previous work by Smith,[1] Beal,[2] and Stuenkel.[3] In the first section we look at the relationship between the IRR and ROE starting with a universal life (UL) product example in which they are nearly equal before making a series of assumption and product changes to get to a ULSG design. Similar to the term product findings in Stuenkel, we were able to define unrealistic constructs where IRR and year-by-year ROE are very similar. As those constructs are changed to include more realistic assumptions, however, yearly ROEs are less level, although point statistic ROEs remain similar to IRRs.

In practice there is not a singular approach for calculating the SOP 03-1 liability, and in the second section we analyze various definitions of excess benefits and the impact of a stochastic versus a deterministic calculation. We found that the excess benefit definition should be tailored to the product design and that the results of a stochastic calculation may not always be that different from those of a deterministic one.

In the third section we applied a set of stochastic scenarios to our sample ULSG products. We observed that, even with a fair mix of up and down scenarios, results can be negatively skewed if the products are very sensitive to interest rate volatility. On a GAAP basis, it is cumbersome to review the typical ROE data from the stochastic output, so it may be more effective to use point statistic ROEs or develop alternative ways to review results.

With more companies looking at results on an embedded value basis, an important issue is how to determine the cost of a secondary guarantee feature. We looked at the question using sources of profit analysis to compare sample products with and without a secondary guarantee.

**With more companies looking at results on an embedded value basis, an important issue is how to determine the cost of a secondary guarantee feature.**

Finally, we projected the capital requirements under the potential revisions to the risk-based capital (RBC) framework under C3 Phase III. On a pricing cell level, the outcome may not look favorable depending on the product design. However, with an aggregate level calculation we believe that the capital requirement will be more sustainable. The challenge for pricing actuaries will be how to allocate the capital cost fairly among pricing cells.

1 Brad Smith (Transactions of the Society of Actuaries, Vol. 39, pgs. 257-293)
2 Bob Beal (North American Actuarial Journal, Vol. 4, pgs. 1-11)
3 Wayne Stuenkel (The Financial Reporter, Sept. 2002)

## PRODUCT DESIGNS

Universal life (UL) products have offered long-term secondary guarantees since the late 1990s. The first versions appeared, at least partially, in response to the vanishing premium issues that plagued UL products issued in the high-interest eras of the 1980s and 1990s. For any marketing concerns arising from how well illustrated values would be met in the future, a way to ease consumer and agent uncertainty about UL was to offer a guarantee that the product would not lapse regardless of the performance of the underlying cash surrender value.

Early versions of secondary guarantees were layered onto UL products created to accumulate cash surrender value. Over time, as premium competitiveness has increased, insurers have whittled down the account value growth in the most competitive secondary guarantee products, making them less like UL products and more like long-duration term products.

Many of the first secondary guarantees appearing in the U.S. market were referred to as specified premium designs. These guarantees kept policies in force as long as the accumulated premiums paid to date (sometimes including an interest rate) were at least as great as an underlying guarantee premium accumulated to the same point in time.

As popularity of secondary guarantees increased, so did the desire to offer increased flexibility to policyholders with respect to funding the guarantee. One means for permitting this flexibility is to offer a shadow account design. Shadow accounts are calculated values inside UL contracts that serve as a benchmark for the secondary guarantee. The shadow fund increases and decreases in much the same way as the actual policyholder account value, but often the shadow fund has a separate set of interest rates and charges from those used in the actual account value. As long as the shadow fund is positive, the secondary guarantee is considered to be in force. Shadow fund balances do not represent funds available to the policyholder but simply provide a measure for determining whether the insurance provided by the policy is in force.

The first shadow fund products had a relatively simple design, i.e., without any division of the shadow fund into sub-funds or buckets. Over time, shadow fund products have evolved to include variations with two, three, or even four buckets. The mechanics of how a premium gets into a given bucket varies by product. Sometimes premiums fund certain buckets based on the policy year in which they are paid; sometimes premiums fund buckets based on exceeding certain defined premium thresholds.

**Over the last 15 years, the ingenuity of product actuaries has led the market to a place where a wide variety of product designs are currently in force.**

Over the last 15 years, the ingenuity of product actuaries has led the market to a place where a wide variety of product designs are currently in force. These include level specified premium (simple sum of premiums), level specified premium with interest (premiums summed with interest), non-level specified premium (annual renewable term [ART] design) with and without an interest rate, single bucket shadow funds, and multiple bucket shadow funds.

Additionally, secondary guarantees are not limited to guarantees for life. A variety of products have been offered that permit policyholders to customize the length of the guarantee to a certain number of years or attained age. Most recently, companies have started competing in the term marketplace with secondary guarantee UL products.

# COMPARISON OF GAAP ROE TO STATUTORY IRR

## FINANCIAL REPORTING BASICS FOR UL AND ULSG

In this section and throughout the report we describe our analysis of a variety of hypothetical UL and ULSG products. The analysis was done in a financial reporting construct in accord with our interpretation and experience with U.S. GAAP and statutory accounting principles. Our application of these principles represents one of the possible approaches or interpretations.

**The analysis was done in a financial reporting construct in accord with our interpretation and experience with U.S. GAAP and statutory accounting principles. Our application of these principles represents one of the possible approaches or interpretations.**

On a statutory basis, the reserves for UL and ULSG products are calculated according to the UL model regulation and Actuarial Guideline XXXVIII. As part of our analysis of ROE and IRR, we used certain simplifications by setting reserves equal to account value and equal to the average of account value and cash value. Our analysis also includes statutory target surplus at levels intended to produce risk-based capital (RBC) ratios that are representative for the industry.

On a GAAP basis, UL and ULSG products are subject to FAS97 and SOP 03-1. Three components of FAS97 reporting included in our analysis are the benefit reserve, deferred acquisition costs (DAC), and unearned revenue liability (URL). For UL and ULSG products the GAAP benefit reserve is the policyholder balance or account value. In the common circumstance of significant first-year acquisition expenses, costs can be deferred and amortized with the establishment of a DAC asset. Similarly, when a policy has early duration expense loads greater than the ultimate load, they are required to be deferred by establishing an unearned revenue liability.

The other component of GAAP financial reporting in our analysis is an SOP 03-1 liability, which is established as a reserve in the case of early-year profits followed by losses. We have found that there are a variety of definitions used when calculating SOP 03-1 and we will discuss them in a later section. For the task of comparing IRR with ROE in this section, we have defined excess benefits as death benefit payments when a policy is held in force by a secondary guarantee and the account value used to determine cash surrender benefit is zero or negative. We have defined assessments as cost of insurance (COI), load, and surrender charge revenue plus the interest spread on account value.

## PROFIT MEASURES

Throughout the report we utilize two profit measures commonly applied to insurance products—internal rate of return and return on equity. The internal rate of return (IRR) is the interest rate at which the sum of the discounted future stream of profits is equal to zero. IRR provides a single statistic with which to evaluate the product, often by comparing it to a benchmark return. In our experience, an IRR is calculated for analysis of statutory pre-tax profits, post-tax profits, or distributable earnings. For this report we have determined IRR based on statutory distributable earnings (post-tax profits, after provision for required capital).

**IRR provides a single statistic with which to evaluate the product, often by comparing it to a benchmark return.**

The return on equity (ROE) is calculated as the after-tax GAAP profit in a period divided by an equity base. In common practice and for our analysis this measure is calculated on a U.S. GAAP basis. We used a beginning-of-year equity base calculated as total statutory assets less the net GAAP reserve including the provision for deferred taxes. While IRR is a point statistic, the basic ROE calculations yield an array of values. The stream of ROE values can be used to analyze the profitability over time or can be summarized into a single statistic using a range of methods. We examined the overall pattern of ROEs as well as two different point statistic ROEs. The first was an ROE statistic calculated as the sum of profits divided by the sum of the equity bases. The second was a weighted average ROE calculated as the present value of profits divided by the present value of the equity bases. The discount rate used to calculate the weighted average ROEs may be set at a company's hurdle rate, net investment earned rate, or other benchmark; for this analysis we used 8%.

## ANALYSIS OF IRR AND ROE

We have projected a single pricing cell under a range of assumptions and product specifications. As a precursor to reviewing the IRR/ROE relationship for ULSG products, it was important to first understand that interplay for simpler current assumption products. With this thought in mind, we created a hypothetical current assumption universal life product that develops significant cash value. We then

explored the isolated impact of several single assumption changes on the IRR-ROE relationship. Next, we considered four variations of the product design to examine the impact of product features on the IRR-ROE relationship. Finally, we added specified premium and shadow account secondary guarantees to the base product.

**The pricing cell included in this analysis is a male, standard nonsmoker at issue age 55 with a $1 million average face amount.**

The pricing cell included in this analysis is a male, standard nonsmoker at issue age 55 with a $1 million average face amount. The pricing cell contained seven policies for $7 million of total face amount. A description of the pricing cell, the basic product specifications, and the projection assumptions applied consistently across all projections can be found in Appendix C.

Prior to presenting any results, it should be emphasized that work completed for this report is based on hypothetical product designs for one pricing cell (issue age, sex, class, band). Pricing results were not adjusted to produce particular return levels. The effect of each assumption and design change, therefore, is dependent on the starting return prior to the change. Additionally, actual pricing exercises would include a complete aggregation of business based on anticipated demographics and not one pricing cell. The single cell chosen for this project does not necessarily produce return levels that would be expected from new product pricing in today's market, but it is intended to be representative.

The table in Figure 1 summarizes results for our complete analysis. Because this report is focused on ULSG products, the interested reader is referred to Appendix A for detailed analysis on the current assumption product. The report body will detail only the ULSG results following the table.

**FIGURE 1: RESULTS OF COMPLETE ANALYSIS**

| PROJECTION | PRODUCT TYPE | DESCRIPTION | IRR | SUM ROE | IRR/ROE |
|---|---|---|---|---|---|
| Statutory = GAAP Profits | UL | Hypothetical assumptions in order to achieve equal statutory and GAAP profits | N/A | N/A | None calculated; statutory equals GAAP profits |
| IRR-ROE Similar (*initial*) | UL | *Initial* run: Hypothetical assumptions so that statutory IRR and GAAP ROE are almost equal | 10.5% | 10.5% | 35 of first 36 calculated ROEs nearly equal to IRR |
| Realistic Target Surplus | UL | *Initial* plus single change to test the impact of adding realistic target surplus | 8.2% | 7.6% | Declining ROEs start higher than IRR Years 2-9 |
| DAC Tax | UL | *Initial* plus single change to test impact of adding DAC tax | 9.3% | 9.2% | Declining ROEs start higher than IRR Years 2-5 |
| FAS97 Interest Rate | UL | *Initial* plus single change to test impact of using the FAS97 discount rate instead of discounting at IRR | 10.5% | 10.9% | ROE Similar to IRR Years 2-15; then upward sloping |
| California Reserves | UL | *Initial* plus single change to test impact of the California reserve method instead of account value | 17.4% | 13.1% | Early ROE much larger than IRR, declines later |
| Model Regulation Reserves | UL | *Initial* plus single change to test impact of model regulation reserve method instead of account value | 39.7% | 18.1% | Negative equity in some durations makes yearly ROE analysis difficult |
| Real Approach (*realistic*) | UL | *Realistic* run: Combines previous tests to represent a realistic set of actuarial assumptions | 11.1% | 8.1% | Varying ROEs Years 1-10, declining below IRR later |
| Heaped Per-Unit Load | UL | *Realistic* plus change to test impact of heaped per-unit load and lower interest spread | 22.7% | 11.2% | Varying (but higher) ROEs Years 1-10, declining below IRR later |
| Increase Interest Spread | UL | *Realistic* plus change to test impact of wider interest spread and lower COI rates | 11.6% | 8.3% | Varying (but higher) ROEs Years 1-10, declining below IRR later |
| Decrease COIs | UL | *Realistic* plus change to test impact of lower COI rates and level per-unit load | 16.7% | 9.1% | Varying (but higher) ROEs Years 1-10, declining below IRR later |
| Increase COIs | UL | *Realistic* plus change to test impact of higher COI rates and lower interest spread | 10.6% | 7.9% | Varying ROEs Years 1-10, declining later; overall more level |
| Specified Premium Guarantee With Cash Value Endowment | ULSG | *Realistic* plus adds a specified premium secondary guarantee; cash value endowments | 6.3% | 6.1% | Declining ROEs start higher than IRR Years 2-9 |
| Specified Premium Guarantee | ULSG | *Realistic* plus specified premium secondary guarantee plus reduced account value/ higher loads | 7.2% | 6.6% | Declining ROEs start higher than IRR Years 1-9 |
| Shadow Account Guarantee | ULSG | *Realistic* reconfigured with lower ULSG premiums, shadow account design, and low account value | 5.1% | 5.5% | Increasing ROEs start lower than IRR Years 1-12 |
| Shadow Account Guarantee With Financing | ULSG | *Realistic* adding a hypothetical financing solution to the shadow account design | 8.3% | * | ROEs vary greatly in size (both positive and negative) |

* Negative GAAP equity does not allow calculation of rational GAAP ROE point statistics

The full ROE stream and additional data for each projection can be found in Appendix B.

## DETAILED ANALYSIS OF IRR AND ROE FOR ULSG PRODUCTS

After working through the current assumption product analysis of IRR and ROE, we added secondary guarantees to the hypothetical current assumption product in four stages. In the first stage, a specified premium guarantee was added without any other product changes from the "realistic" projection defined previously. Second, we increased the COI rates and added a level per-unit load charge to the base account mechanics so that the account value is eventually depleted and the policy is supported by the secondary guarantee. For the third stage, we reduced the premium level and added a shadow account guarantee to mimic a design more similar to those available in the market today. Finally, we set up a simple, but typical, financing arrangement in which a subsidiary would assume the secondary guarantee risk and use a letter of credit to back the reserve in excess of an economic reserve. To address policyholder behavior and the lapse-supported nature of ULSG products, lapse rates were assumed to be half of the UL rates with lapses occurring only at the annual premium payment dates.

**An important element of GAAP accounting for secondary guarantee products is the SOP 03-1 liability. For these projections we applied an approach that we have seen used in the market and consider acceptable for pricing.**

An important element of GAAP accounting for secondary guarantee products is the SOP 03-1 liability. For these projections we applied an approach that we have seen used in the market and consider acceptable for pricing. The definitions for benefits and assessments were laid out earlier in this section, and the values were calculated from a deterministic projection that we have used as a simplification in initial pricing. Additional definitions and a discussion of deterministic versus stochastic methodology are found later in this report.

