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

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A critical step in valuing a company for the purpose of financial reporting is the computation of the market value of economic surplus (MVES). This article provides a novel approach to the valuation of MVES 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 (MVA) supporting the liabilities less the market value of liabilities (MVL). While MVA is observable in the market, MVL is typically computed directly, without regard to the underlying supporting assets. Subtracting 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 is further used in the calculation of market-consistent embedded value (MCEV) when a balance sheet approach is used.[2]

Currently, most direct methods for computing MVL involve discounting at the risk-free rate plus a spread to account for the illiquidity of the liabilities. Some additional adjustments are typically made to account for (1) capital that must be held in case the future pattern of cash flows does not match the projected ones and (2) 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 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 because, unlike assets, there are no observable values for liabilities, resulting in a volatile economic surplus.

Since the economic value of surplus and MCEV are computed similarly, the terms "MCEV" and "economic surplus" (and MVES) will be used interchangeably in this article. MCEV is a great tool in evaluating company value and is widely used in Europe, yet its use in the United States has been curtailed because of its volatile nature.

GENERAL APPROACHES TO THE CALCULATION OF MVL

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

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

This concept stems from the belief that there is a unique value for every object independent of its owner. The proponents of this method come up with a unique value for an insurance liability, for which the market is neither liquid nor deep. To achieve that, they have concentrated on a unique discount curve that can be applied to the insurance cash flows to arrive at the liability's market value. A simple example highlights the flaw in this approach. Assume two identical term insurance 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.

MVL Should Reflect the Assets Backing Them

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

1. 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.

2. No liability is ever sold without the assets backing it.

3. Many insurance products' cash flows are dependent on the assets backing them (e.g., fixed annuity, universal life or variable annuity products).

4. MVL is used in the calculation of many asset and liability management (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.

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. 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.[3] In this example, the average return on assets is about 84 basis points (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.

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, 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.

Had a replicating portfolio technique been used to select the assets—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. 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 starting universe of assets.

