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# A Novel Approach to Valuing an Insurance Company's Economic Surplus

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# A Novel Approach to Valuing an Insurance Company's Economic Surplus

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## Abstract
The computation of the market value of economic surplus is a critical step in the valuation of a company; a line of business; or a product line for the purpose of merger/acquisition, financial reporting or internal management. The market value of economic surplus of an insurance company is generally defined as the market value of the assets supporting the liabilities less the market value of liabilities (MVL). MVL is typically computed directly, without regard to the underlying supporting assets, resulting in an unstable surplus. This paper provides a novel approach to the valuation of the market value of economic surplus (MVS). The resulting MVS is stable and reasonably immune to "market noise," and it can be used for better management of the business. A useful by-product of the proposed method is that MVL can be computed indirectly by subtracting MVS from the market value of assets. This indirect method avoids the many complications associated with direct computation, which typically involves discounting liability cash flows.

A critical step in valuing a company, a line of business, or a product line for the purpose of merger/acquisition, financial reporting or internal management is the computation of the market value of economic surplus. This paper provides a novel approach to the valuation of the market value of economic surplus that is stable and reasonably immune to "market noise."[1] Current approaches to the calculation of economic surplus of an insurance company generally define such surplus as the market value of the assets supporting the liabilities less the market value of liabilities (MVL). While the market value of assets is observable in the market, the market value of liabilities is typically computed directly, without regard to the underlying supporting assets. Subtracting the MVL from any value of assets that changes with market movements results in an unstable surplus. Consequently, a surplus that is not fully reflective of market sentiment has been rejected by many. This same approach (subtracting a directly computed MVL from the market value of supporting assets) is further used in the calculation of market consistent embedded value (MCEV) when a balance sheet approach is used (American Academy of Actuaries 2011).

Perhaps the most useful by-product of the proposed method is that MVL can be computed by an indirect method without the many complications associated with a direct computation of MVL, which typically involves discounting liability cash flows.

Currently most direct methods for computing MVL involve discounting at the risk-free rate plus a spread (which could be zero) to account for the illiquidity of the liabilities. Some additional adjustments are typically made to account for capital that must be held in case the future pattern of cash flows does not match the projected ones. Finally, a further adjustment might be made to account for the fact that interest earned on funds in an insurance company is taxed inside the corporation before it is distributed to shareholders and becomes taxable income to the shareholder at distribution.

The most important driver of the direct method of calculating MVL is how the aforementioned spread is calculated and how quickly this spread can react to market changes. Unfortunately, current proposed approaches rely on spreads that do not react quickly enough to market movements. This is due to the fact that unlike assets, there are no observable values for liabilities, resulting in a volatile economic surplus whose value could change significantly even for small market changes.

For clarity, the economic value of surplus and MCEV are computed similarly, and in fact, one could argue that they are the same. As such, the terms "MCEV" and "economic surplus" (and "market value of surplus") will be used interchangeably in this paper. MCEV is a great tool in evaluating company value and is widely used in Europe. However, its acceptance in the United States has been curtailed, mostly because it results in a value that is very volatile from period to period and prone to market noise in the context of insurance company value. Market noise is created when the MCEV for a company changes materially in an unexplainable way with small market movements. The author believes that creation of a method that produces stable MCEV will result in its acceptance worldwide.

[1] "Market noise" in this paper is used in the context of insurance and signifies variation in the value of a company that is not reflective of overall market sentiment.

As previously indicated, in the balance sheet method of calculating MCEV, one needs the value of MVL. Thus, this paper starts by outlining why there is a need for MVL and then giving an example to highlight a major flaw in a common current method. Subsequently, other proposed methods and their flaws are discussed and examined. Finally, an outline of an approach for calculating a stable economic surplus that will allow for better management of the business is presented. The proposed method directly calculates a stable economic surplus with MVL emerging as a by-product.

In short, the primary deliverable of this paper is a proposed method that produces a stable surplus that can be used for better business management. An additional benefit of the methodology is that MVL can be obtained by a simple indirect method of computation in which surplus is subtracted from the market value of assets. This results in a stable MVL that is linked to supporting assets. The proposed methodology also facilitates the derivation of spreads over the risk-free rate, which can be used in a direct method computation to obtain the same MVL by discounting liability cash flows directly—should one desire to compute MVL directly for International Financial Reporting Standard (IFRS) 17 or other purposes. It should be noted that these derived spreads react quickly to market changes consistent with those in the assets backing them, a most desirable result.

Note that since the proposed method produces an MVL that is derived from and moves with the market value of supporting assets, that MVL is clearly a market-based liability. However, it is not intended that the MVL exactly match the U.S. Generally Accepted Accounting Principles (GAAP) fair value liability (FVL) obtained by applying the principles of Statement of Financial Accounting Standard (SFAS) 157 *Fair Value Measurements* (ASC Topic 820) or any FVL used for purchase-GAAP purposes as addressed by SFAS 141R *Business Combinations* (ASC Topic 805) and/or its accompanying SFAS 142 *Intangible Assets* (ASC Topic 350).[2] Similar guidance is provided by comparable International GAAP accounting and financial reporting standards.

## 1. Why Is Market Value of Liabilities (MVL) Needed?

In practice, there are three main areas where MVL is needed: finance, governance and mergers and acquisitions (M&A).

### 1.1 Finance

In order to assign a value to a business, one needs to contrast the value of its liabilities with its assets. That is to say, one is mainly interested in the value of a company's surplus as an intrinsic value of that company.

[2] While most readers will be familiar with SFAS 157 *Fair Value Measurements*, after FASB Accounting Standard Codification (ASC), SFAS 157 was codified into ASC Topic 820. Likewise, SFAS 141R *Business Combinations* and its accompanying SFAS 142 *Intangible Assets* were codified into ASC Topics 805 and 350, respectively.