The base product and assumptions prior to the introduction of UL secondary guarantee variations is outlined in Appendix C for reference.

- **ULSG Design 1**: Specified premium with cash value endowment
  - For the first stage, the secondary guarantee is a specified premium type with the required premiums equal to the previously assumed gross premiums. Compared with the *realistic* UL projection, the account value growth is identical, but the lower lapse rates cause a larger proportion of the cell to remain in force. Because of the specified premium secondary guarantee, segmented reserves are calculated, but there is no excess reserve.
  - Statutory profits decreased compared with the UL projection because of two main drivers. The first is that the lower lapse rates result in significantly more death claims compared with the reduction in surrender benefits. Second, the segmented reserves generated by the secondary guarantee are much higher than UL model regulation reserves. The IRR drops to 6.3% for this product compared with the *realistic* UL product.
  - GAAP profits increased in this projection, which is mainly due to investment income on the larger reserves and surplus levels. A slight offset exists in the surrender margin caused by lower lapse rates. Despite the increased profits compared with the UL product, the ROEs are actually lower because the equity base is much larger for the ULSG product. For about the first 10 years, ROEs are significantly lower for the ULSG product, but then the differences narrow to less than 100 bps. In the tail the ROEs settle around 6%.
  - Because the product in this projection continues to build cash value, no SOP 03-1 liability was necessary in the simplified deterministic approach applied for this part of the analysis. In the stochastic method discussed later in the report an SOP 03-1 liability is reflected.

**FIGURE 2: PROJECTION 13**

| | "REALISTIC" UL | SP ULSG WITH CV |
|---|---|---|
| STATUTORY IRR | 11.1% | 6.3% |
| SUM GAAP ROE | 8.1% | 6.1% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 6.4% |

- **ULSG Design 2**: Specified premium

  — With the intention of emphasizing the effect of the secondary guarantee, COI rates were increased to 110% of assumed mortality and a $1.50 per-unit load was added. The result was that the cell runs out of account value and goes in-the-money in the 40th policy year.

  — These changes have no impact on the statutory reserve because it is mostly disjoint from the account value. The amount paid out as surrender benefits decreased and the IRR is 7.2%, a modest increase from the prior ULSG projection.

  — On a GAAP basis, these changes have a greater impact. The revised COI rates and loads make the basic GAAP profits larger, but there are significant losses in the tail because of the secondary guarantee that necessitate an SOP 03-1 liability. In early years the net GAAP profits are reduced as income is diverted to establish the liability. When the policy is in-the-money the liability is released to offset the negative mortality margin. At that point the investment income is the primary driver of positive profits.

  — The ROEs for this product design are higher than those in the previous iteration by over 100 bps in early years because profits are higher and the equity base is only marginally different. The difference gradually diminishes and the ROEs for this iteration drop below those of the previous in about the 30th year. There is a jump in the ROEs in the tail to between 9% and 15% because of the boost to profits from the SOP 03-1 liability release.

**FIGURE 3: PROJECTION 14**

| | "REALISTIC" UL | SP ULSG LOWER CV |
|---|---|---|
| **STATUTORY IRR** | **11.1%** | **7.2%** |
| **SUM GAAP ROE** | **8.1%** | **6.6%** |
| **WTD. AVE. GAAP ROE @ 8%** | **6.6%** | **7.2%** |

- **ULSG Design 3**: Shadow account

  — The guarantee was changed to a standard single-fund shadow account design comparable to slightly older products we have observed in the market. In addition, we lowered the assumed premiums to $14.50 per unit, a level that would be more competitive in the current market for standard insureds.

  — This product has very low cash value because of the reduced premiums, higher COI rates and percent of premium load charges, and a wider interest spread. The cell becomes in-the-money after 21 years when the account value declines to zero.

  — Because of the shadow account design, this product develops significant excess reserves, but minimal segmented reserves. The reserves for this product are slightly less than for the specified premium product in all years after the first.

  — Driven primarily by the lower premiums, the IRR for this product iteration dropped to 5.1%.

  — On a GAAP basis, the larger COI charges generate a wider margin in early years before the account value is exhausted and charges cannot be collected. Because the reserve is much larger than the account value for this product, a larger portion of investment income flows into profits. However, the cost of setting up the SOP 03-1 liability consumes the majority of what would otherwise be profit in early years in order to offset the would-be losses in later years.

**The ROEs for this product design are less than the IRR in the first several years but exhibit a gradual increasing pattern over the policy lifetime.**

— The ROEs for this product design are less than the IRR in the first several years but exhibit a gradual increasing pattern over the policy lifetime. In the tail, the ROEs are between 6% and 7%.

**FIGURE 4: PROJECTION 15**

| | "REALISTIC" UL | SHADOW ACCOUNT ULSG |
|---|---|---|
| STATUTORY IRR | 11.1% | 5.1% |
| SUM GAAP ROE | 8.1% | 5.5% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 4.9% |

- **ULSG Design 4**: Shadow account with financing solution

**In a hypothetical situation, a company selling a ULSG product could reinsure a portion of each policy, including the secondary guarantee, to a captive. In appropriate circumstances, the captive might be able to use a letter of credit to back the statutory reserve in excess of an economic reserve.**

— In a hypothetical situation, a company selling a ULSG product could reinsure a portion of each policy, including the secondary guarantee, to a captive. In appropriate circumstances, the captive might be able to use a letter of credit to back the statutory reserve in excess of an economic reserve. We applied such a scenario to our shadow account product and observed the results from an entity-wide viewpoint where the differences are the cost of a letter of credit and the reduction in the invested assets required to back the reserve. The intercompany transaction mechanics were not relevant for this analysis. Additionally, the risks associated with future letter of credit (LOC) costs and guarantee periods are outside the scope of this report.

— The cost of a letter of credit was assumed to be 200 basis points of the financed amount and flows through the statutory and GAAP income statements as an expense. The economic reserve was calculated as the present value of the product cash flows including the financing charges with the level 5% investment earned rate as the discount rate. For income statement and balance sheet purposes, this effectively became the reserve because any excess is backed by the letter of credit. Investment income was assumed to be earned on the statutory reserve net of financing.

— On a statutory pre-tax basis, profits after the first several years were essentially zero and the after-tax bottom line was driven by taxes and target surplus. The IRR increased to 8.3%.

— In the GAAP profit calculation, expenses increased to include the letter of credit cost and investment income decreased because of the smaller invested assets. The expense difference reduced the estimated gross profits (EGPs) for DAC amortization. None of the components of the SOP 03-1 calculation were affected.

— The GAAP equity base was significantly different with the reserve financing. After Year 10, the equity base is negative for over 40 years (asset base is less than GAAP reserve), and it is minimally positive in the tail. As a result, the typical ROE stream breaks down as a profit measure. One view is that the negative GAAP equity implies less strain on a GAAP basis and the equity can be applied elsewhere. We think that concept is reasonable, but it still presents a challenge for profit analysis at a cell level. For example, in Years 17-21, profits are projected to be negative, but the ROEs are positive because of negative equity.

— This challenge also impacts the calculation of ROE point statistics because both the sum and the present value of equity are negative. Given that the sum and the present value of profits are positive, this could be interpreted to mean that this cell would generate a profit and create new equity that could be invested into other business, which would be a very desirable outcome.

**FIGURE 5: PROJECTION 16**

| | "REALISTIC" UL | SA ULSG W/ FINANCING |
|---|---|---|
| STATUTORY IRR | 11.1% | 8.3% |
| SUM GAAP ROE | 8.1% | * |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | * |

* Negative GAAP equity does not allow calculation of rational GAAP ROE point statistics

The table in Figure 6 summarizes the results from the four iterations of our sample ULSG product design.

**FIGURE 6: SUMMARY OF ULSG VARIATIONS**

| | STATUTORY IRR | SUM GAAP ROE | WEIGHTED AVERAGE GAAP ROE @ 8% |
|---|---|---|---|
| *REALISTIC* CURRENT ASSUMPTION UL | 11.1% | 8.1% | 6.6% |
| SPECIFIED PREMIUM ULSG W/ CASH VALUE ENDOWMENT | 6.3% | 6.1% | 6.4% |
| SPECIFIED PREMIUM ULSG | 7.2% | 6.6% | 7.2% |
| SHADOW ACCOUNT ULSG | 5.1% | 5.5% | 4.9% |
| SHADOW ACCOUNT ULSG W/ FINANCING | 8.3% | * | * |

* Negative GAAP equity does not allow calculation of rational GAAP ROE point statistics

## IMPACT OF SOP 03-1 DEFINITIONS AND METHODOLOGY

An important consideration in setting up an SOP 03-1 liability is the definition of excess benefits and assessments. While the opinion of a company's auditor should be relied upon, we extended our analysis to the application of two additional definitions of excess benefits:

- Death benefit payments when a policy has a secondary guarantee and cash value is zero or negative
- COI and load charges that cannot be collected because of insufficient account value

These are definitions that some actuaries may see as fitting within the instructions of the SOP. In our experience, there may also be variations on the definition of assessments, albeit less dramatic. Because of materiality we limited our analysis to the definition of excess benefits only.

A second area of variance in the application of SOP 03-1 is the use of stochastic versus deterministic calculations of excess benefits and assessments. We have encountered numerous approaches ranging from hundreds of scenarios used to feed a single valuation date calculation to a single scenario calculation at each valuation date with periodic validation using scenarios. The approach used for pricing analysis may differ and be simplified from the approach used for financial reporting. The company auditor would be a leading voice on the company's approach.

**Our initial analysis utilized a single deterministic calculation of benefits and assessments from the base scenario. To expand on this, we used a nested stochastic approach for the projection of the SOP 03-1 liability.**

Our initial analysis utilized a single deterministic calculation of benefits and assessments from the base scenario. To expand on this, we used a nested stochastic approach for the projection of the SOP 03-1 liability. Our model used fifty inner loop paths of yield curves to recalculate the SOP 03-1 liability at each future year. The mean of the excess benefits and assessments was determined from the fifty paths.

The tables below summarize key values for these tests for each of the three products showing results using the account value and uncollectible charges definitions of excess benefits on a deterministic and stochastic basis.

## ULSG DESIGN 1: SPECIFIED PREMIUM WITH CASH VALUE ENDOWMENT

**FIGURE 7: SOP 03-1 ANALYSIS: SPECIFIED PREMIUM ULSG WITH CASH VALUE ENDOWMENT**

| | DETERMINISTIC | | STOCHASTIC | |
|---|---|---|---|---|
| | AV <= 0 | UNCOLLECTIBLE | AV <= 0 | UNCOLLECTIBLE |
| **YEAR** | **SOP 03-1 BALANCES** | | | |
| 1 | - | - | 464 | 437 |
| 5 | - | - | 2,899 | 2,726 |
| 10 | - | - | 5,265 | 4,916 |
| 15 | - | - | 6,205 | 5,743 |
| 20 | - | - | 5,988 | 5,557 |
| 25 | - | - | 5,023 | 4,669 |
| 30 | - | - | 3,548 | 3,309 |
| 40 | - | - | 764 | 713 |
| 50 | - | - | 0 | 0 |
| | **GAAP PROFIT MEASURES** | | | |
| SUM. ROE | 6.1% | 6.1% | 6.1% | 6.1% |
| 8% WTD. AVE. ROE | 6.4% | 6.4% | 6.4% | 6.4% |

Note that the base ULSG product that develops significant cash value did not generate excess benefits under our original or uncollectible charges definition of excess benefits on a deterministic basis. On a deterministic basis, the product did not meet the criteria of profits followed by losses and we did not believe it would be necessary to establish an SOP liability under any of the definitions.

On a stochastic basis, the account value growth does not always carry the product to maturity such that the secondary guarantee is triggered, but there is very little difference between results for the definitions of excess benefits because the COI rates are equal to the expected mortality rates. For the account value and uncollectible charges definitions, the present values of the excess benefits were small compared to the assessments and the resulting SOP 03-1 liabilities were modest along with the impacts on the ROEs. Profitability decreased slightly when calculating the SOP 03-1 liability stochastically because of the small cost of setting up the liability, but the corresponding change in the equity levels was an important driver in the ROE. The presence of the SOP 03-1 liability reduces equity, and we found that it actually caused negative equity in the tail. However, the negative equity values had an impact of only a few basis points on the point statistic ROEs.

**On a stochastic basis, the account value growth does not always carry the product to maturity such that the secondary guarantee is triggered, but there is very little difference between results for the definitions of excess benefits because the COI rates are equal to the expected mortality rates.**

We observed that the only difference between the results for the cash value and account value definitions was that benefits paid in the first two years when the surrender charge is larger than the account value are considered excess benefits under the cash value definition. This causes a negative SOP 03-1 balance in the first few years because excess benefits occur before enough of the assessments have been capitalized. Otherwise the benefit streams under the account value and cash value definitions were identical because the two balances go to zero in the same period. Upon examination of the other two ULSG designs, we saw similar results. We concluded that the cash value definition of excess benefits is not very meaningful for this analysis of our sample ULSG products because the account value and cash value are exhausted in the same period, so we omitted the results of the cash value calculations from Figure 7 and for the other designs.

A company would have to consider the product design when deciding on whether to use a cash value or any other definition of excess benefits. In the market we have observed products where the cash value is very low or nonexistent despite many years of account values. We also can envision the case of policyholders that pay minimum premiums, whether intentionally or not, and have minimal account

balances and no cash values. In both situations, the difference between an account value and cash value definition of excess benefits could have a significant impact on projected and actual results.