Figure 1
Discount Curves

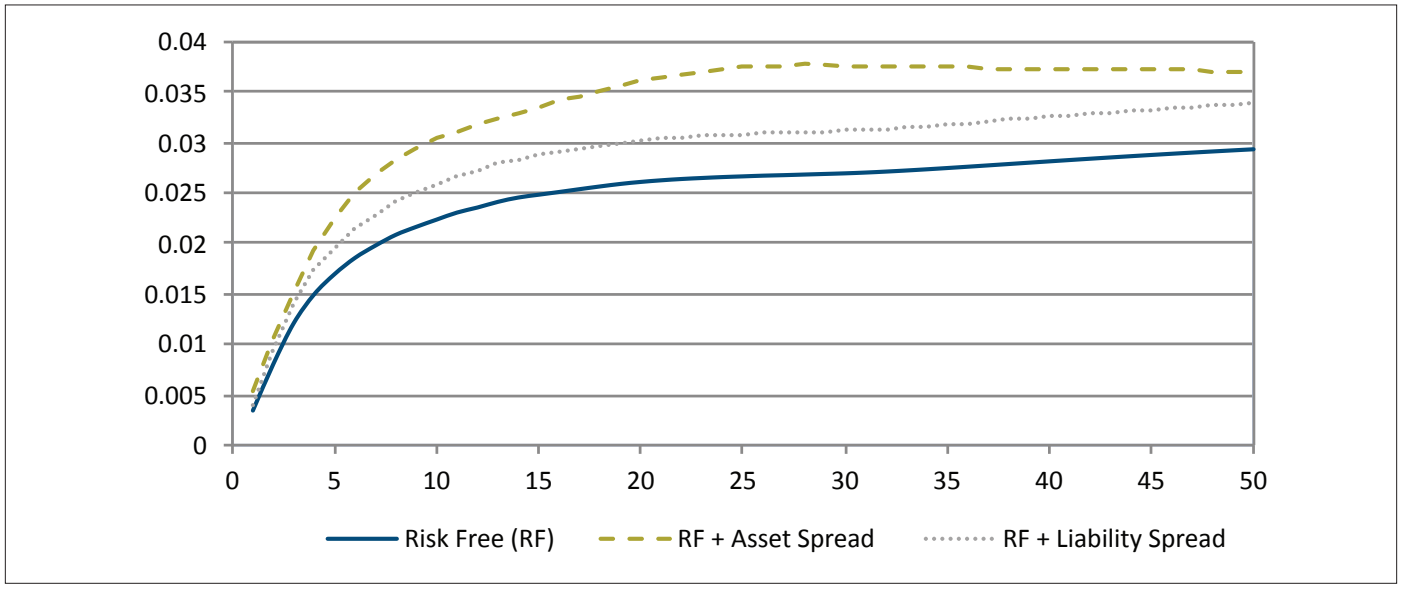


Table 1
ALM Metrics—Current Method (Matching Asset and Liability Cash Flows), in Millions of Dollars

Metric	Base Curve	Rates Up 25 bps	Rates Up 300 bps	Rates Down 25 bps
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 convexity	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

Abbreviations: bps, basis points; MVA, market value of assets; MVL, market value of liabilities.

- Policyholder behavior cannot be replicated with market instruments,[4] so it would be impossible to arrive at a basket of assets that replicates the liabilities.
- The replication techniques rely on linear regression that minimizes errors but does not necessarily match cash flows.
- The results are dependent on the scenarios that are run. Two companies using the same assumptions but different economic scenario generators (ESGs) could arrive at different baskets of assets.
- The recursive issue of products, the interdependency of liability cash flows and the assets backing them mean that this method cannot be applied to value nearly a third of the existing products in the insurance market.

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. In many cases, ALM metrics of liabilities are calculated using a set of scenarios based on some risk-neutral ESG. However, the ALM metrics of assets may not have been calculated using the same scenarios. 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 as well as the ALM metrics for those liabilities.

PROPOSED METHOD OF CALCULATING MVL

As indicated earlier, 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, avoiding the complexities associated with a direct computation of MVL, which involves discounting liability cash flows. In essence, the proposed approach in this article delivers a more stable market-based value of liabilities.

In the proposed methodology, terminology is borrowed from MCEV because of its acceptability in many parts of the world:[5]

ACF_t = Default-adjusted asset cash flow[6] at time t

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 = $ACF_t + LCF_t$

$S^* = PV(@DR)(NCF_t)$

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 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. This article further uses "company surplus" to refer to the sum of required capital (RC) and free surplus.

The first step in the proposed method is for the company to have a well-defined investment strategy that identifies asset classes, asset mix and asset quality 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 transition matrices.[7] Both asset and liability cash flows are projected using best-estimate assumptions for assets backing the liabilities under the same scenario. The goal here is to represent cash flows that are expected, as business is managed based on company-specific assumptions and management actions. Once both asset and liability cash flows are projected under the 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).

One approach with theoretical appeal involves using different risk discount rates to discount net asset cash flows and net liability cash flows. 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 used 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 should be completely 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. 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, it is 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. To know the spread when many scenarios are run, one needs to convert both the DR and the 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 or scenario.

For products with options and guarantees, 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 TVFOG emerges. 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 could be used to account for this variance.[8] To make this approach consistent with MCEV, this article borrows the cost of residual non-hedgeable risks (CRNHR) calculation and uses it consistently.[9] 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.

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

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 article 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, 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 article further borrows the 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.

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

The market value of surplus then becomes MVS = S* – TVFOG – CRNHR – FCRC.[10] This valuation means that MVS has accounted for all capital and tax charges at a particular confidence level—MCEV asks for 99.5 percent.[11] Based on this approach, the calculated MVS plus the market value of a company's surplus would equal MCEV using the balance sheet approach.

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, the portfolio is assumed to earn the DR for the period.