### 1.2 Governance

Regulators are interested in the value of liabilities to ensure that an insurance company holds sufficient assets to meet its obligations. In most parts of the world, this value is market-based. However, in the United States, this value is not calculated based on the market value of liabilities, and its valuation currently varies by product type. However, reluctance to move to a market-based approach in the United States mostly stems from the fact that the proposed techniques produce a volatile value for liabilities, resulting in a company's capital ratio fluctuating wildly with even small market movements. Regulators are interested in knowing how secure a company is in meeting its obligations or whether there is enough capital in the company. This means that, once again, the interest lies in the amount of available capital/surplus and not the value of liabilities on its own.

### 1.3 Mergers and Acquisitions

Potentially, one should know the value of liabilities in an M&A activity for a transaction to take place. In practice, however, liabilities are sold/acquired with the assets backing them, making M&A a subset of finance. Consequently, the value of surplus (value of assets less value of liabilities, whether positive or negative) becomes the primary objective when assets and liabilities are acquired together.

As noted earlier, MVL is often a vehicle to identify the market value of surplus. It can further be argued that had the MVL calculation resulted in a more stable surplus value over time (i.e., reflecting true movements of surplus as opposed to noise due to its method of calculation), U.S. regulators and actuaries might have embraced it, as has the rest of the world.

With all this in mind, the author argues that one actually does not need to calculate MVL, but instead market value of surplus (MVS). Should one need to allocate a value to the liabilities for any reason, it would simply be the market value of assets (MVA) net of MVS. In this regard, MVA at the product or line-of-business level includes not only the market value of assets necessary to meet future net liability cash outflows, but also required capital (RC). Required capital can be defined as some percentage of regulatory capital, economic capital or some level of capital deemed necessary by management to support a line of business. To keep things simple, no attempt will be made to precisely define or derive RC in this paper. At the company level, MVA also includes free surplus, which can be thought of as an amount of surplus in excess of RC that, ignoring any regulatory limitations, is immediately distributable to shareholders (in the case of a stock company) or policyholders (in the case of a mutual company). Finally, assuming some reasonable method has been chosen to define surplus, in the illustrations that follow, MVL can then be derived formulaically as MVL = MVA – MVS.

## 2. General Approaches to the Calculation of MVL

Approaches to the valuation of MVL can be generalized into two broad and distinct categories.

### 2.1 MVL Should Not Be Dependent on the Value of the Assets Backing Them

This concept stems from the belief that there is a value for every object independent of who owns that object. Yet it is also a well-known fact that, in reality, an object's value is what someone is willing to pay for it, and this depends on the utility it brings to the buyer. Consequently, in an efficient market, when a deep and liquid market for a particular security exists, that security has a defined value. The proponents of this idea wish to apply this concept to the valuation of insurance liabilities. However, even in an efficient market, this concept does not hold for a security that is not liquid or for which no deep market exists. For example, one could ask how the value of a 40% out-of-money, 30-year put option is determined. The answer is one shops around for the best price, but there is no single value. Yet the same proponents of this method insist on coming up with a unique value for an insurance liability, for which the market is neither liquid nor deep. Furthermore, a major area on which supporters of this method have concentrated has been the discount rate. In their belief, there is a unique discount curve that can be applied to the insurance cash flows to arrive at the liability's market value. Let's examine this concept.

Consider the value of a simple term insurance product. Assume two identical contracts for the same face amount on the life of the same individual are held by two different insurance companies. Since the projected death claim by the two companies would most likely not be identical, discounting them using identical rates would not result in identical values. In fact, there would be other differences, such as how capital is calculated on this product at the two different companies. This example involves a simple product with few assumptions. One could easily extrapolate how different the projected cash flows for the same liability might be when the product becomes more complex. Nonetheless, it is believed that if the same discount curve is used, one can arrive at nirvana. So the primary area on which the followers of this technique have concentrated is the discount rate, while all other non-market assumptions could be wildly different and company-specific. Further, there is some argument as to whether the risk-free rates should be based on the Treasury yield curve, the swap curve or a variant thereof (e.g., a spread added to the Treasury yield curve or the swap curve). Regardless, some think if everyone used the same discount rate, then somehow all valuation problems would be resolved.

Those who argue for this approach would generally allow a spread to be added to the risk-free rate for discounting projected liability cash flows. In the early stages of valuing insurance liabilities, it was argued that the spread should be zero based on the concept of risk neutral valuation. Then, in 2008 it became apparent that this meant most, if not all, insurance companies were insolvent. In fact, using this concept, the market value of an illiquid bond would not match the discounted value of its expected cash flows even after allowing for default risk (expected and unexpected). Thus, an allowance for a non-zero spread over the risk-free rate was provided to account for the illiquidity of insurance cash flows. The question still remains as to how this spread is defined.

Based on the premise that two instruments that provide the same cash flows under any scenario should have identical market values, some have argued for a replicating portfolio approach. In such an approach, a basket of assets is sought to replicate the cash flows of liabilities under a large number of scenarios. The value of the liabilities is then set equal to the total value of the assets, making up the replicating portfolio. Thus, by reverse engineering, a spread over the risk-free rate could be derived to arrive at the same value of liabilities. While in theory this approach seems easy to understand, it is fraught with several (yes, more than one) flaws, as discussed in the next section. These flaws are in addition to the fact that a given liability could be projected differently (resulting in different sets of cash flows) depending on the assumptions used, thus resulting in a different basket of assets required to match liability cash flows.

Some have tried, albeit unsuccessfully, to value the liabilities based on their characteristics. In essence, this method is similar to what the market makers do to come up with the value of an illiquid bond. This leads to the same result as our earlier example when valuing a 40% out-of-money, 30-year put option: one could not arrive at a unique value for the liability because the value would depend on the many assumptions needed for various insurance, policyholder behavior, the appropriate amount of capital and so on. Thus, unless all assumptions are prescribed (resulting in other concerns, such as not being useful to manage the business), no unique value could be calculated by two independent parties, regardless of the instrument being valued. Further, this method has several other flaws that are inherent in any method that values liabilities independent of the assets backing them (see section 3).

## 2.2 MVL Should Reflect the Assets Backing Them

This concept reflects a number of extremely important elements of insurance markets and business models.