## ULSG DESIGN 2: SPECIFIED PREMIUM

**FIGURE 8: SOP 03-1 ANALYSIS: SPECIFIED PREMIUM ULSG**

| | DETERMINISTIC | | STOCHASTIC | |
|---|---|---|---|---|
| | AV <= 0 | UNCOLLECTIBLE | AV <= 0 | UNCOLLECTIBLE |
| YEAR | SOP 03-1 BALANCES | | | |
| 1 | 3,190 | 3,385 | 3,516 | 3,726 |
| 5 | 21,901 | 23,235 | 23,074 | 24,486 |
| 10 | 54,702 | 58,034 | 54,997 | 58,396 |
| 15 | 101,879 | 108,085 | 99,188 | 105,169 |
| 20 | 168,291 | 178,541 | 161,346 | 171,285 |
| 25 | 261,353 | 277,273 | 252,091 | 267,693 |
| 30 | 388,147 | 411,790 | 380,097 | 404,069 |
| 40 | 568,337 | 605,808 | 567,917 | 605,306 |
| 50 | 86,301 | 89,471 | 86,327 | 89,462 |
| | GAAP PROFIT MEASURES | | | |
| SUM ROE | 6.6% | 6.7% | 6.4% | 6.6% |
| 8% WTD. AVE. ROE | 7.2% | 7.2% | 7.3% | 7.3% |

This product met the criteria of the profits followed by losses test on a deterministic basis because by design it is intended to be supported by the secondary guarantee when the account value runs out. While establishing the SOP 03-1 liability reduces the early-year profits, this effect is less than the profit gain from the changes to the product design. Because the COI rates are set at 110% of expected mortality, the uncollectible charges definition produces a greater SOP 03-1 liability than the account value definition.

**Comparing the stochastic to deterministic results for these first two product designs, we found that nested stochastic calculations lead to a broad range of tail risk of the secondary guarantee because of the interest rate volatility.**

Comparing the stochastic to deterministic results for these first two product designs, we found that nested stochastic calculations lead to a broad range of tail risk of the secondary guarantee because of the interest rate volatility. Even if the average earned rate and credited rates in a scenario are higher than in the deterministic scenario, a couple years at a lower credited rate can cause the account value to be exhausted much sooner. Conversely, some stochastic paths generate higher credited rates and eliminate tail risk. Thus, the impact on results was mixed when comparing deterministic and stochastic approaches for these products.

## ULSG DESIGN 3: SHADOW ACCOUNT

**FIGURE 9: SOP 03-1 ANALYSIS: SHADOW ACCOUNT ULSG**

| | DETERMINISTIC | | STOCHASTIC | |
|---|---|---|---|---|
| | AV <= 0 | UNCOLLECTIBLE | AV <= 0 | UNCOLLECTIBLE |
| **YEAR** | **SOP 03-1 BALANCES** | | | |
| 1 | 22,316 | 39,276 | 29,143 | 51,278 |
| 5 | 151,632 | 266,880 | 191,856 | 337,574 |
| 10 | 395,290 | 695,728 | 476,178 | 837,816 |
| 15 | 764,875 | 1,346,215 | 901,843 | 1,586,472 |
| 20 | 1,324,624 | 2,331,399 | 1,513,702 | 2,662,315 |
| 25 | 1,492,746 | 2,624,253 | 1,629,061 | 2,861,753 |
| 30 | 1,364,730 | 2,392,520 | 1,442,606 | 2,527,519 |
| 40 | 581,416 | 1,023,306 | 608,315 | 1,070,219 |
| 50 | 84,233 | 143,470 | 86,582 | 147,360 |
| | **GAAP PROFIT MEASURES** | | | |
| SUM ROE | 5.5% | -8.7% | 5.4% | -6.1% |
| 8% WTD. AVE. ROE | 4.9% | 49.1% | 4.6% | 14.2% |

For the ULSG product with a shadow account, the deterministic and stochastic results for each definition were similar, but slightly less similar than with the first two designs. It appears that there is more variation in the account value among nested stochastic scenarios and more tail risk overall for this design.

On both bases, the uncollectible charges definition causes such a large write-up in the SOP 03-1 liability that the GAAP profits are negative for the first 20 years before the policy goes in-the-money and the SOP 03-1 liability is released. When that occurs, profits are much higher than in the account value definition of excess benefits. To make the results even more complicated, the SOP 03-1 liability grows to be larger than the statutory assets, creating a negative equity situation in Years 15-57. Consequently, the ROE point statistics in the table may not appropriately reflect the profitability of the business. The summed ROE point statistics are negative because of the equity in the denominator. In the discounted ROE point statistics, the present value of profits and equity are negative, so the statistic has even more potential to cause confusion. As discussed earlier, the negative equity could indicate that the product generates equity that can be used elsewhere, but this time it would be at the expense of profitability. (While there are mechanics in GAAP accounting that may be invoked in situations where profits are negative, we did not apply them because this is a pricing-cell-level analysis.)

Our conclusion is that the uncollectible charges definition of excess benefits may be sensible in situations where charges are actually linked to expected mortality and expenses but not in designs such as this shadow account product where COI rates are arbitrarily high. With charges set at economically reasonable levels, the uncollectible amounts may better reflect the cost of the secondary guarantee. In Design 1 and Design 2, where COI rates are equal to expected mortality or slightly above it, the uncollectible charges definition appears to be better suited.

**Our conclusion is that the uncollectible charges definition of excess benefits may be sensible in situations where charges are actually linked to expected mortality and expenses but not in designs such as this shadow account product where COI rates are arbitrarily high.**

As noted in our initial work on the shadow account product with a financing solution, there was no impact on the SOP 03-1 calculations, so we have excluded that iteration from this analysis.

## STOCHASTIC PROFIT ANALYSIS

Stochastic profit analysis has become a more important aspect of the pricing process. It can be applied on both a statutory and GAAP basis to analyze how profit measures would be affected under adverse, optimistic, or random scenarios. An obvious practice would be to explore interest rate scenarios, but a more intense approach could utilize alternative combinations of lapse assumptions, mortality assumptions, premium payment patterns, and account value withdrawals. The opportunity exists to generate an exponentially larger stochastic set with each possible assumption and a massive amount of output data for analysis.

**We applied a range of interest rate scenarios to our sample ULSG products.**

**Our goal was to develop a representation of the results produced by random interest rate patterns within a reasonable range and with a reasonable long-term reversion point.**

To create a simple example, we applied a range of interest rate scenarios to our sample ULSG products. There could be much debate on the number, balance, and type of scenarios to use, but we elected to use a set of 50 scenarios from a generator provided by the American Academy of Actuaries. With these scenarios, an investment portfolio of 10- and 20-year bonds was selected to be reasonably consistent with the anticipated liability structure of the ULSG products. The bonds were assumed to be AAA- and A-rated with appropriate spreads included in the yield. Our goal was to develop a representation of the results produced by random interest rate patterns within a reasonable range and with a reasonable long-term reversion point. For simplicity we present only the results using the account value definition of excess benefits and a nested stochastic projection for the SOP 03-1 liability.

### ULSG DESIGN 1: SPECIFIED PREMIUM WITH CASH VALUE ENDOWMENT

The IRRs from the stochastic projections are summarized in Figure 10. Note that the base scenario IRR for this product was 6.3%.

**FIGURE 10: ULSG DESIGN 1, IRR FROM STOCHASTIC PROJECTIONS**

| IRR RANGE | NUMBER OF SCENARIOS |
|---|---|
| UNDEFINED | 1 |
| 0% TO 1.99% | 3 |
| 2% TO 3.99% | 16 |
| 4% TO 5.99% | 20 |
| 6% TO 7.99% | 9 |
| 8% TO 9.99% | 1 |
| 10% AND LARGER | 0 |
| AVERAGE IRR | 4.49% |

We had previously used ROE as a profit measure for GAAP reporting, but for stochastic analysis the streams of data are more cumbersome. Instead, the charts below present just the point statistic ROEs. Note that base scenario point statistic ROEs for this product were 6.1% using sums and 6.4% with discounting.

**FIGURE 11: ULSG DESIGN 1, SPECIFIED PREM W/ CV ENDOWMENT**

| ROE RANGE | NUMBER OF SCENARIOS | |
|---|---|---|
| | SUM | 8% DISCOUNT RATE |
| NEGATIVE | 1 | 1 |
| 0% TO 1.99% | 4 | 0 |
| 2% TO 3.99% | 20 | 10 |
| 4% TO 5.99% | 13 | 28 |
| 6% TO 7.99% | 11 | 10 |
| 8% TO 9.99% | 1 | 1 |
| 10% AND LARGER | 0 | 0 |
| AVERAGE ROE | 4.29% | 5.01% |

## ULSG DESIGN 2: SPECIFIED PREMIUM

The IRRs from the stochastic projections are summarized in Figure 12. Note that the base scenario IRR for this product was 7.2%.

**FIGURE 12: ULSG DESIGN 2, IRR FROM STOCHASTIC PROJECTIONS**

| IRR RANGE | NUMBER OF SCENARIOS |
|---|---|
| UNDEFINED | 1 |
| 0% TO 1.99% | 1 |
| 2% TO 3.99% | 10 |
| 4% TO 5.99% | 18 |
| 6% TO 7.99% | 14 |
| 8% TO 9.99% | 3 |
| 10% AND LARGER | 3 |
| AVERAGE IRR | 5.50% |

The chart in Figure 13 presents stochastic results for the analysis of the GAAP profits. Note that base scenario point statistic ROEs for this product were 6.4% using sums and 7.3% with discounting.

**FIGURE 13: ULSG DESIGN 2, SPECIFIED PREMIUM**

| ROE RANGE | NUMBER OF SCENARIOS | |
|---|---|---|
| | SUM | 8% DISCOUNT RATE |
| NEGATIVE | 1 | 0 |
| 0% TO 1.99% | 3 | 0 |
| 2% TO 3.99% | 16 | 5 |
| 4% TO 5.99% | 16 | 23 |
| 6% TO 7.99% | 9 | 15 |
| 8% TO 9.99% | 3 | 4 |
| 10% AND LARGER | 2 | 3 |
| AVERAGE ROE | 4.83% | 6.20% |

## ULSG DESIGN 3: SHADOW ACCOUNT

The IRRs from the stochastic projections are summarized in Figure 14. Note that the base scenario IRR for this product was 5.1%.

**FIGURE 14: ULSG DESIGN 3, IRR FROM STOCHASTIC PROJECTIONS**

| IRR RANGE | NUMBER OF SCENARIOS |
|---|---|
| UNDEFINED | 4 |
| 0% TO 1.99% | 11 |
| 2% TO 3.99% | 16 |
| 4% TO 5.99% | 12 |
| 6% TO 7.99% | 3 |
| 8% TO 9.99% | 3 |
| 10% AND LARGER | 1 |
| AVERAGE IRR | 3.5% |

The chart in Figure 15 presents stochastic results for the analysis of the GAAP profits. Note that base scenario point statistic ROEs for this product were 5.4% using sums and 4.6% with discounting.

**FIGURE 15: ULSG DESIGN 3, SHADOW ACCOUNT**

| ROE RANGE | NUMBER OF SCENARIOS | |
|---|---|---|
| | SUM | 8% DISCOUNT RATE |
| NEGATIVE | 4 | 11 |
| 0% TO 1.99% | 6 | 18 |
| 2% TO 3.99% | 9 | 10 |
| 4% TO 5.99% | 9 | 5 |
| 6% TO 7.99% | 6 | 2 |
| 8% TO 9.99% | 7 | 1 |
| 10% AND LARGER | 9 | 3 |
| AVERAGE ROE | 6.24% | 2.21% |

**We believe that the volatility of the investment returns likely had a large impact on results.**

In these tests, almost all the results of the stochastic scenarios were skewed negatively, but a handful of scenarios had positive impacts on profitability. This effect could be partly attributable to scenario bias, but almost half of the scenarios showed an average investment return larger than the base scenario. We believe that the volatility of the investment returns likely had a large impact on results. This impact was visible primarily in the investment income lines of the statutory and GAAP income statements.

The volatility of the investment returns also impacted the projected credited rates on the base account value. In the cases where investment returns were poor, the secondary guarantee in both designs kept the policy in force despite the policy running out of account value in earlier durations compared to higher-return scenarios. However, we found that even in scenarios with generally above-average returns, a few intermittent years of poor investment returns could reduce profitability.

Additionally, the summed ROE point statistics for the shadow account product indicated a generally positive effect of the stochastic scenarios while the IRR and discounted ROE statistics showed mostly negative results. This occurred because both statutory and GAAP profits tended to be lower or negative in early years and higher and positive in later years.

## ULSG DESIGN 4: SHADOW ACCOUNT WITH FINANCING SOLUTION

We also applied this form of stochastic analysis to our shadow account product with a financing solution. On a statutory basis we found that the present value of profits at our tested discount rates increased for almost every scenario. However, the shape of the general profit pattern observed across the scenarios changed in such a way that an IRR could not be calculated for most scenarios. It turns out that without the financing solution the scenarios in that subset had small positive IRRs and negative present values of profit. Even though the financing improved profitability on these scenarios, the present value of profits remained negative. On scenarios where the present value of profits was positive, the IRRs were calculable and increased compared with the results without financing.

Analyzing the stochastic GAAP profit results for the product with a financing solution, we found that the point statistic ROEs tended to be negative or large because of negative sums of equity in the denominator for the sum statistics and small positive present values of equity in the denominator for the discounted statistics. This reduced the effectiveness of the point statistics for summarizing the underlying profitability.

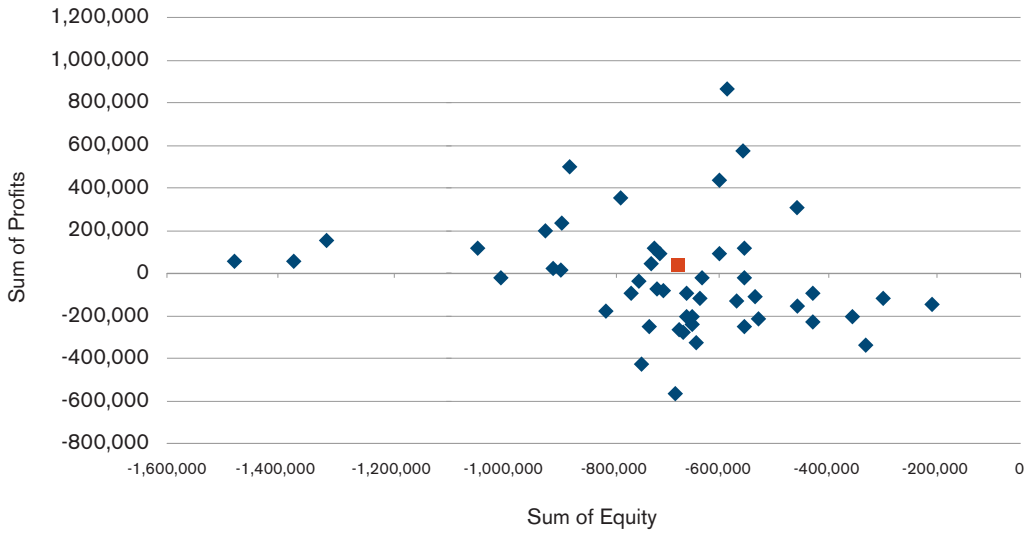
Because our typical analysis of ROEs didn't provide much insight for these results, we looked for alternative summaries of the data. An interesting concept is to plot a data point for each scenario with the sums of profits and equity as the coordinates. This allowed us to get some sense of how the scenarios impacted results. The chart in Figure 16 plots these points.

We also considered a quadrant system to categorize results:

- Quadrant I contains scenarios with positive profits and equity, which may be desirable if the ROE for the scenario is sufficient. No scenarios fell into this quadrant, and it is not shown on the chart below.
- Quadrant II contains scenarios with positive profits and negative equity; these scenarios may be considered desirable outcomes.
- The scenarios in Quadrant III can be viewed as a mix of good and bad results. The negative sum of equity means that the projected cell would generate new equity that could be applied elsewhere; for some scenarios the negative sum of profits could represent a fair cost for this equity. A company would have to decide where to draw the line on acceptable outcomes.
- Quadrant IV contains scenarios with negative profits and positive equity; these are the worst outcomes because they consume capital and do not generate a return. No scenarios fell into this quadrant, and it is not shown on the chart below.

**FIGURE 16: PLOT OF GAAP PROFIT VS. EQUITY**

The point marked as a square represents the results from the base scenario.

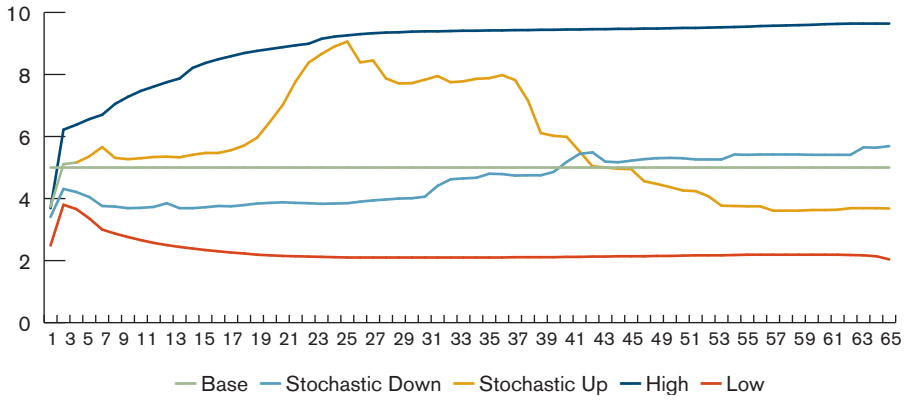



**For an additional demonstration of scenario analysis, we developed two deterministic scenarios for interest rates that represent opposite but not absolute extreme cases of interest rate movements.**

## ADDITIONAL SCENARIO ANALYSIS

For an additional demonstration of scenario analysis, we developed two deterministic scenarios for interest rates that represent opposite but not absolute extreme cases of interest rate movements. In the sustained high-interest-rate (High) scenario, interest rates are projected to quickly increase from their December 31, 2010, levels over a period of 12 years with the 10-year yield reaching 8% over the long term. This scenario could be representative of the interest rate environment from the 1970s through the mid-1990s in the United States. In the sustained low-interest-rate (Low) scenario, interest rates are projected to drop from their December 31, 2010, levels over the next 12 years with the 10-year yield reaching 1% over the long term. This scenario would be similar to the interest rate environment in Japan over the last 20 years. The chart in Figure 17 displays the resulting investment return rates for these scenarios. The chart also includes the base scenario rate and the pattern of returns from two of the stochastic scenarios that we selected as representing volatile up and down scenarios.

**FIGURE 17: NET INVESTMENT EARNED RATES**



Note that, in the first projection year, offsetting initial cash flows results in no funds to invest in assets. The rates on the chart in the first year are cash investment rates. By the end of the first year, when funds are invested in assets, the yield curves have already diverged from the December 31, 2010, starting point.

We applied this subset of scenarios to the ULSG product with a shadow account. For the SOP 03-1 liability, we continued to use a nested stochastic approach. The table in Figure 18 presents the familiar range of statistics on the results of the scenarios.

**FIGURE 18: ULSG DESIGN 4, SCENARIOS FOR SHADOW ACCOUNT WITH FINANCING SOLUTION**

| | STAT PROFIT MEASURES | | | GAAP PROFIT MEASURES | |
|---|---|---|---|---|---|
| SCENARIO | IRR | 5% NPV PROFITS | 8% NPV PROFITS | SUM ROE | 8% W.A. ROE |
| BASE | 5.1% | 3,019 | (60,571) | 5.4% | 4.6% |
| STOCHASTIC "DOWN" | 1.4% | (124,546) | (139,459) | 2.3% | -0.5% |
| STOCHASTIC "UP" | 9.2% | 184,578 | 31,219 | 19.0% | 10.3% |
| HIGH | 13.6% | 392,894 | 155,050 | 36.1% | 20.2% |
| LOW | UNDEFINED | (308,743) | (242,170) | -4.9% | -4.5% |

Not surprisingly, the High and Low scenarios produce dramatically higher and lower profits compared with the other three scenarios. While the stochastic up and down scenarios are not too extreme, their results were representative of the high and low ranges of the stochastic scenario analysis. On a statutory basis, the scenarios lead to large drops or gains in investment income. While this does impact the policyholder account values, the cell runs out of account value in the 19th and 23rd policy years in the Low and High scenarios, respectively. These are near the range of the results from the earlier stochastic set and base scenario, so there are only marginal differences in surrender benefits paid between higher and lower earned rate scenarios.

**Not surprisingly, the High and Low scenarios produce dramatically higher and lower profits compared with the other three scenarios.**

On the GAAP income statement, the interest credited to the policyholder account value directly cuts into the investment income. For our ULSG products the asset base (statutory reserves and surplus) that earns income is disjoint from and much higher than the account value, so the credited interest does not amount to much of an offset to the contribution of investment income to GAAP profits. In the Low scenario, as on a statutory basis, investment income is low enough that profits are negative, causing ROE point statistics to be negative.

## INTEREST RATE SCENARIOS AND PORTFOLIO SENSITIVITY

In the baseline scenario, we elected to use a 5% annual return on investments. For the stochastic SOP 03-1 and profit projections, we used stochastically generated scenarios based on a December 31, 2010, yield curve. With those scenarios, a simple investment portfolio of 10- and 20-year bonds was used so that interest rates progress somewhat smoothly. The bonds are assumed to be AAA- and A-rated with appropriate spreads included in the yield. Over the projection period and across the 50 scenarios, the average annual return on investment was just above 5%. The pattern of average returns is generally upward sloping and ranges from about 4.4% in the first investment year to about 6.5% in the final year of the projection.

**Recognizing that there are many viewpoints on model asset portfolios that would be appropriate to back a ULSG product, we conducted a sensitivity test of our stochastic calculations with an asset portfolio of three-, five-, and 10-year bonds.**

Recognizing that there are many viewpoints on model asset portfolios that would be appropriate to back a ULSG product, we conducted a sensitivity test of our stochastic calculations with an asset portfolio of three-, five-, and 10-year bonds. Appropriate spreads for corporate bonds of these durations were used. We repeated the scenario projections of the ULSG product with a shadow account guarantee with this new portfolio to test the stochastic profit analysis. The table in Figure 19 compares results from the projections with the sensitivity test portfolio to those with the base investment portfolio.

**FIGURE 19: SHADOW ACCOUNT ULSG, ASSET PORTFOLIO SENSITIVITY**

| | ASSET PORTFOLIO | |
|---|---|---|
| | BASE – 10 & 20 YR | SENSITIVITY – 3, 5 & 10 YR |
| **I. SCENARIO PORTFOLIO RATE OVERVIEW** | | |
| PROJECTION AVERAGE NET EARNED RATE ON INVESTMENTS | 5.12% | 5.19% |
| FIRST YEAR AVERAGE NET EARNED RATE ON INVESTMENTS | 4.44% | 3.46% |
| LAST YEAR AVERAGE NET EARNED RATE ON INVESTMENTS | 6.50% | 6.21% |
| **II. STOCHASTIC PROFIT ANALYSIS** | | |
| AVERAGE IRR | 3.5% | 3.7% |
| AVERAGE POINT STATISTIC ROE (SUM / 8% DISCOUNT) | 6.2% / 2.2% | 4.8% / 3.4% |

In the sensitivity test, earned rates in the first and last years of the projection have declined, but the projection average earned rate has climbed slightly. This appears to be due to the frequent reinvestment of assets catching more upswings in yield rates. With longer duration investments, the net investment returns are less sensitive to changes in the underlying yield curve.

**We found that the average stochastic IRR increased in the sensitivity with upward and downward movement across the scenarios.**

We found that the average stochastic IRR increased in the sensitivity with upward and downward movement across the scenarios. On a scenario level it appears that the increase or decrease in IRR is correlated to the average earned rate, but the actual path of earned rates in a scenario is a better predictor of IRR movement. Higher earned rates in the tail of a scenario have much less of an impact on the IRR than high earned rates in early years. Similar logic would apply in the GAAP calculations, where we found that the average point statistic ROEs exhibited small shifts.

**Our conclusion from this brief sensitivity test was that our selected portfolio of 10- and 20-year bonds does not produce substantially different results than would a portfolio of three-, five-, and 10-year bonds.**

Our conclusion from this brief sensitivity test was that our selected portfolio of 10- and 20-year bonds does not produce substantially different results than would a portfolio of three-, five-, and 10-year bonds. This outcome is influenced by many factors including the scenarios, shape of yield curve, bond spreads, and the interest sensitivity of the product itself. We believe it is important to reflect the actual expectation of investments in any stochastic work and to potentially test alternative portfolios.

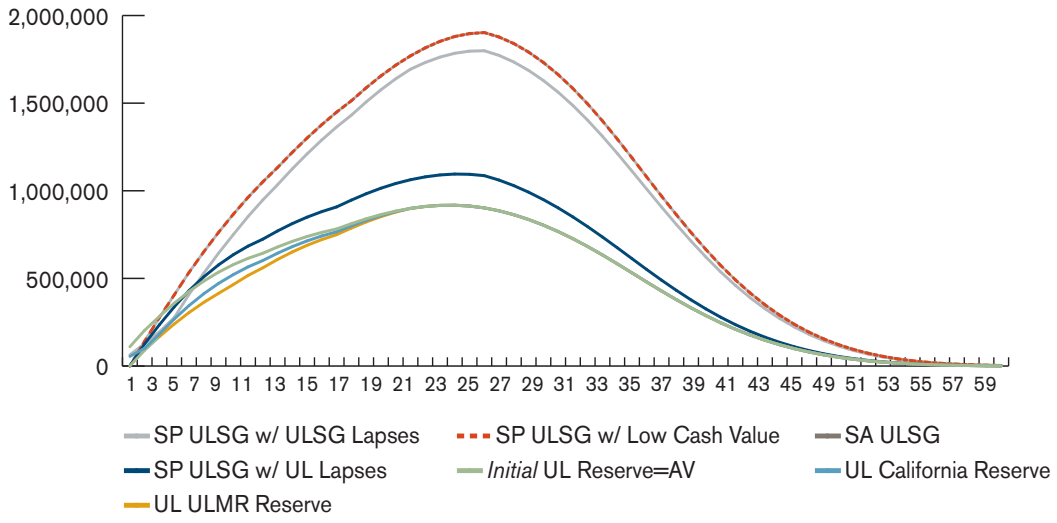
## STATUTORY PROFIT DRIVERS

A common format for analyzing profit results is a sources-of-profit report. It may also be called a profit drivers report. In this type of format, statutory cash flow items are laid out similarly to items typically found in FAS97 GAAP reports in order to develop margins for interest on account value, mortality, surrender, and expenses. The format could be described as *account value-centric* with two lines devoted to the difference between the change in account value and reserve and the interest income on that difference. When put together correctly, the bottom line profits on a sources-of-profit report are equal to those on a regular statutory income statement.

We revisited several of the iterations detailed in the IRR-to-ROE comparison to look at the results in a sources-of-profit format. Previously, we have noted that the statutory reserve tends to be more disjoint from the account value for a product with a secondary guarantee than for a typical universal life product. The profit impact of this relationship is explicitly shown in a sources-of-profit report. We focused our analysis on this impact and on how changes in the ULSG design affect profitability.

To give context to the analysis that follows, the chart in Figure 20 plots the projected reserves for each of the projections. Note that the reserve lines overlap for the specified premium ULSG products with and without the cash value endowment because they have identical statutory reserves. Please also remember that a lower lapse rate was applied to the ULSG products, so their levels of in-force policies and reserves are larger. To bridge this lapse rate difference, the purple line represents the reserve for the specified premium ULSG product with the UL lapse rates.

**FIGURE 20: STATUTORY RESERVES FOR SOURCES OF PROFIT ANALYSIS**



The table in Figure 21 contains the sources-of-profit summary on a present value basis for the first four iterations that are subsequently discussed. The results are pre-tax and are calculated at an 8% discount rate.