### *2.2.1 Holding Assets to Maturity*

Due to the illiquidity of insurance cash flows, insurers could buy and hold an instrument to maturity, making them indifferent to the credit migration of these assets. A study by Ng and Phelps (2010) suggests that while the long-term average index credit spread premium of investment-grade assets is only about 48 bps, one could achieve an additional 38 bps in premium by fully recognizing a buy-and-hold strategy. This suggests that the insurance business model allows the assets backing the liabilities to provide more value, on average, than their market value suggests. This is intuitively obvious, as a buyer of an asset expects to make money by purchasing the asset prior to maturity. Thus, if the asset is held to maturity, the holder should experience this extra profit.

### *2.2.2 Liability Is Sold With the Assets Backing It*

No liability is ever sold without the assets backing it. This is due, in part, to the fact that should the seller sell the assets separate from the liability, the “market value” of the assets may not be achieved due to the illiquidity of the assets. In fact, it could further be argued that these assets are worth more in conjunction with the liabilities, as these liabilities allow the assets to be held until a more opportune time for them to be divested.

### *2.2.3 Liability Cash Flows Depend on the Assets Backing Them*

Many insurance products’ cash flows are dependent on the assets backing them (e.g., fixed annuity, universal life or variable annuity products). Valuing these liabilities with no regard to the assets backing them is meaningless to the company holding them. To address this problem, it has been suggested that a hypothetical basket of assets (possibly a replicating portfolio) might be used to project the liability cash flows. However, this actually becomes a recursive problem since the assets depend on the liability cash flows, which in turn depend on the underlying assets. In addition, this assumes that one could replicate insurance cash flows that reflect policyholder behavior with market instruments (more on this in the next section).

### *2.2.4 ALM Metrics Depend on MVL*

MVL is used in the calculation of many ALM metrics, such as duration and convexity. Not reflecting the value in conjunction with the assets backing them will result in the mismanagement of the business. This important issue is explored further in the next section.

## 3. Flaws in the Current Approaches to the Calculation of MVL

A simple example can be used to highlight a major flaw with valuing liabilities independent of the assets backing them. In this example, assume that the basket of assets backing the liabilities actually has cash flows that match those of the liabilities in every scenario. Now assume that a spread over the risk-free rate has been provided to calculate the value of the liabilities (as is the case in most current methods). Figure 1 shows three rates: the risk-free rate, the rate used to discount liabilities and the risk-adjusted rate of return of the supporting assets (hypothetical but very plausible in this case).[3] In this example, the average return on assets is about 84 bps over the risk-free rate, and the average spread used for discounting liabilities is about 36 bps. This spread differential results in the value of assets being lower than the value of liabilities, which can roughly be estimated at 48 bps times the duration of liabilities times the value of the liabilities. Note that the larger the duration of liabilities, the more pronounced this issue becomes (i.e., lower relative value of assets), and the less attractive the long-term liabilities would be (due to larger duration) under this method.

[3] "Risk-adjusted rate of return" refers to a rate that can be used to discount an instrument's expected (or best-estimate) cash flows to reproduce the sum of the instrument's market value and its cost of capital. In this regard, "expected or best-estimate cash flows for a market instrument" refers to cash flows derived using management's best-estimate default assumptions. Risk adjustment will cover charges meant to reflect what a market participant would demand for accepting the risk of default (since defaults might actually turn out to be much higher than expected).

**Figure 1. Discount Curves**

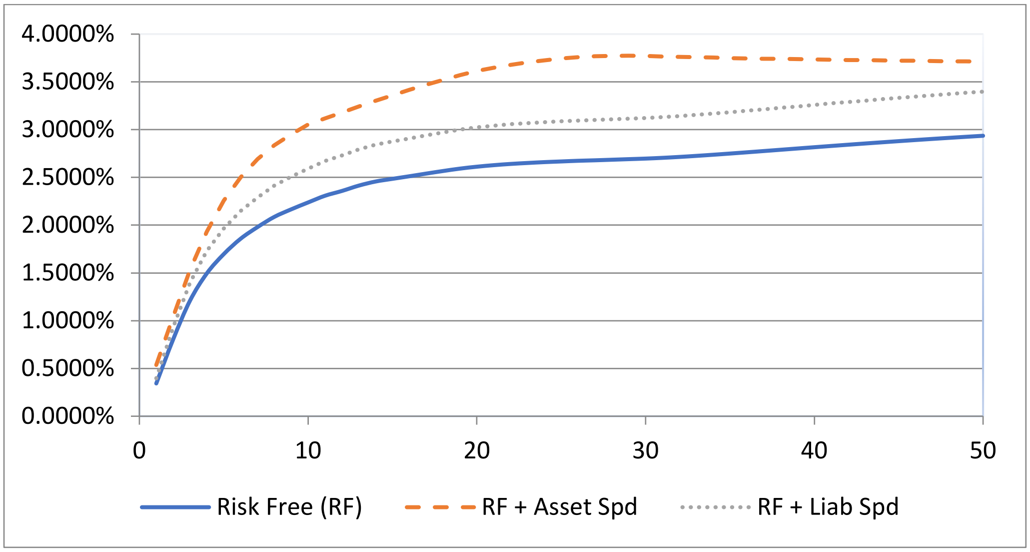


Table 1 reflects the ALM metrics and values based on the rates in Figure 1. Since the asset cash flows were identical to those of the liabilities in every scenario, one would expect a zero surplus from this combination of assets and liabilities. However, as shown in Table 1, this approach does not produce a zero surplus either at the valuation rate or under any of the rate shocks. Only one deterministic rate has been used in this simple example to highlight the issue, but one could have used a set of stochastic runs and achieved a similar result. The reason for this anomaly is the fact that when liabilities are discounted using any rates other than those of the assets, the produced ALM metrics (including MVL) differ from those of the assets, which is counterintuitive to how one would expect to manage this business. Table 1 suggests that the assets are less sensitive to interest rate movement than the liabilities (lower duration created by using a higher rate). Yet it is already known that the asset cash flows exactly match those of the liabilities in every scenario. This simple example highlights a major flaw in using a spread for valuing liabilities that is independent of the spread on assets backing them. It should be noted that other ALM metrics such as duration, convexity, DV01[4] and so on are similarly impacted.