**FIGURE 21: SOURCES-OF-PROFIT SUMMARY FOR FIRST FOUR ITERATIONS**

| | "INITIAL" UL ACCT. VAL. RESERVE | UL CALIFORNIA RESERVE | UL ULMR RESERVES | SP ULSG W/ NO LAPSE CHANGE |
|---|---|---|---|---|
| INTEREST EARNED ON AV | 331,602 | 336,720 | 343,855 | 332,773 |
| INTEREST CREDITED TO AV | (274,118) | (274,118) | (274,118) | (274,118) |
| INTEREST MARGIN | 57,483 | 62,602 | 69,736 | 58,655 |
| | | | | |
| COLLECTED COI CHARGES | 188,798 | 188,798 | 188,798 | 188,798 |
| AV RELEASED ON DEATH | 120,011 | 120,011 | 120,011 | 120,011 |
| DEATH BENEFITS PAID | (308,763) | (308,763) | (308,763) | (308,763) |
| MORTALITY MARGIN | 46 | 46 | 46 | 46 |
| | | | | |
| AV RELEASED ON SURRENDER | 285,793 | 285,793 | 285,793 | 285,793 |
| SURRENDERS PAID | (208,795) | (208,795) | (208,795) | (208,795) |
| SURRENDER MARGIN | 76,998 | 76,998 | 76,998 | 76,998 |
| | | | | |
| EXPENSE LOADS COLLECTED | 47,083 | 47,083 | 47,083 | 47,083 |
| ACQUISITION EXPENSE | (3,889) | (3,889) | (3,889) | (3,889) |
| MAINTENANCE EXPENSE | (19,937) | (19,937) | (19,937) | (19,937) |
| COMMISSIONS | (127,754) | (127,754) | (127,754) | (127,754) |
| EXPENSE MARGIN | (104,497) | (104,497) | (104,497) | (104,497) |
| | | | | |
| CHG. IN AV-RESERVE | - | 41,009 | 64,421 | (45,571) |
| INT. EARNED ON AV/RES DIFF | - | (30,749) | (52,516) | 27,310 |
| PRE-TAX STATUTORY PROFIT | 30,031 | 45,409 | 54,177 | 12,930 |

Note that the method for allocating investment income from assets to an amount earned on the account value is an approximation using year-end balances. Thus *Interest Earned on AV* in the table is affected by some noise even though the account value is the same in each of the four iterations.

- Beginning with the *initial* UL product in the first column we find that if the statutory reserves are equal to the account value there is no difference in the change between the two and the sources-of-profit layout provides a perfect breakdown of the pre-tax profit by margin.

- Moving to the second column, where the reserve is equal to the average of the account value and cash value, we first note that the four margins are virtually unchanged. What is important to note is the additional profit that is recognized because the California method allows the reserve to be less than the account value. Even though the reserve equals the account value after the surrender charge period, the delay in setting up the reserve frees up cash flow. This increases the present value of statutory profits, but it is offset by a negative adjustment to investment income because the invested assets are less than the account value.

- A similar pattern of results continues when observing the sources of profit for the projection with UL model regulation reserves. In this method the reserves are a notch lower than the California method for many years. While there is no mathematical guarantee that model regulation reserves will be lower than account value, a product can be designed to achieve the result. The other cash flows are largely unchanged, and the present value of profits increases because reserves are even lower than account value.

- For the fourth iteration of this analysis, we added a projection that was not detailed previously. In order to isolate the reserve impact of adding a specified premium guarantee we applied the UL lapse rates to the product with a specified premium guarantee and cash value endowment. Because of the secondary guarantee, segmented reserves are required and from Year 5 on the reserves are larger than the account value. On the sources-of-profit report this impact is shown by the reversal of the sign on the present value of the account value to reserve difference. With reserves larger than account value, the cost of establishing the reserve must be funded from profits. In some years, the sum of the margins may be negative and represent a need for the reserve to be funded from the shareholders; this is offset by investment income that can be earned on the larger reserve. The change in profits from the previous iteration could be described as the cost of the secondary guarantee. Alternatively, the *cost of the guarantee* could be split into two pieces. The first piece would be a portion that can be funded by policyholder cash flows, specifically the reserve increase that makes reserve equal to account value (plus a prorated portion of the investment income change). The second piece would be the remaining reserve increase (less a prorated portion of the investment income change), specifically those unfunded by policy cash flows (and therefore needed from shareholders).

The table in Figure 22 contains the sources-of-profit summary on a present value basis for the other three iterations that are subsequently discussed. The summary for the specified premium ULSG product before the lapse rate change is repeated for easier comparison. The results are pre-tax and are calculated at an 8% discount rate.

**FIGURE 22: SOURCES-OF-PROFIT SUMMARY FOR THREE SUBSEQUENT ITERATIONS**

| | SP ULSG W/ NO LAPSE CHANGE | SP ULSG W/ CV ENDOWMENT | SPECIFIED PREMIUM ULSG | SHADOW ACCOUNT ULSG |
|---|---|---|---|---|
| INTEREST EARNED ON AV | 332,773 | 497,218 | 406,743 | 128,117 |
| INTEREST CREDITED TO AV | (274,118) | (409,038) | (336,478) | (82,593) |
| INTEREST MARGIN | 58,655 | 88,180 | 70,265 | 45,525 |
| | | | | |
| COLLECTED COI CHARGES | 188,798 | 288,133 | 372,497 | 511,628 |
| AV RELEASED ON DEATH | 120,011 | 210,453 | 130,028 | 15,383 |
| DEATH BENEFITS PAID | (308,763) | (498,521) | (498,521) | (498,521) |
| MORTALITY MARGIN | 46 | 65 | 4,005 | 28,491 |
| | | | | |
| AV RELEASED ON SURRENDER | 285,793 | 180,355 | 153,405 | 63,649 |
| SURRENDERS PAID | (208,795) | (139,080) | (113,224) | (28,842) |
| SURRENDER MARGIN | 76,998 | 41,275 | 40,181 | 34,807 |
| | | | | |
| EXPENSE LOADS COLLECTED | 47,083 | 59,157 | 149,125 | 176,357 |
| ACQUISITION EXPENSE | (3,889) | (3,889) | (3,889) | (3,889) |
| MAINTENANCE EXPENSE | (19,937) | (25,157) | (25,157) | (21,028) |
| COMMISSIONS | (127,754) | (127,754) | (127,754) | (103,380) |
| EXPENSE MARGIN | (104,497) | (97,642) | (7,674) | 48,060 |
| | | | | |
| CHG. IN AV-RESERVE | (45,571) | (82,027) | (221,545) | (571,481) |
| INT. EARNED ON AV/RES DIFF | 27,310 | 51,175 | 142,943 | 371,726 |
| PRE-TAX STATUTORY PROFIT | 12,930 | 1,008 | 28,172 | (42,872) |

- When the lapse rate is decreased to reflect assumed policyholder behavior on the specified premium product, the margins move accordingly. Because less business surrenders, there is more account value in force on which to earn the spread. The mortality margin remains minimal because COI rates are equal to expected mortality. The surrender margin decreases because there are fewer lapses. The expense margin is less negative because the load charges are set to be larger than the maintenance expenses. Because more business remains in force, the cost of the setting-up reserves above the

**When the lapse rate is decreased to reflect assumed policyholder behavior on the specified premium product, the margins move accordingly. Because less business surrenders, there is more account value in force on which to earn the spread.**

account value is larger. The changes in margins do not cover the additional reserve cost so the present value of profits decreases, and we can say the product is lapse-supported. Changing the lapse rates to reflect the predicted policyholder behavior accentuates the cost of the secondary guarantee.

**In today's market, UL products are often customized specifically for the secondary guarantee. COI and load rates are set artificially high so that the account value runs out before maturity, meaning that the account value structure would not be marketable without the secondary guarantee. This creates a situation where it becomes harder to explicitly identify the costs of the secondary guarantee.**

Up to now we have discussed secondary guarantees on UL products that can stand alone without the guarantee. In today's market, UL products are often customized specifically for the secondary guarantee. COI and load rates are set artificially high so that the account value runs out before maturity, meaning that the account value structure would not be marketable without the secondary guarantee. This creates a situation where it becomes harder to explicitly identify the cost of the secondary guarantee.

- For the next iteration of the specified premium product, loads and COI rates were increased to a level that causes the account value to go to zero after 39 years. Interest and surrender margins decrease because of the lower account values. The mortality and expense margins increase because of the additional charges. Although the reserve levels are the same as in the previous iteration, the lower account values cause a large negative jump in the present value of account value to reserve differences. Overall, the present value of profits increases because the increase in loads collected and decrease in interest credited offset the change in the account value to reserve difference. Note how the sum of the interest earned on the account value and on the account value to reserve difference is nearly the same between the two iterations because the reserve is unchanged. With the change to account value mechanics being responsible for the additional profits, it is difficult to say if the cost of the secondary guarantee has changed. Obviously the secondary guarantee is now responsible for keeping the policy in force when the account value runs out, but that happens because of the artificial changes in mechanics.

- For the final iteration, the product was converted to a shadow account design with lower premiums, larger credited rate spread, larger premium load, and higher COI rates. The account value runs out after just 21 years. Despite the wider spread the interest margin decreases because there is much less account value. In the mortality margin, much of the revenue shifts to the COI charge from the account value released and the total margin increases. Again there are fewer surrender benefits taken, so that margin declines. The additional premium load is enough to cause a positive expense margin. The net positive change in the margins is more than wiped out by the large increase in the account value to reserve difference because there is so little account value. This occurs even though the shadow account design produces lower reserve levels than the specified premium design. Overall, when compared with the prior iteration, the cost of the guarantee has increased and is not sufficiently offset by other profit drivers to avoid a drop in profitability.

## C3 PHASE III

Much attention has been paid to the forthcoming revisions to valuation law that will introduce a principles-based approach to statutory reserving for life insurance in the United States. Under separate consideration is an extension of the principles-based approach to risk-based capital (RBC) for insurance products. The previous stages, C3 Phases I and II, have applied to annuities and single premium life insurance, but the new Phase III would be applied specifically to life insurance. It would replace the current factor-based system for determining the C3 component of the RBC framework. While it remains to be seen what the final outcome and scope will be, any new instructions on required capital almost certainly will be applicable to universal life insurance with secondary guarantees.

**While it remains to be seen what the final outcome and scope will be, any new instructions on required capital almost certainly will be applicable to universal life insurance with secondary guarantees.**

The most recent exposure draft of new C3 RBC instructions was released by the National Association of Insurance Commissioners (NAIC) in late 2009. The process for calculating the capital requirement under C3 Phase III can be summarized briefly as follows:

- At a valuation date, project liability and asset cash flows over a range of scenarios with starting assets set at a level equal to the statutory reserves.
- For each scenario, determine the deficiency of accumulated asset balances compared with the aggregate cash value of the liabilities.
- For each scenario, discount the stream of deficiency values back to the valuation date. Determine the largest present value of deficiency for each scenario noting that the value may be negative, which indicates that accumulated assets were always larger than cash values.
- Add the greatest present value of deficiency from each scenario to the starting asset balance to determine the *Scenario Amounts*. Calculate the CTE90 statistic of the Scenario Amounts as the average of the largest 10% of the values to get the *Stochastic Amount*. Subtract the statutory reserve from the Stochastic Amount to obtain the required C3 capital amount for the block of business.

The principles-based calculation of C3 Phase III should be completed at some aggregate level of business. However, in a pricing environment, actuaries may want to recognize the capital requirements of individual pricing cells to assess both the accuracy of traditional surplus estimates and the profit impact of the new requirements. This presents a challenge as cells at different levels of pricing competitiveness may be unevenly responsible for the aggregate C3 capital requirements. To assign all of the capital blame to cells that generate C3 Phase III deficiencies may unfairly skew cell-level analysis. Furthermore, the C3 requirement must be projected over the life of the policy because the stochastic calculation could generate different levels of capital at issue and throughout the policy lifetime.

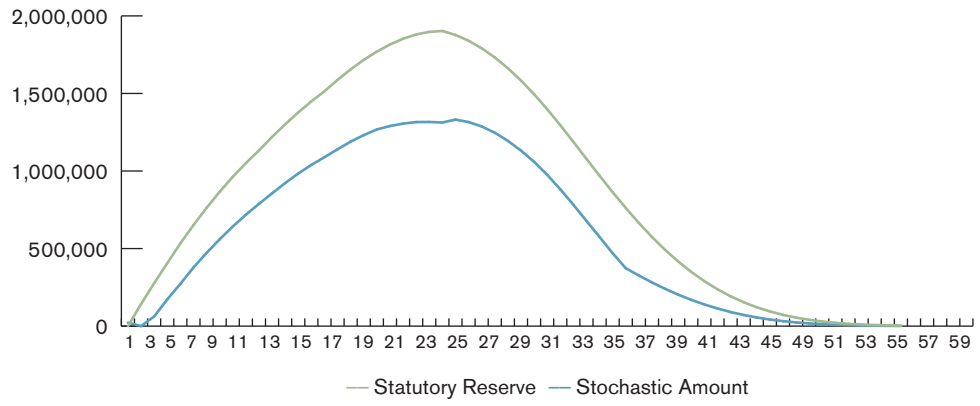
To illustrate an initial step in this analysis, we calculated the C3 Phase III capital requirements for the single pricing cell of two of our sample ULSG products. At each valuation date in a projection, our model calculates 100 stochastic paths and determines the "Stochastic Amount" or total level of assets that would be required by C3 Phase III. The tables below summarize the statutory reserves and assets, the Stochastic Amount, and the C3 capital requirement in the factor-based and C3 Phase III worlds for the specified premium and shadow account ULSG products. The accompanying charts show the projected paths of the statutory reserve and C3 Phase III stochastic amount. Note that the factor-based C3 component shown is 0.77% times the reserve amount and represents just one component of the current RBC framework.

## ULSG DESIGN 2: SPECIFIED PREMIUM

**FIGURE 23: SPECIFIED PREMIUM ULSG**

| PROJECTION YEAR | STATUTORY RESERVE & ASSET | C3 PHASE III STOCHASTIC AMOUNT | FACTOR BASED C3 REQUIREMENT | C3 PHASE III REQUIREMENT |
|---|---|---|---|---|
| 1 | 0 | 22,339 | 0 | 22,339 |
| 2 | 141,947 | 0 | 1,093 | 0 |
| 3 | 276,606 | 61,921 | 2,130 | 0 |
| 4 | 405,178 | 172,190 | 3,120 | 0 |
| 5 | 533,460 | 272,234 | 4,108 | 0 |
| 6 | 651,036 | 377,570 | 5,013 | 0 |
| 7 | 762,027 | 471,892 | 5,868 | 0 |
| 8 | 865,694 | 559,298 | 6,666 | 0 |
| 9 | 962,280 | 641,860 | 7,410 | 0 |
| 10 | 1,050,698 | 717,980 | 8,090 | 0 |
| 15 | 1,448,823 | 1,039,264 | 11,156 | 0 |
| 20 | 1,769,809 | 1,267,725 | 13,628 | 0 |
| 25 | 1,902,723 | 1,312,616 | 14,651 | 0 |
| 30 | 1,662,871 | 1,194,555 | 12,804 | 0 |
| 40 | 665,168 | 326,352 | 5,122 | 0 |
| 50 | 94,605 | 42,604 | 728 | 0 |

**FIGURE 24: SPECIFIED PREMIUM ULSG RESERVES AND C3 PHASE III**



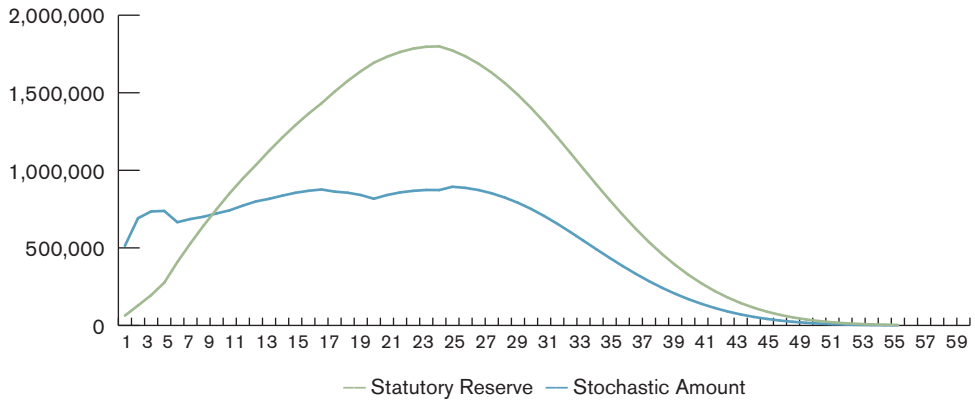

For our specified premium product, we found that the C3 requirement under Phase III would be zero after the first year. There is a requirement in the first year primarily because there is no statutory reserve. The necessary capital is relatively low and could be interpreted roughly to mean that just $22,239 is needed to ensure asset sufficiency because the future cash flows from the liabilities are significant. While the C3 Phase III capital requirement may be much higher than the factor-based requirement in the first year for this product, it could be an acceptable trade-off for the zero capital levels thereafter. With the potential of a heaped C3 component in the RBC, a pricing actuary might want to revise target surplus estimates accordingly.

## ULSG DESIGN 3: SHADOW ACCOUNT

**FIGURE 25: SHADOW ACCOUNT**

| PROJECTION YEAR | STATUTORY RESERVE & ASSET | C3 PHASE III STOCHASTIC AMOUNT | FACTOR BASED C3 REQUIREMENT | C3 PHASE III REQUIREMENT |
|---|---|---|---|---|
| 1 | 63,298 | 513,770 | 487 | 450,471 |
| 2 | 128,537 | 691,584 | 990 | 563,047 |
| 3 | 195,100 | 734,760 | 1,502 | 539,660 |
| 4 | 275,420 | 738,177 | 2,121 | 462,757 |
| 5 | 407,965 | 665,508 | 3,141 | 257,543 |
| 6 | 529,217 | 686,024 | 4,075 | 156,807 |
| 7 | 643,279 | 700,628 | 4,953 | 57,349 |
| 8 | 749,621 | 722,014 | 5,772 | 0 |
| 9 | 852,680 | 742,349 | 6,566 | 0 |
| 10 | 947,142 | 772,447 | 7,293 | 0 |
| 15 | 1,364,175 | 867,897 | 10,504 | 0 |
| 20 | 1,693,550 | 816,596 | 13,040 | 0 |
| 25 | 1,798,947 | 872,756 | 13,852 | 0 |
| 30 | 1,562,416 | 824,131 | 12,031 | 0 |
| 40 | 622,306 | 332,330 | 4,792 | 0 |
| 50 | 88,755 | 41,934 | 683 | 0 |

**FIGURE 26: SHADOW ACCOUNT ULSG RESERVES AND C3 PHASE III**




For our shadow account product, we found that the C3 requirement is $450,471 in the first year, increases in the second year, and then runs off over five more years. This could indicate that, in an economic sense, the asset level backing the early-year reserves is subject to significant interest rate risk. In subsequent years, when the excess reserve continues to grow, the risk is not as substantial. Compared with the traditional factor-based capital requirement, the C3 Phase III result is much higher and would represent an almost unbearable capital strain. However, at an aggregate level the projected deficiencies in the Phase III calculations from this sample cell could be offset by sufficiencies in other cells so that the aggregate capital requirement is feasible.

Considering the example above, we don't expect that it would be easy to achieve an even distribution of the C3 requirement across pricing cells, especially with the pressure of price competition and products designed to minimize statutory reserve levels. It might become necessary to adjust the product design

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and rates to get to an acceptable model office outcome, but certain cells may still look poor when their individual C3 Phase III contribution is considered. Even if the aggregate C3 Phase III requirement comes out similar enough to the current factor-based requirement that target surplus estimates do not need adjustment, a pricing actuary will need to consider the individual cells because of the risk that the sales distribution may not match the model office.

# APPENDIX A

## DETAILED IRR/ROE ANALYSIS FOR CURRENT ASSUMPTION UL PRODUCT

In order to better understand the relationship between statutory IRR and GAAP ROE, this analysis compares these profit measures after a variety of changes away from the initial assumptions. The initial assumptions are designed so the IRR and ROE have similar values.

- Statutory Profit = GAAP Profits
  - As a baseline we set up this projection to obtain statutory and GAAP profits that are equal. This required assumptions that no acquisition expenses or commissions be deferred on a GAAP basis, that there is no DAC tax or target surplus, and that reserves are equal to account value.
  - With no target surplus or FAS97 DAC and with statutory reserves equal to the GAAP benefit reserve, no equity base exists with which to calculate an ROE.
  - To justify assuming no deferred costs, commissions were changed to a level pattern. As a result, there is no first-year strain and an IRR cannot be calculated.
  - We calculated the present value of cash flows as an alternative profit measure. Because the statutory and GAAP profits are equal, the present values are the same on both bases. At 5% and 8% discount rates, the present values of profits are $104,551 and $77,557, respectively.
- IRR-ROE similar (*initial*)
  - For this *initial* projection the goal was to obtain ROEs equal to the IRR. We found that methods identified by the prior analysis of IRR and ROE on term insurance were also necessary for our analysis. This included no DAC tax, no target surplus based on reserves or the net amount at risk (NAR), and FAS97 DAC interest rate equal to IRR. Additionally we found that reserves should be set equal to account value. We also reverted to heaped first-year commissions with regular deferrals of expenses and commissions in the calculation of a DAC.
  - Given the complexity of universal life products, we stopped short of making every possible change to achieve a perfectly level ROE equal to IRR. The IRR for this projection is 10.5%. The first-year ROE is low at 4.7% (because of first-year cash-flow timing), but is followed by 35 years of ROEs that fluctuate between 10.5% and 10.6%. After that time the ROEs gradually decline for the remainder of the projection period.
  - Unlike the first projection, the commissions create a strain on statutory profits so that an IRR can be calculated. The FAS97 DAC and target surplus provide the equity base necessary to calculate an ROE. For comparison with the baseline projection, the net present values of statutory profits are $51,016 and $17,209 at 5% and 8% discount rates, respectively. The 5% and 8% discount rates were chosen because they are similar to a net investment earned rate and common embedded value discount rate, respectively. While these are common discount rates, no industry standard exists.

**FIGURE 27: PROJECTION 2, IRR ~ ROE**

| | |
|---|---|
| **STATUTORY IRR** | **10.5%** |
| **SUM GAAP ROE** | **10.5%** |
| **WTD. AVE. GAAP ROE @ 8%** | **7.8%** |

- Realistic target surplus

  — A realistic target surplus assumption would reflect surplus based on reserves and net amount at risk in addition to premiums.

  — Because the *initial* projection included only the premium component of target surplus, a projection with realistic target surplus results in a larger strain in the first year. Statutory profits are reduced in early years as a higher level of surplus is required, but eventually the interest earned on that higher level of surplus offsets the cost of its growth. In later years profits are higher as the surplus is released. A net result is a decrease in the IRR to 8.2%.

  — On a GAAP basis, profits increase because of the interest income on the additional surplus. However, the resulting stream of ROEs is lower than the IRR after the first 10 years because the additional surplus increases the equity base and the interest on it is earned at a rate lower than the previous ROEs. Compared with the *initial* projection, the ROEs are slightly higher than the IRR in the second through ninth years and consistently decline over the projection period.

**FIGURE 28: PROJECTION 3, REALISTIC TARGET SURPLUS**

| | |
|---|---|
| **STATUTORY IRR** | **8.2%** |
| **SUM GAAP ROE** | **7.6%** |
| **WTD. AVE. GAAP ROE @ 8%** | **5.9%** |

- DAC tax

  — Although the inclusion of a DAC tax on premiums may be considered a statutory change, there is also a GAAP impact given the assumptions of the *initial* approach. Because the statutory IRR is being used as the discount rate for the DAC calculation, the change in IRR for the DAC tax shifts the FAS97 DAC runoff and causes the GAAP profits to change. If a more typical DAC interest rate were used, there would not be any impact on the GAAP profits. The GAAP equity base changes slightly because of the impact of the DAC tax on deferred tax liability.

  — The IRR for this projection decreased because early-year statutory profits were reduced by the additional tax.

  — ROEs have also decreased slightly in early years and more significantly in the tail. The ROEs are larger than the IRR in Years 2-5 before declining to less than the IRR. The overall pattern is a decreasing ROE compared with the *initial*, but it exhibits an S-shape reaching a minimum after 11 years and a maximum after 30 years.

**FIGURE 29: PROJECTION 4, DAC TAX**

| | |
|---|---|
| **STATUTORY IRR** | **9.3%** |
| **SUM GAAP ROE** | **9.2%** |
| **WTD. AVE. GAAP ROE @ 8%** | **6.9%** |

- FAS97 interest rate

  — The interest rates used in FAS97 calculations would generally not be linked to a statutory IRR. One approach is to use the crediting rate on the policy account value. Because the first-year credited rate is set at 4.50%, that same rate might be selected for FAS97 calculations.

— A change in a GAAP interest rate has no impact on the statutory accounting, so the IRR for the cell remains the same as the *initial* at 10.5%.

— With a FAS97 interest rate at 4.5% instead of 10.5%, the present value of estimated gross profits is much larger and the amortization rate is lower. However, the DAC balance accrues interest at the lower rate, so the resulting DAC pattern, GAAP profits, and equity base are not significantly different. There is enough of a shift, though, that the pattern of ROEs changes to upward sloping. Initially the ROEs are very similar to those in the *initial* projection, but after duration 15 the pattern becomes increasing for the remainder of the projection.

**FIGURE 30: PROJECTION 5, FAS97 INTEREST RATE**

| | |
|---|---|
| **STATUTORY IRR** | **10.5%** |
| **SUM GAAP ROE** | **10.9%** |
| **WTD. AVE. GAAP ROE @ 8%** | **7.9%** |

- California method reserves

— Before moving to UL model regulation reserves, we examined the impact of using a California method statutory reserve, the average of account value and cash value. This resulted in much lower reserve levels at issue compared with the *initial* with the reserves converging at the end of the 20-year surrender charge period.

— As a result of the lower reserve there is less strain on statutory profits in the first year, contributing to an increase in the IRR. This increase is tempered by the reduction in investment income caused by having a smaller asset base for the first 20 years.

— On a GAAP basis the reduced investment income also flows through the profits. The reduced statutory reserve has no offset in also reducing the GAAP equity base. The result is larger ROEs in early years that peak at 35%, followed by a declining pattern of ROEs that are lower in the tail than the *initial* ROEs and lower than the IRR after Year 25.

**FIGURE 31: PROJECTION 6, CALIFORNIA RESERVE METHOD**

| | |
|---|---|
| **STATUTORY IRR** | **17.4%** |
| **SUM GAAP ROE** | **13.1%** |
| **WTD. AVE. GAAP ROE @ 8%** | **10.7%** |

- UL model regulation reserves

— UL model regulation reserves are lower than California method reserves in early years, and by year 8 they are equal to the cash value. They remain equal to cash value for many years and in the tail the reserves are slightly larger.

— The IRR is 39.7% for this projection because the lower levels reduce the strain compared with the *initial*. On a GAAP basis the difference between the low statutory reserve and the GAAP benefit reserve (account value) generates low or negative equity in the third through 11th policy years, so rational ROEs cannot be calculated. In the second and third durations, ROEs of 30% and 23% are observed. After the period of negative equity the next ROE is about 50% (which is due to the very small equity base compared with GAAP profit) followed by a rapidly decreasing pattern as the GAAP equity base grows.

— For this analysis we included the negative equity when calculating the present value and sum of equity, so the point statistic ROEs benefit from leverage. There are other methods used in the industry to handle negative equity situations, but that is outside the scope of this report.

**FIGURE 32: PROJECTION 7, ULMR RESERVE METHOD**

| | |
|---|---|
| **STATUTORY IRR** | **39.7%** |
| **SUM GAAP ROE** | **18.1%** |
| **WTD. AVE. GAAP ROE @ 8%** | **18.9%** |

- Real approach (*realistic*)

  — A realistic approach would combine each of the changes discussed above except for California method reserves (i.e., target surplus, DAC tax, FAS97 interest rate equal to first-year credited rate, and UL model regulation reserves).

  — The resulting IRR is 11.1%. This is a slight increase from the *initial* that is driven mainly by lower first-year strain and larger profits in the tail.

  — The equity levels produced by the combination of changes are very different than those in the *initial* projection. The interaction of the model regulation reserves, surplus, and, to a lesser extent, the FAS97 interest rate, results in lower equity for 11 years and higher equity thereafter. Driven by the investment income differences, the GAAP profits are similarly different from the *initial*. The result is a pattern of ROEs that range from 19% to 10% over the first 10 years before declining to and remaining close to level at about 7%.

**FIGURE 33: PROJECTION 8, REALISTIC APPROACH**

| | |
|---|---|
| **STATUTORY IRR** | **11.1%** |
| **SUM GAAP ROE** | **8.1%** |
| **WTD. AVE. GAAP ROE @ 8%** | **6.6%** |

Before moving on to analysis of ULSG products, we explored the profit measure impacts of modifying COI rates, per-unit load structure, and interest spread. For each test, we changed two of the product mechanics in order to maintain a policy that develops significant cash value and endows at maturity. The full ROE stream and additional data for each projection can be found in Appendix B.