[4] DV01 represents the change in value caused by a parallel interest rate change of +1 bps (+0.01%).

**Table 1. ALM Metrics—Current Method (Matching Asset and Liability Cash Flows)**

| ($M) | Base Curve | Rates Up 25 bps | Rates Up 300 bps | Rates Down |
|---|---|---|---|---|
| MVA | 714.9 | 692.9 | 507.6 | 737.9 |
| Assets duration | 12.6 | 12.4 | 10.3 | 12.8 |
| Assets convexity | 2.43 | 2.36 | 1.73 | 2.50 |
| Assets DV01 | (0.90) | (0.86) | (0.53) | (0.94) |
| | | | | |
| MVL | 765.2 | 740.7 | 535.3 | 791.0 |
| Liabilities duration | 13.2 | 12.9 | 10.8 | 13.4 |
| Liabilities | 2.62 | 2.54 | 1.86 | 2.70 |
| Liabilities DV01 | (1.01) | (0.96) | (0.58) | (1.06) |
| | | | | |
| Surplus | (50.4) | (47.8) | (27.8) | (53.1) |
| Surplus DV01 | 0.11 | 0.10 | 0.05 | 0.11 |

Had the method of selecting assets been the replicating portfolio technique, and *if the replicating portfolio technique had actually produced the exact basket of assets*, it would be immune to this flaw because the value of the liabilities would be set equal to the value of the basket of assets. Put another way, the spread used for valuing the liabilities would have been the same as the spread used for valuing the assets. However, even this method has its limitations:

- There is no guarantee that the method would produce the exact basket of assets. It is highly possible that two different baskets would be produced, depending on the universe of assets with which one starts. To arrive at two different baskets of assets with identical spreads would indicate an extremely efficient market for all such assets that is very deep and liquid.
- Policyholder behavior cannot be replicated with market instruments (Koursaris 2011; Hörig 2012), so it would be impossible to arrive at a basket of assets that replicates the liabilities in every scenario. Thus, the true value for the liabilities cannot be identified with this technique.
- The replication techniques rely on linear regression that minimizes errors but does not necessarily match cash flows. Once again, this means that cash flows in each scenario cannot be matched exactly, and the best that can be expected is the selection of a basket of assets (chosen from the universe of assets) that minimizes the cash flow matching error.

- The results are dependent on the scenarios that are run. Two different companies using the same assumptions but different economic scenario generators (ESGs) could arrive at different baskets of assets. It has been suggested that running an extremely large number of scenarios may minimize this concern, but such a process makes this method somewhat impractical.
- The recursive issue of products, the interdependency of liability cash flows and the assets backing them means that this method cannot be applied to value nearly a third of the existing products in the insurance market.

### 3.1 Flaws in the Use of ESGs

ESGs are calibrated to reproduce the observed value of market instruments. Depending on the instruments used for the calibration of the parameters and the models, the scenarios in two different ESG models will differ. Such different scenarios are likely to generate liability cash flows that may be significantly different. This is another major concern with the techniques that value liabilities independent of the assets backing them. In many cases, ALM metrics of liabilities are calculated using a set of scenarios based on some risk neutral ESG (possibly internally generated by the insurance company). However, the ALM metrics of assets may not have been calculated using the same scenarios (e.g., scenarios and/or the metrics may have been provided by an external investment firm). When different ESGs are used to value assets and liabilities, revaluing liabilities using the same scenarios that are used to value assets may produce a significant change in the value of liabilities (changes in excess of 10% have actually been encountered in practice), as well as the ALM metrics for those liabilities.

Even when ALM metrics for assets use the same scenarios, an option-adjusted spread (OAS) is calculated to match the market value of the assets. This OAS is assumed to be unchanged when asset values are evaluated under various shocks to the risk-free rate. This means that despite the use of the same ESG, ALM metrics for assets may not be as accurate as one might expect. So trying to match asset and liability metrics for ALM purposes poses another problem when current methods are used to manage the business.

## 4. Proposed Method of Calculating MVL

As indicated in section 1, the main reason a value for MVL is important is to calculate the market value of surplus, which is obtained by subtracting MVL from the market value of assets. Formulaically, this means MVS = MVA – MVL. However, if the goal is to evaluate MVS, why not calculate MVS directly? MVL can then be obtained by subtracting MVS from MVA (i.e., MVL = MVA – MVS), avoiding the complexities associated with a direct computation of MVL, which involves discounting liability cash flows. In essence, the proposed approach in this paper utilizes the latter formula to deliver a more stable market-based value of liabilities.

In the proposed methodology, terminology is borrowed from market-consistent embedded value due to its acceptability in many parts of the world and well-documented explanations of its terms, definitions and derivations (American Academy of Actuaries 2011). Thus, the following will be assumed:

$ACF_t$ = Default-adjusted asset cash flow at time $t$[5]

$LCF_t$ = Best-estimate liability cash flow at time $t$ (inflow less outflow)

DR = Discount rate (time variant)

$Spread_t$ = Spread over risk-free rate (RF) = $DR_t - RF_t$

TVFOG = Time value of financial options and guarantees

CRNHR = Cost of residual non-hedgeable risks

FCRC = Frictional cost of required capital

$NCF_t$ = Net cash flow at time $t$ = $ACF_t + LCF_t$

S* = Present valuing at the discount rate (PV(@DR)($NCF_t$)

Assume the assets backing the liabilities are set based on the amount needed to cover the statutory reserve amount. The excess of the value of assets over the assets needed to cover liabilities computed on a best-estimate set of assumptions without regard for solvency can be considered as surplus at the product or line-of-business level. In other words, this surplus is equivalent to the solvency margin as used in Solvency II or provisions for adverse deviation (PfAD) as was previously used by Canadian actuaries to compute the Canadian counterpart to U.S. statutory reserves. This paper further uses "company surplus" to refer to the sum of required capital (RC)[6] and free surplus (i.e., assets in excess of what is used to back the statutory reserve and RC). *Note:* If one includes required capital in the assets backing the liabilities, then the terminology in this paper should be adjusted so "product surplus" refers to solvency margin plus required capital, and "company surplus" refers only to the free surplus.

The first step in the proposed method is for the company to have a well-defined and documented investment strategy that identifies asset classes, asset mix and asset quality (e.g., ratings of bonds) that it intends to invest in to fulfill a year t expected cash flow.

In this approach, default-adjusted asset cash flows are projected using industry accepted (as opposed to internally created) transition matrices.[7] Both asset and liability cash flows are projected using best-estimate assumptions for assets backing the liabilities under the same scenario, as is performed in cash flow testing in the United States and for ALM purposes around the world. The goal here is to represent cash flows that are expected, as business is managed based on company-specific assumptions and management actions (the importance of this will be discussed in section 6). Once both asset and liability cash flows are projected under the

[5] Default-adjusted asset cash flows are created by assuming best-estimate default rates in the projection of asset cash flows. Best-estimate default rates are considered to be realistic, real-world assumptions as opposed to market-consistent or risk-neutral assumptions, which contain premiums that market participants demand for accepting the risk that defaults might be much higher than expected. As an example, if the best-estimate default rate of an asset over the year is 1%, and if the conditional (or promised) cash flow of that asset is $100 one year from now, the default-adjusted cash flow would be $99.

[6] Refer to section 1.3 for the definition of "required capital."

[7] A number of industry approved transition matrices (e.g., Moody's) provide best-estimate default assumptions for many market instruments in addition to the probability of the transition of assets from one rating to another.

same scenario, their net cash flows for each period are produced. Net cash flow at time $t$ will either be positive (surplus or asset) or negative (deficit or liability) for that period.

One approach with theoretical appeal involves using different risk discount rates to discount net asset cash flows (i.e., positive NCFs) and net liability cash flows (i.e., negative NCFs). More specifically, a net asset cash flow one year from now represents an amount that can increase surplus at that time. To convert that amount immediately into cash, the company can borrow an amount today and pay the load in full with the cash flow one year from now. Hence, it makes sense that the discount rate to use to convert a future positive net cash flow into cash would be the loan rate the company would be charged. This rate would be based on the company's credit rating. In contrast, a net liability cash flow (i.e., negative NCF) should be completely covered (funded) by invested assets. Hence, the rate for discounting net liability cash flows should be based on the company's investment strategy, which includes the mix of assets and corresponding risk-adjusted rates of return. This combination of company credit rating and risk-adjusted return from the company's investment strategy defines the discount rate (DR).

Despite the theoretical appeal of using two different discount rates, there are some practical limitations. For example, one could argue that should too much debt be used, the company's credit rating would deteriorate and the borrowing costs would increase. Further, a company's rating is also dependent on the type of invested assets, so the borrowing cost and risk-adjusted return on invested assets could converge. For these reasons, and for simplicity's sake, it is further suggested that both positive and negative NCFs be discounted at the same risk-adjusted rate of return that will then define the DR. This means that all one needs are the rates used for discounting, as opposed to a spread over the risk-free rate. However, for reporting purposes, the spread could be calculated by subtracting the RF from the DR. It should be noted that spread is a curve, varying by period (i.e., it is time variant, not a constant over RF, as is generally the case for OAS). To know the spread when many scenarios are run (stochastic valuation), one needs to convert both the DR and RF to forward rates, thus defining "spread" as the spread over forward or short rates. This will allow the addition of a spread when discounting using short rates along each path/scenario.

For products with options and guaranties, a stochastic set of risk-neutral scenarios needs to be created. The cash flows of both assets and liabilities are projected using these scenarios. $NCF_t$ in each scenario is calculated and discounted using the scenario's short rate plus the spread (calculated as spread over forward rate). By subtracting the average of the resulting S*s (derived from the set of stochastic scenarios) from S* (derived from a single deterministic scenario based on the prevailing RF at the valuation date), the time value of financial options and guarantees (TVFOG) emerges. It should be noted that unless one needs to specifically provide a value for TVFOG—such as for MCEV reporting purposes—its actual value is not needed if the average of S*s is used. In essence, the average of S*s implicitly reflects TVFOG.

Since best-estimate assumptions are used in the calculation of NCFs, one needs to account for possible variance in the experience. The cost of capital approach[8] could be used to account for this variance. To make this approach consistent with MCEV, and due to the fact that there has already been a lot of discussion on the approach, this paper borrows the cost of residual non-hedgeable risks (CRNHR) calculation from the American Academy of Actuaries (2011) and uses it consistently. The calculation of CRNHR should reflect the greater of statutory required capital and the value of capital derived using confidence levels for internal capital valuation/MCEV.

Generally, CRNHR refers to the capital charge for non-economic assumptions. However, since the generation of asset cash flows uses best-estimate default rates from transition matrices, one needs to account for the probability that actual defaults might be greater than projected. For this reason, this paper uses the same cost of capital approach for capital charge on default as well. This means that CRNHR is extended to account for default risk beyond the best estimate.

Tax comes into the picture in two areas. One is tax on income generated from the release of the conservatism built into the held reserves (solvency margin release), and the other is the tax on investment income earned on RC. In the proposed method, the liability cash flows include income taxes but not tax on investment income on assets supporting RC. Further, as investment income on RC is taxable, this paper further borrows the frictional cost of required capital (FCRC) from the American Academy of Actuaries (2011). It should be noted that if one assumes that the assets backing the liabilities include RC, the computed income tax would already include tax on investment income earned on RC, and FCRC would need to be adjusted to exclude such tax.

Since there is enough material in the industry (especially in MCEV guidance) devoted to the calculation of TVFOG, CRNHR, and FCRC, this paper will not go further into their calculations and suggests, where practicable, the use of values obtained from calculations made for other purposes in the company. If such calculations are not performed, one could refer to the American Academy of Actuaries (2011) for additional information on calculation methodology.