- Heaped per-unit load with lower interest spread

  — A $1.75 per-unit load for the first 10 years was added to front-load the profits by reducing the cash value available for surrender benefits and reserve levels. To maintain the cash value endowment a lower interest spread was needed.

  — The result is an IRR of 22.7% compared with the 11.1% in the *realistic* projection.

  — The heaped loads pump up GAAP profits in the early years but are partially offset because an unearned revenue liability is established and amortized over the life of the contract. The lower interest spread results in front-loaded profits when other margins are more significant than the interest margin. This results in more DAC amortization over the first 15 years that partially offsets the additional revenue from the loads. The ROEs are between 18% and 32% in the first 12 years before declining to about the same 7% ROE level as in the *realistic* run.

— The use of front-ended loads to increase the IRR has a similar effect on early ROEs with minimal trade-off on ROEs in the tail.

**FIGURE 34: PROJECTION 9, HEAPED PER-UNIT**

| RESULT | "REALISTIC" UL | PROJECTION 9 |
|---|---|---|
| STATUTORY IRR | 11.1% | 22.7% |
| SUM GAAP ROE | 8.1% | 11.2% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 10.8% |

- Increase interest spread with lower COI rates

  — Increasing the interest spread to 125 bps from roughly 92 bps and reducing the COI rates to a lower percentage of the underlying base table has the effect of increasing IRR slightly compared with the *realistic* projection. The main driver of the change in statutory profits appears to be the slower growth of account value and reserve.

  — GAAP profits are higher in early years because the larger interest spread increases the interest margin. In later years, the lower COIs create a negative mortality margin that overwhelms the additional spread. The result is a pattern of ROEs that are larger than the IRR and *realistic* ROEs over the first 10 years before declining to be less than the IRR and *realistic* ROEs.

**FIGURE 35: PROJECTION 10, INCREASE INTEREST SPREAD**

| RESULT | "REALISTIC" UL | PROJECTION 10 |
|---|---|---|
| STATUTORY IRR | 11.1% | 11.6% |
| SUM GAAP ROE | 8.1% | 8.3% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 6.9% |

- Decrease COIs with a level per-unit load

  — For this projection COI rates were reduced to 90% of expected mortality and a $0.84 per-unit load in all years was used to balance the cash value growth.

  — Similar to the previous test, the increase to the per-unit loads serves to front-load the profits and increase the IRR. Even though the load is level in this case, it is essentially front-loaded because it is used to balance lower COI charges which would have grown in future years.

  — The IRR increases to 16.7% because of the impact of the loading on the growth of statutory reserves and cash value for surrender.

  — For the GAAP profits, larger tail losses on mortality are offset by the load income across all years. Because the load is level we elected not to set-up a URL; however, there may be a case for doing so because the load could be argued to be an offset for the assumed mortality losses. The ROEs have increased in early durations to between 15% and 23% and exceed the IRR and the ROEs in the *realistic* run. After the 10th duration the ROEs decline steadily.

**FIGURE 36: PROJECTION 11, DECREASE COIs**

| RESULT | "REALISTIC" UL | PROJECTION 11 |
|---|---|---|
| STATUTORY IRR | 11.1% | 16.7% |
| SUM GAAP ROE | 8.1% | 9.1% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 8.5% |

- Increase COIs with lower interest spread
  - For this projection COI rates were raised to 110% of expected mortality. The spread was lowered to about 59 bps to maintain the cash value at maturity.
  - The IRR decreased to 10.6% compared with the *realistic* run because the reserve is setting up slightly faster with faster account value growth in early years.
  - The impact of a larger mortality margin is offset in early years by a smaller interest margin, so GAAP profits are lower in early durations and higher in later durations. The ROEs are still larger than IRR in early durations, as they are in the *realistic* projection, but they are not as high. In later durations the ROEs have increased somewhat compared with the *realistic* projection and show an increasing pattern, but they are far below the IRR.

**FIGURE 37: PROJECTION 11, INCREASE COIs**

| RESULT | "REALISTIC" UL | PROJECTION 12 |
|---|---|---|
| STATUTORY IRR | 11.1% | 10.6% |
| SUM GAAP ROE | 8.1% | 7.9% |
| WTD. AVE. GAAP ROE @ 8% | 6.6% | 6.3% |

The table in Figure A-12 summarizes the findings from the four variations on our sample UL product design. It appears that adding a load to the product is one of the most beneficial changes for this design because even a level load depresses account value in early years, which reduces surrender benefits and reserves. On a GAAP basis the income from the load raises early-year profits. Our product design does not appear to be as sensitive to changes to COIs or interest spread. The outcomes from making similar changes to other product designs may not be the same as what we have experienced, but the concept of testing slight variations is a useful exercise. All of the results from product design changes below include the same pricing assumptions.

**FIGURE 38: SUMMARY OF UNIVERSAL LIFE PRODUCT DESIGN VARIATIONS**

| | STATUTORY IRR | SUM GAAP ROE | WEIGHTED AVERAGE GAAP ROE @ 8% |
|---|---|---|---|
| BASE | 11.1% | 8.1% | 6.6% |
| HEAPED PER-UNIT LOAD WITH LOWER INTEREST SPREAD | 22.7% | 11.2% | 10.8% |
| INCREASE INTEREST SPREAD WITH LOWER COI RATES | 11.6% | 8.3% | 6.9% |
| DECREASE COIS WITH A LEVEL PER-UNIT LOAD | 16.7% | 9.1% | 8.5% |
| INCREASE COIS WITH LOWER INTEREST SPREAD | 10.6% | 7.9% | 6.3% |

# APPENDIX B

## COMPARISON OF GAAP ROE TO STATUTORY IRR: ADDITIONAL DATA

**FIGURE 39**

| | UL STAT PROFIT = GAAP PROFIT | UL IRR ~ROE *INITIAL* | UL REALISTIC TARGET SURPLUS | UL DAC TAX | UL FAS97 INTEREST RATE | UL CA METHOD RESERVES | UL ULMR METHOD RESERVES | UL REALISTIC APPROACH |
|---|---|---|---|---|---|---|---|---|
| **STATUTORY IRR** | | | | | | | | |
| | N/A | 10.5% | 8.2% | 9.3% | 10.5% | 17.4% | 39.7% | 11.1% |
| **STATUTORY PROFIT NPV** | | | | | | | | |
| 5% DISCOUNT | 104,551 | 51,016 | 42,445 | 44,832 | 51,016 | 51,016 | 51,015 | 36,955 |
| 8% DISCOUNT | 77,557 | 17,209 | 1,748 | 10,180 | 17,209 | 27,204 | 32,911 | 12,012 |
| **GAAP RETURN ON EQUITY POINT STATISTICS** | | | | | | | | |
| SUM | N/A | 10.5% | 7.6% | 9.2% | 10.9% | 13.1% | 18.1% | 8.1% |
| 8% DISCOUNT | N/A | 7.8% | 5.9% | 6.9% | 7.9% | 10.7% | 18.9% | 6.6% |
| **YEAR** | **GAAP RETURN ON EQUITY** | | | | | | | |
| 1 | N/A | 4.7% | 5.0% | 6.6% | 14.2% | -5.8% | -34.3% | 7.8% |
| 2 | N/A | 10.5% | 9.5% | 10.2% | 10.8% | 13.6% | 30.0% | 18.1% |
| 3 | N/A | 10.6% | 9.6% | 10.1% | 11.5% | 23.5% | 23.2% | 19.4% |
| 4 | N/A | 10.5% | 9.0% | 9.6% | 10.4% | 34.9% | 300.7% | 16.2% |
| 5 | N/A | 10.5% | 8.8% | 9.4% | 10.2% | 29.5% | -95.6% | 15.7% |
| 6 | N/A | 10.5% | 8.6% | 9.2% | 10.2% | 25.5% | -39.3% | 15.5% |
| 7 | N/A | 10.5% | 8.5% | 9.1% | 10.3% | 22.7% | -22.8% | 15.3% |
| 8 | N/A | 10.5% | 8.4% | 9.0% | 10.3% | 20.5% | -14.7% | 15.0% |
| 9 | N/A | 10.5% | 8.2% | 8.9% | 10.2% | 19.1% | -13.6% | 13.2% |
| 10 | N/A | 10.5% | 8.1% | 8.8% | 10.1% | 17.4% | -22.7% | 10.8% |
| 11 | N/A | 10.5% | 7.8% | 8.7% | 9.4% | 17.3% | -86.9% | 8.6% |
| 12 | N/A | 10.5% | 7.7% | 8.8% | 9.4% | 16.2% | 185.3% | 8.0% |
| 13 | N/A | 10.5% | 7.6% | 8.8% | 9.5% | 15.2% | 52.0% | 7.6% |
| 14 | N/A | 10.5% | 7.5% | 8.9% | 9.5% | 14.5% | 32.6% | 7.3% |
| 15 | N/A | 10.5% | 7.4% | 8.9% | 9.5% | 13.9% | 24.9% | 7.1% |
| 16 | N/A | 10.5% | 7.3% | 8.9% | 9.4% | 13.6% | 22.8% | 6.7% |
| 17 | N/A | 10.5% | 7.2% | 9.0% | 9.5% | 13.1% | 19.8% | 6.6% |
| 18 | N/A | 10.5% | 7.2% | 9.0% | 9.7% | 12.6% | 17.6% | 6.6% |
| 19 | N/A | 10.5% | 7.2% | 9.1% | 9.9% | 12.2% | 16.0% | 6.5% |
| 20 | N/A | 10.5% | 7.1% | 9.1% | 10.1% | 11.8% | 14.9% | 6.5% |
| 21 | N/A | 10.5% | 7.1% | 9.2% | 10.4% | 11.4% | 13.8% | 6.5% |
| 22 | N/A | 10.6% | 7.1% | 9.2% | 10.7% | 11.3% | 13.5% | 6.6% |
| 23 | N/A | 10.6% | 7.1% | 9.3% | 11.0% | 11.1% | 13.1% | 6.6% |
| 24 | N/A | 10.6% | 7.0% | 9.3% | 11.3% | 11.0% | 12.8% | 6.7% |
| 25 | N/A | 10.6% | 7.0% | 9.3% | 11.6% | 10.8% | 12.4% | 6.8% |
| 26 | N/A | 10.6% | 7.0% | 9.4% | 12.0% | 10.6% | 12.0% | 6.8% |
| 27 | N/A | 10.6% | 7.0% | 9.4% | 12.3% | 10.5% | 11.7% | 6.9% |
| 28 | N/A | 10.6% | 7.0% | 9.4% | 12.7% | 10.3% | 11.2% | 6.9% |
| 29 | N/A | 10.6% | 6.9% | 9.4% | 13.0% | 10.1% | 10.8% | 7.0% |
| 30 | N/A | 10.6% | 6.9% | 9.4% | 13.4% | 9.9% | 10.3% | 7.0% |

**FIGURE 39 (CONTINUED)**

| | UL STAT PROFIT = GAAP PROFIT | UL IRR ~ROE *INITIAL* | UL REALISTIC TARGET SURPLUS | UL DAC TAX | UL FAS97 INTEREST RATE | UL CA METHOD RESERVES | UL ULMR METHOD RESERVES | UL REALISTIC APPROACH |
|---|---|---|---|---|---|---|---|---|
| **YEAR** | **GAAP RETURN ON EQUITY** | | | | | | | |
| 31 | N/A | 10.6% | 6.9% | 9.4% | 13.8% | 9.6% | 9.9% | 7.1% |
| 32 | N/A | 10.6% | 6.9% | 9.4% | 14.2% | 9.4% | 9.3% | 7.1% |
| 33 | N/A | 10.6% | 6.8% | 9.4% | 14.6% | 9.2% | 8.8% | 7.1% |
| 34 | N/A | 10.6% | 6.8% | 9.3% | 15.0% | 8.9% | 8.3% | 7.2% |
| 35 | N/A | 10.5% | 6.8% | 9.3% | 15.4% | 8.7% | 7.7% | 7.2% |
| 36 | N/A | 10.5% | 6.8% | 9.2% | 15.8% | 8.4% | 7.2% | 7.2% |
| 37 | N/A | 10.5% | 6.7% | 9.2% | 16.2% | 8.2% | 6.7% | 7.2% |
| 38 | N/A | 10.5% | 6.7% | 9.1% | 16.6% | 7.9% | 6.2% | 7.2% |
| 39 | N/A | 10.4% | 6.7% | 9.0% | 17.0% | 7.6% | 5.6% | 7.2% |
| 40 | N/A | 10.4% | 6.6% | 8.9% | 17.4% | 7.4% | 5.1% | 7.2% |
| 41 | N/A | 10.3% | 6.6% | 8.8% | 17.8% | 7.1% | 4.6% | 7.2% |
| 42 | N/A | 10.3% | 6.6% | 8.7% | 18.2% | 6.8% | 4.0% | 7.2% |
| 43 | N/A | 10.2% | 6.6% | 8.6% | 18.6% | 6.5% | 3.5% | 7.2% |
| 44 | N/A | 10.2% | 6.5% | 8.5% | 19.0% | 6.2% | 3.0% | 7.2% |
| 45 | N/A | 10.1% | 6.5% | 8.3% | 19.4% | 5.9% | 2.5% | 7.1% |
| 46 | N/A | 10.0% | 6.5% | 8.1% | 19.8% | 5.6% | 2.0% | 7.0% |
| 47 | N/A | 9.9% | 6.4% | 8.0% | 20.3% | 5.2% | 1.5% | 7.0% |
| 48 | N/A | 9.8% | 6.4% | 7.8% | 20.7% | 4.8% | 1.0% | 6.9% |
| 49 | N/A | 9.7% | 6.4% | 7.5% | 21.2% | 4.4% | 0.5% | 6.8% |
| 50 | N/A | 9.6% | 6.3% | 7.3% | 21.7% | 4.0% | 0.0% | 6.8% |
| 51 | N/A | 9.5% | 6.3% | 7.0% | 22.2% | 3.6% | -0.4% | 6.7% |
| 52 | N/A | 9.3% | 6.2% | 6.7% | 22.7% | 3.1% | -0.9% | 6.6% |
| 53 | N/A | 9.2% | 6.2% | 6.4% | 23.3% | 2.5% | -1.4% | 6.5% |
| 54 | N/A | 9.0% | 6.1% | 6.0% | 24.0% | 1.9% | -1.9% | 6.4% |
| 55 | N/A | 8.7% | 6.1% | 5.6% | 24.8% | 1.2% | -2.5% | 6.2% |
| 56 | N/A | 8.5% | 6.0% | 5.2% | 25.8% | 0.3% | -3.2% | 6.1% |
| 57 | N/A | 8.1% | 5.9% | 4.7% | 27.3% | -1.0% | -4.1% | 6.0% |
| 58 | N/A | 7.6% | 5.8% | 4.1% | 29.8% | -3.1% | -5.7% | 5.8% |
| 59 | N/A | 6.7% | 5.6% | 3.3% | 34.8% | -7.2% | -8.8% | 5.6% |
| 60 | N/A | 3.8% | 2.5% | 2.2% | 48.3% | -20.0% | -16.1% | 4.0% |