Extension of the risk-free rate beyond the observable values in the market is outside the scope of this paper. However, the author is in favor of extending the risk-free rate using a mean reversion of forward rates over a long term (possibly to year 100 or 120), as such extension should contribute to a more stable surplus.

The market value of surplus then becomes S* net of the sum of TVFOG, CRNHR, and FCRC. Formulaically, MVS = S* – TVFOG – CRNHR – FCRC.[9] This valuation means that MVS has accounted for all capital and tax charges at a particular confidence level—MCEV asks for 99.5%,

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[8] For understanding the cost of capital approach, please refer to the American Academy of Actuaries (2011). In short, each assumption is shocked to a desired level of confidence for capital to be held, such as 99.5%. The resulting discounted liability cash flows less the best-estimate liability is considered capital needed for that assumption. This capital amount needs to be calculated for all future years (projected capital). A cost for this capital needs to be used, for example, 6% (this assumes that investors require a 10% return and the company earns 4% on that capital, netting a charge of 6%). In this example, a present value of 6% of projected capitals is the cost of capital for that assumption. In essence, it is the cost to pay a potential risk buyer to take the risk.

[9] If S* already includes TVFOG derived from a set of stochastic scenarios, only CRNHR and FCRC would be subtracted from S* to obtain MVS.

as explained in American Academy of Actuaries (2011). Obviously, should an MVL be required, then MVL = MVA – MVS. Based on this approach, the calculated MVS plus the market value of a company's surplus would equal MCEV using the balance sheet approach.

IFRS 17 requires a spread over the risk-free rate in the calculation of MVL. This can be achieved by solving for a multiple of the spread used in discounting net cash flows, which when used to discount LCFs would result in the MVL (i.e., MVA – MVS). This backsolving for a spread technique, as defined here, is generally used to calculate the option-adjusted spread of an asset. However, using a multiple of the current available spread has the benefit of producing a spread over the risk-free rate that is not constant but is time variant.

For the valuation of liabilities with no assets, such as when valuing new business, the projected liability cash flows are discounted using the DR created from the assets to be invested to back the liability based on the investment strategy. Further, if the liability cash flows are dependent on the portfolio returns (e.g., in the case of universal life or fixed annuities—two products whose liability cash flows generally depend on the assets backing them), the portfolio is assumed to earn the DR for the period.

## 5. Rationale for the New Proposal

It is important to remember that asset/liability management risk is the risk created by a mismatch of asset and liability cash flows. As such, a method that incorporates these cash flow differentials is more advantageous for business management. This proposal offers two important benefits to management:

1. Existing assets in the market, as opposed to synthetic assets that are generally used in the replicating portfolio methods, are used to cover the net cash flows.
2. The company's investment strategy is incorporated in the choice of assets, which allows this method to be consistent with MCEV, ALM, and how business is managed.

However, the most important benefit of this approach is the fact that it allows for more appropriate investment management using ALM metrics. This becomes clear through the use of an example. It was shown earlier that should assets backing liabilities have identical cash flows to the liabilities, the ALM metrics of these assets also should be identical to those of the liabilities. This will never be the case if the valuation of liabilities is independent of the assets backing them. For this example, the proposed approach would result in zero net cash flows at all durations, resulting in zero surplus in any scenario and the aggregate, ensuring that all asset ALM metrics also match those of liabilities.

In the example that follows, the same liability cash flows as before are used, while the asset cash flows are projected from the actual assets backing them. The discount curve used for discounting NCFs is assumed to be the same as that from the previous example (i.e., RF + Liab Spd in Figure 1), which could be achievable in the current market based on the documented investment strategy. The ALM metrics of the assets are calculated by finding an OAS over risk-free rate and keeping it constant for the shocked discounted values. Further, for this simple example, it is assumed that the cash flows of both assets and liabilities are not interest-rate sensitive. As such, only interest rates impact the ALM metrics. Figure 2 shows both the asset and liability cash flows, with liability cash flows depicted as inflow less outflow. As shown, in years 7 to 16, there are large excess net cash flows (LCF + ACF) to cover deficits in years 30 and over, where there are no asset cash flows.

**Figure 2. Cash Flows**

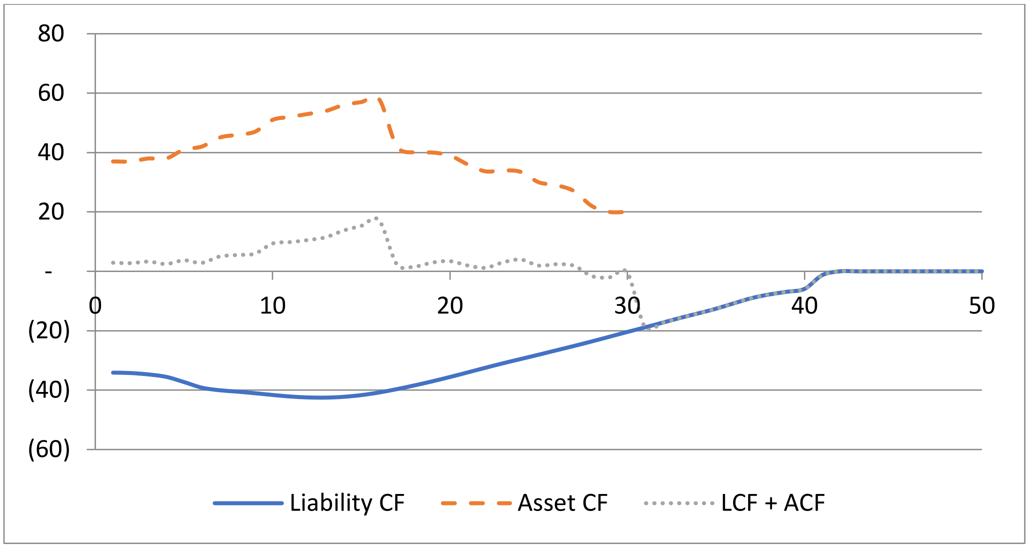


Table 2 shows the result of the current method and the proposed method on surplus value and ALM metrics.

**Table 2. Comparison of ALM Metrics Using Current and Proposed Methods**

| | ALM Metrics Current Method (Discount L) | | | | | | ALM Metrics Proposed Method (Discount NCF) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ($M) | Base Curve | Rates Up 25 bps | Rates Up 300 bps | Rates Down 25 bps | | ($M) | Base Curve | Rates Up 25 bps | Rates Up 300 bps | Rates Down 25 bps |
| MVA | 778.6 | 756.6 | 565.3 | 801.5 | | PV(NCF) | 62.1 | 62.5 | 58.7 | 61.6 |
| Assets duration | 11.5 | 11.4 | 9.9 | 11.7 | | NCF duration | (2.7) | (1.6) | 4.8 | (4.0) |
| Assets convexity | 1.95 | 1.90 | 1.49 | 1.99 | | NCF convexity | (4.71) | (4.16) | (0.97) | (5.33) |
| Assets DV01 | (0.90) | (0.86) | (0.56) | (0.94) | | NCF DV01 | 0.02 | 0.01 | (0.03) | 0.02 |
| | | | | | | | | | | |
| MVL | 765.2 | 740.7 | 535.3 | 791.0 | | MVL | 716.5 | 694.1 | 506.6 | 739.9 |
| Liabilities duration | 13.2 | 12.9 | 10.8 | 13.4 | | Liabilities duration | 12.8 | 12.6 | 10.4 | 13.0 |
| Convexity | 2.62 | 2.54 | 1.86 | 2.70 | | Convexity | 2.52 | 2.45 | 1.77 | 2.60 |
| Liabilities DV01 | (1.01) | (0.96) | (0.58) | (1.06) | | Liabilities DV01 | (0.92) | (0.87) | (0.53) | (0.96) |
| | | | | | | | | | | |
| Surplus | 13.4 | 15.9 | 30.0 | 10.5 | | Surplus | 62.1 | 62.5 | 58.7 | 61.6 |
| Surplus DV01 | 0.11 | 0.10 | 0.02 | 0.12 | | Surplus DV01 | 0.02 | 0.01 | (0.03) | 0.02 |

Examining Table 2, the current method suggests that there is a $13.4 million surplus, and should rates increase by 300 bps instantaneously, surplus will increase to $30 million (an increase of $16.6 million). In addition, a 25-bps instantaneous rate change could mean a $2.5 million to $2.9 million change in surplus, depending on the direction of the change. The proposed method first indicates that this combination of assets and liabilities actually has $62.1 million of surplus, and a 300-bps rate increase reduces surplus by $3.4 million (as opposed to increasing surplus by $16.6 million under the current method). Thus, a rate increase is detrimental to this combination of assets and liabilities, in contrast to what the current method suggests.

The current method first and foremost *underestimates* the value of this block of assets and liabilities. Further, it not only produces a larger surplus movement for interest rate shocks, but in this example it also suggests that a large interest rate movement could be beneficial to the business, when it may actually be detrimental. In addition, note that under the proposed method a 25-bps rate change impacts surplus by only $0.4 million to $0.5 million, which highlights the stability of this method over the current one. This stability could further be noted from surplus DV01, where the current method is roughly 5.5 times that of the proposed method.

*Note:* In the proposed method, MVL was not calculated directly but as the value of assets less value of surplus.

## 6. Benefits of the New Proposal

The greatest benefit of the proposed approach is that the resulting MVS should be reasonably stable and far less susceptible to market noise than MVS obtained by current methods. It should be noted that unless one uses the same ESG and discounting assumptions in the calculation of assets and liabilities, one will introduce volatility in the surplus value. To recap, there are two main reasons causing MVS volatility in methods where the spread used in valuing liabilities is independent of the assets backing them. These reasons and how the proposed method addresses them are explained in this section.

### 6.1 Linking Liability Spreads to Asset Spreads

The current methods do not have a way of reflecting a change to the spread used in discounting liability cash flows due to market movement, whereas the corresponding assets, with observable market values, have already implicitly incorporated a spread. The proposed method projects and discounts net cash flows utilizing spreads obtained from observable assets. Consequently, liability cash flows are implicitly discounted using the same spreads used to discount asset cash flows.

### 6.2 Using ESGs

Using different ESGs for valuing assets and liabilities and their corresponding ALM metrics not only results in large value differences, but it also does not provide the needed information to identify under what scenarios there might be a cash flow shortfall. The proposed approach addresses both issues. Using the same ESG to calculate NCFs eliminates these concerns. For example, for the case illustrated in Table 2, one would notice that there was a large concentration of positive cash flows in years 7 to 16, which would allow the investment manager to change the asset allocation in this block if desired. Using only ALM metrics, such as duration and convexity, would not necessarily highlight such information.

## 6.3 What If the Discount Rate Is Not Well Defined?

Because surplus is a fraction of the liability value, even with disagreement in the discount rates applied to the NCFs, the magnitude of disagreement is grossly mitigated. This point is highlighted in the previous example. Generally, assets that back liabilities are set based on a statutory reserve that is slightly larger than the best-estimate liability, say about 10% larger. Thus, when net cash flows are discounted, the discount rate is applied to this 10% as opposed to the entire liability. This means that should there be disagreement about the spread used for discounting (e.g., an argument as to which basket of assets the company will invest in), it only impacts 10% of the value as opposed to the entire liability, resulting in a more stable surplus value (and a more stable liability value).

## 6.4 Other Benefits

### *6.4.1 Reserve Adequacy Testing*

One could use assets only equal to reserves for this calculation, meaning the assets backing the RC would not be included. Should this method produce a negative surplus, it suggests that the assets backing the liabilities are deficient, and additional assets from the company surplus need to be transferred to this line. This method thus provides a means of reserve adequacy testing. It should be noted that the company surplus assets are simply valued based on their market value, as they are not backing liabilities directly.