**FIGURE 40**

| | UL HEAPED PER-UNIT LOAD | UL INCREASE INTEREST SPREAD | UL DECREASE COIs | UL INCREASE COIs | ULSG SPECIFIED PREMIUM CV ENDOW | ULSG SPECIFIED PREMIUM | ULSG SHADOW ACCOUNT | ULSG SHADOW ACCOUNT FINANCING |
|---|---|---|---|---|---|---|---|---|
| **STATUTORY IRR** | | | | | | | | |
| | 22.7% | 11.6% | 16.7% | 10.6% | 6.3% | 7.2% | 5.1% | 8.3% |
| **STATUTORY PROFIT NPV** | | | | | | | | |
| 5% DISCOUNT | 55,675 | 38,289 | 46,475 | 35,785 | 44,246 | 75,748 | 3,019 | 15,092 |
| 8% DISCOUNT | 32,910 | 13,586 | 23,235 | 10,629 | (36,089) | (18,443) | (60,571) | 1,080 |
| **GAAP RETURN ON EQUITY POINT STATISTICS** | | | | | | | | |
| SUM | 11.2% | 8.3% | 9.1% | 7.9% | 6.1% | 6.6% | 5.5% | N/A* |
| 8% DISCOUNT | 10.8% | 6.9% | 8.5% | 6.3% | 6.4% | 7.2% | 4.9% | N/A* |
| **YEAR** | **GAAP RETURN ON EQUITY** | | | | | | | |
| 1 | 19.3% | 8.1% | 19.0% | 7.6% | -4.4% | 12.1% | -9.6% | -16.2% |
| 2 | 24.0% | 18.5% | 21.7% | 17.7% | 10.9% | 16.5% | 3.9% | -3.5% |
| 3 | 27.9% | 19.9% | 23.8% | 19.0% | 10.6% | 13.5% | 3.6% | -2.5% |
| 4 | 23.7% | 16.8% | 20.9% | 15.8% | 9.3% | 11.6% | 3.2% | -3.3% |
| 5 | 23.8% | 16.4% | 20.8% | 15.1% | 7.6% | 9.4% | 3.2% | -1.9% |
| 6 | 24.8% | 16.3% | 21.2% | 14.8% | 7.1% | 8.5% | 3.9% | -0.9% |
| 7 | 26.1% | 16.2% | 21.5% | 14.6% | 6.8% | 8.0% | 4.2% | 1.1% |
| 8 | 27.7% | 16.0% | 21.8% | 14.2% | 6.6% | 7.6% | 4.4% | 4.8% |
| 9 | 29.5% | 14.1% | 21.0% | 12.3% | 6.5% | 7.3% | 4.6% | 11.6% |
| 10 | 32.2% | 11.5% | 15.3% | 10.2% | 6.3% | 7.1% | 4.7% | 31.1% |
| 11 | 27.6% | 9.1% | 11.3% | 8.2% | 6.2% | 6.9% | 4.9% | 109.0% |
| 12 | 18.4% | 8.4% | 10.0% | 7.6% | 6.0% | 6.6% | 5.0% | -975.6% |
| 13 | 14.1% | 8.0% | 9.2% | 7.3% | 6.0% | 6.5% | 5.1% | -55.2% |
| 14 | 11.8% | 7.7% | 8.6% | 7.0% | 5.9% | 6.5% | 5.2% | -22.5% |
| 15 | 10.4% | 7.4% | 8.1% | 6.8% | 5.9% | 6.4% | 5.3% | -9.9% |
| 16 | 8.9% | 7.0% | 7.5% | 6.4% | 5.9% | 6.3% | 5.4% | -4.4% |
| 17 | 8.4% | 6.9% | 7.3% | 6.4% | 5.8% | 6.2% | 5.1% | 3.2% |
| 18 | 8.1% | 6.8% | 7.1% | 6.4% | 5.8% | 6.2% | 4.8% | 6.9% |
| 19 | 7.8% | 6.8% | 6.9% | 6.3% | 5.8% | 6.2% | 4.5% | 9.0% |
| 20 | 7.6% | 6.7% | 6.8% | 6.3% | 5.8% | 6.1% | 4.1% | 6.3% |
| 21 | 7.5% | 6.7% | 6.7% | 6.3% | 5.8% | 6.1% | 5.3% | -0.1% |
| 22 | 7.5% | 6.8% | 6.7% | 6.4% | 5.8% | 6.1% | 6.0% | 2.0% |
| 23 | 7.6% | 6.8% | 6.7% | 6.5% | 5.8% | 6.0% | 5.8% | 1.8% |
| 24 | 7.7% | 6.8% | 6.7% | 6.6% | 5.8% | 6.0% | 6.0% | -5.1% |
| 25 | 7.7% | 6.9% | 6.7% | 6.7% | 5.8% | 6.0% | 6.1% | -4.1% |
| 26 | 7.7% | 6.9% | 6.7% | 6.8% | 5.8% | 6.0% | 6.0% | -2.2% |
| 27 | 7.8% | 6.9% | 6.6% | 6.8% | 5.9% | 6.0% | 5.6% | -0.2% |
| 28 | 7.8% | 6.9% | 6.6% | 6.9% | 5.9% | 6.0% | 6.1% | -9.8% |
| 29 | 7.9% | 6.9% | 6.6% | 7.0% | 5.9% | 6.0% | 6.2% | -10.1% |
| 30 | 7.9% | 6.9% | 6.5% | 7.1% | 5.9% | 6.0% | 6.3% | -10.3% |

**FIGURE 40 (CONTINUED)**

| YEAR | UL HEAPED PER-UNIT LOAD | UL INCREASE INTEREST SPREAD | UL DECREASE COIs | UL INCREASE COIs | ULSG SPECIFIED PREMIUM CV ENDOW | ULSG SPECIFIED PREMIUM | ULSG SHADOW ACCOUNT | ULSG SHADOW ACCOUNT FINANCING |
|---|---|---|---|---|---|---|---|---|
| | GAAP RETURN ON EQUITY | | | | | | | |
| 31 | 7.9% | 6.9% | 6.5% | 7.1% | 5.9% | 5.9% | 6.3% | -10.1% |
| 32 | 7.9% | 6.9% | 6.4% | 7.2% | 6.0% | 5.9% | 6.4% | -9.5% |
| 33 | 8.0% | 6.9% | 6.4% | 7.3% | 6.0% | 5.9% | 6.2% | -8.0% |
| 34 | 8.0% | 6.9% | 6.3% | 7.4% | 6.0% | 5.9% | 5.8% | -5.7% |
| 35 | 8.0% | 6.8% | 6.2% | 7.4% | 6.0% | 5.8% | 6.3% | -14.1% |
| 36 | 8.0% | 6.8% | 6.1% | 7.5% | 6.0% | 5.8% | 6.4% | -16.2% |
| 37 | 8.0% | 6.8% | 6.1% | 7.6% | 6.1% | 5.7% | 6.4% | -19.1% |
| 38 | 7.9% | 6.7% | 6.0% | 7.6% | 6.1% | 5.4% | 6.5% | -22.9% |
| 39 | 7.9% | 6.7% | 5.9% | 7.6% | 6.1% | 8.1% | 6.5% | -28.5% |
| 40 | 7.9% | 6.7% | 5.9% | 7.7% | 6.1% | 7.4% | 6.6% | -37.4% |
| 41 | 7.9% | 6.6% | 5.8% | 7.7% | 6.1% | 7.3% | 6.6% | -54.1% |
| 42 | 7.8% | 6.6% | 5.8% | 7.7% | 6.1% | 7.1% | 6.6% | -100.6% |
| 43 | 7.7% | 6.6% | 5.7% | 7.7% | 6.1% | 6.9% | 6.7% | -830.5% |
| 44 | 7.6% | 6.5% | 5.6% | 7.6% | 6.1% | 6.8% | 6.7% | 126.2% |
| 45 | 7.5% | 6.5% | 5.6% | 7.5% | 6.1% | 6.6% | 6.8% | 56.5% |
| 46 | 7.4% | 6.4% | 5.5% | 7.4% | 6.2% | 11.9% | 6.8% | 35.1% |
| 47 | 7.3% | 6.4% | 5.5% | 7.4% | 6.2% | 12.0% | 6.8% | 24.5% |
| 48 | 7.2% | 6.4% | 5.4% | 7.3% | 6.2% | 12.0% | 6.8% | 18.6% |
| 49 | 7.1% | 6.3% | 5.4% | 7.1% | 6.2% | 12.0% | 6.8% | 14.8% |
| 50 | 7.0% | 6.3% | 5.4% | 7.0% | 6.2% | 12.0% | 6.8% | 12.2% |
| 51 | 6.9% | 6.4% | 5.4% | 6.8% | 6.2% | 11.8% | 6.7% | 10.2% |
| 52 | 6.8% | 6.4% | 5.5% | 6.6% | 6.2% | 11.6% | 6.6% | 8.8% |
| 53 | 6.7% | 6.5% | 5.6% | 6.3% | 6.1% | 11.3% | 6.5% | 7.6% |
| 54 | 6.5% | 6.8% | 5.8% | 6.0% | 6.1% | 10.8% | 6.3% | 6.7% |
| 55 | 6.4% | 7.2% | 6.2% | 5.6% | 6.1% | 10.2% | 6.0% | 6.0% |
| 56 | 6.2% | 8.1% | 7.0% | 5.1% | 6.0% | 9.4% | 5.7% | 5.5% |
| 57 | 6.0% | 10.2% | 8.9% | 4.5% | 6.0% | 8.6% | 5.4% | 5.2% |
| 58 | 5.9% | 17.5% | 17.0% | 3.8% | 5.9% | 7.6% | 5.2% | 4.9% |
| 59 | 5.6% | -80.3% | -31.0% | 3.1% | 5.8% | 6.8% | 4.9% | 4.8% |
| 60 | 4.0% | -5.2% | -3.0% | 1.9% | 4.7% | 5.9% | 4.6% | 4.5% |

* Negative GAAP equity does not allow calculation of rational GAAP ROE point statistics

# APPENDIX C

## PRODUCT SPECIFICATIONS AND ACTUARIAL ASSUMPTIONS

**FIGURE 41**

**PRICING CELL**

| | |
|---|---|
| CELL: | AGE 55, MALE, NON-SMOKER, STANDARD CLASS |
| AVERAGE FACE AMOUNT: | $1,000,000 |
| POLICIES IN CELL: | 7 |
| TOTAL FACE: | $7,000,000 |
| DEATH BENEFIT: | OPTION A |
| ISSUE: | FIRST MONTH OF PROJECTION |

**FIGURE 42**

**BASIC PRODUCT SPECIFICATIONS (SOME PROJECTIONS USE OTHER VARIATIONS AS NOTED IN REPORT)**

| | |
|---|---|
| PREMIUMS: | $17.92 PER UNIT;<br>$14.50 PER UNIT FOR SHADOW ACCOUNT ULSG |
| PREMIUM MODE/PATTERN: | ANNUAL/LEVEL LIFETIME |
| INSURANCE PERIOD: | TO AGE 121 |
| COIS: | 60% OF 2001 VBT TABLE;<br>100% OF 2001 CSO ANB TABLE FOR SHADOW ACCOUNT ULSG |
| NAR DISCOUNTING: | NONE |
| PREMIUM LOAD: | 5% ALL PREMIUM/ALL YEARS;<br>10% ALL PREMIUM/ALL YEARS FOR SHADOW ACCOUNT ULSG |
| POLICY LOAD: | $84 ANNUALLY PER POLICY |
| UNIT LOAD: | NONE;<br>$1.50 FOR SPECIFIED PREMIUM ULSG WITH MINIMAL CASH VALUE AND FOR SHADOW ACCOUNT ULSG |
| SURRENDER CHARGE: | $40 PER UNIT YEAR 1;<br>DECLINE BY $1.60 PER YEAR THROUGH YEAR 8;<br>DECLINE BY $2.40 PER YEAR TO $0.00 IN YEAR 20 |
| AT-ISSUE CREDITED RATE: | 4.50%;<br>3.00% FOR SHADOW ACCOUNT ULSG |
| CREDITED RATE SPREAD: | 0.92%;<br>2.00% FOR SHADOW ACCOUNT ULSG |
| GUARANTEED CREDITED RATE: | 3.00%;<br>2.00% FOR SHADOW ACCOUNT ULSG |

**FIGURE 43**

**PROJECTION ASSUMPTIONS**

| | |
|---|---|
| COMMISSIONS: | 110% FIRST YEAR ONLY |
| ACQUISITION EXPENSES: | $600 PER POLICY |
| MAINTENANCE EXPENSES: | $50 ANNUALLY PER POLICY WITH 2% INFLATION FOR 20 YEARS;<br>2% ALL PREMIUMS/ALL YEARS |
| EARNED INTEREST RATE: | 5.00% |
| MORTALITY: | 60% OF 2001 VBT TABLE |
| LAPSES: | 8% YEARS 1-3;<br>6% YEARS 4-10;<br>4% YEARS 11-15;<br>2% AFTER;<br><br>UNIFORMLY DISTRIBUTED;<br><br>ULSG LAPSE RATES ARE ½ OF THESE AND OCCUR AT PREMIUM DUE DATES |
| FIT: | 35% |
| VALUATION MORTALITY: | 2001 CSO ANB SELECT AND ULTIMATE |
| VALUATION INTEREST RATE: | 4.00% |

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