### *6.4.2 Asset Segmentation*

Another benefit of this technique is that it can be used to segment assets by lines of business. Using an optimization model, one could allocate a mixed basket of assets from all the company's existing assets with the constraint of the market value (or book value based on statutory accounting) of chosen assets being equal to or greater than the statutory liability (or statutory liability plus RC if that's how the company manages its business). This would reduce the dispersion of calculated S*s in a large number of scenarios. The resulting assets would be well suited to back the liabilities, given the existing asset portfolio. Obviously, if some assets are exchanged for new assets, additional assets may be put into the mix to arrive at a better matched portfolio. *Note:* Due to taxes and GAAP accounting, it may be disadvantageous to sell certain assets. To account for this, one could restrict their sale in the optimization program.

### *6.4.3 Choosing Between Short-term and Long-term Business*

As discussed earlier, another concern with an independent liability spread approach is that long-term products are at a disadvantage compared to short-term products, because any spread difference between what could have been used to discount liabilities and what is actually used would be exaggerated when valuing longer term liabilities, making them relatively unattractive. This issue has been raised by many in the industry, indicating that current methods result in a disservice to society because they discourage insurers from introducing products that address the long-term needs of policyholders. Again, the proposed methodology resolves this issue by taking full advantage of the insurance business model that allows assets to be held to maturity to achieve an additional spread and implicitly uses this spread in the valuation of liabilities or surplus.

### *6.4.4 Appropriate ALM Actions*

The proposed approach also ensures that correct ALM metrics are used and appropriate ALM actions are taken consistent with how the business is managed. This is because investment is made only for the mismatch of asset and liability cash flows. Potentially, ALM metrics are only applied to the NCFs, which are a small fraction of liabilities (mitigating any miscalculation). In essence, ALM is viewed more as net cash flow management, and there is no need to try to rebalance a few metrics based on parallel movements to the risk-free rate.

### *6.4.5 Optimized Portfolio*

Another advantage of this technique is that it can be used to optimize the portfolio of assets backing the liabilities by trying to find assets for which the dispersion of discounted NCFs are minimized. If a perfect match does happen, meaning the dispersion is zero, then a replicated portfolio has been found, and this method has essentially converged to a replicated portfolio. The difference between this method and one that values liabilities based on a replicating portfolio is that a fully replicated portfolio may not be found (except for simple non-interest-sensitive products) for the reasons previously explained. Thus, the proposed technique could be used to produce an optimized portfolio. Further, use of this technique only suggests what assets would optimize the portfolio, and not until these assets are included in the portfolio would their value impact the liability/surplus value. Once the assets have been replaced, the updated assets could better match the liabilities, making ALM and rebalancing assets less problematic and more cost-effective.

## 7. Acceptability of the New Proposal

This technique shares similar traits with the Canadian Asset and Liability Method (CALM) that was used in Canada before a change to IFRS. There are two major differences between this method and CALM. The first is that the proposed method does not use a reinvestment asset strategy, since NCFs are discounted based on the current asset investment strategy. Second, this proposal includes CRNHR on both market and non-market assumptions. Not considering the capital cost of default assumptions has been one complaint about CALM that this technique addresses. For these reasons, this method would be more acceptable to those who agree with the valuation of liabilities being dependent on the assets backing them.

Many techniques have allowed for a spread to be added to the risk-free rate, but none have formulized how that spread should be defined. These methods include IFRS 17, MCEV, and Solvency II. Solvency II's matching and volatility adjustments are corollaries to this technique. However, due to the matching adjustment's numerous requirements, many companies opt not to bother with it. The proposed technique essentially suggests that, to the extent that assets do back liability cash flows, that portion of the liability should be valued using the asset values, while the remaining piece can be valued based on what can be achieved in the market at the valuation date according to the documented investment strategy.

The International Association of Insurance Supervisors (IAIS), in its insurance capital standard (ICS), allows a spread over the risk-free rate to be used, providing this spread itself. However, a group of insurers, including AIA, AIG, Allianz, AVIVA, and Manulife, proposed the use of a company's own assets with guard rails in the ICS valuation ("ICS Valuation" 2017). This suggests that many disagree with the valuation of liabilities independent of the assets backing them. Under specific circumstances, the European Insurance and Occupational Pensions Authority (EIOPA) allows for the addition of a spread to the RFR for long-term guaranteed insurance products, calling the process "volatility adjustment" (VA). The goal of VA is to mitigate the impact of unjustified credit spreads that result in the deterioration of bond prices and subsequently the valuation of insurance companies' surplus. The VA is calculated based on a predefined reference investment portfolio, representing an average European insurer, and is published by EIOPA every month. VA suffers from the same fate as the spread provided by IAIS, since it is not tied to the actual assets backing the liabilities. In fact, Deloitte has proposed a technique that uses company assets backing the liabilities with the identical approach used by EIOPA to evaluate the VA for those assets; the organization calls this a company's "own VA adjustment" (Meli et al. 2018). This author applauds Deloitte for identifying many concerns about a VA adjustment that is not tied to assets backing the liabilities and proposing an approach to create a VA adjustment tied to a company's own assets. However, this approach would be valuable only if one is mainly interested in a more appropriate MVL, since it does not address other issues raised in this paper. In addition, the calculation of "own VA adjustment" is complicated and nontrivial.

It should be emphasized again that liabilities are not typically sold without assets backing them. While there is an existing market value for nearly all financial assets, the liabilities are sold along with their supporting assets, further negating the need for the value of liabilities to be independent of the assets backing them.

## 8. Conclusion

This paper has proposed a novel approach for calculating a stable economic surplus for an insurance business that allows better management of the business using more appropriate ALM metrics. It should achieve more acceptability by the industry as it addresses many of the concerns with current approaches. Should the technique be used with an optimization process, it will reduce ALM reinvestment risk and rebalancing costs. In its ultimate form, if one could arrive at a portfolio where NCFs are zero in every scenario, a theoretical value for the liabilities could be derived by subtracting CRNHR and FCRC from the market value of the assets. Thus, this method could be used to provide a theoretical or market value for liabilities and to evaluate a stable economic/market value of surplus, eliminating the need to compute a theoretical MVL and achieving wider industry acceptance. This technique should also encourage more acceptance of MCEV use in the United States, since it will result in a more stable MCEV that can be used to compare values of various products or businesses.

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