RATIONALE FOR THE NEW PROPOSAL

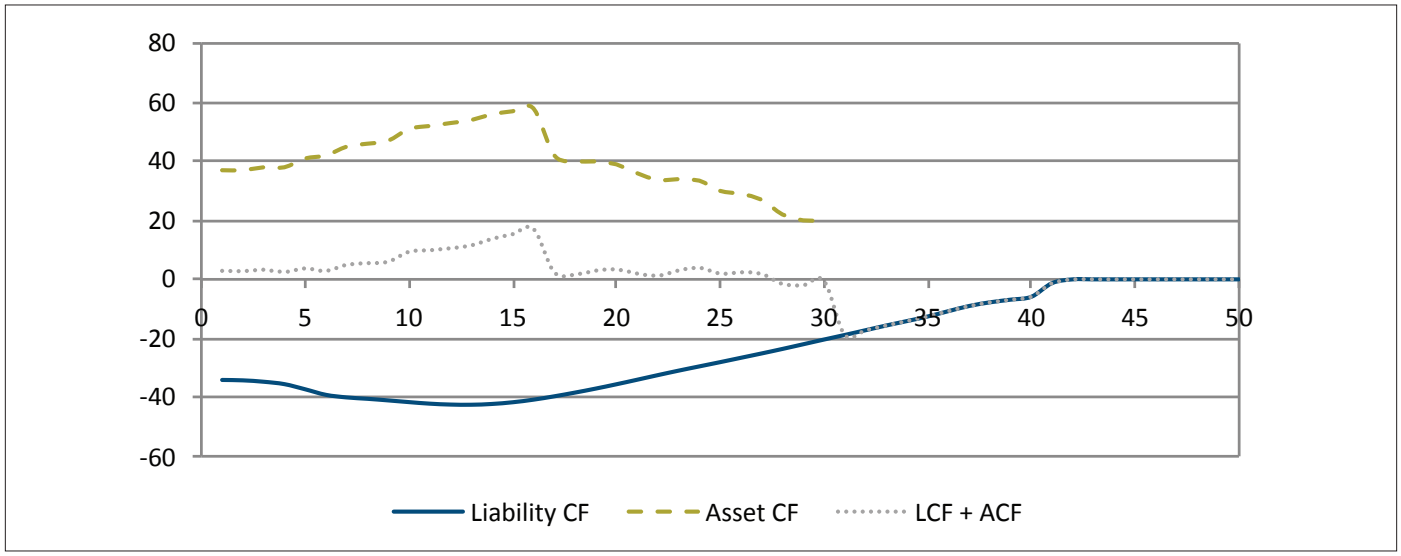
It is important to remember that ALM risk is the risk created by a mismatch of asset and liability cash flows. As such, a method that incorporates these cash flow differentials is more advantageous for business management. This proposal offers two important benefits:

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; and
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, which could be achievable in the current market based on the documented investment strategy. It is assumed here that the cash flows of both assets and liabilities are not interest-rate sensitive, so 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



Abbreviations: ACF, asset cash flow; CF, cash flow; LCF, liability cash flow.

Table 2
Comparison of ALM Metrics Using Current and Proposed Methods, in Millions of Dollars

	ALM Metrics Current Method (Discount L)			
Metric	Base Curve	Rates Up 25 bps	Rates Up 300 bps	Rates Down 25 bps
MVA	778.6	756.6	565.3	801.5
Assets duration	11.5	11.4	9.9	11.7
Assets convexity	1.95	1.90	1.49	1.99
Assets DV01	(0.90)	(0.86)	(0.56)	(0.94)
MVL	765.2	740.7	535.3	791.0
Liabilities duration	13.2	12.9	10.8	13.4
Liabilities convexity	2.62	2.54	1.86	2.70
Liabilities DV01	(1.01)	(0.96)	(0.58)	(1.06)
Surplus	13.4	15.9	30.0	10.5
Surplus DV01	0.11	0.10	0.02	0.12

	ALM Metrics Proposed Method (Discount NCF)			
Metric	Base Curve	Rates Up 25 bps	Rates Up 300 bps	Rates Down 25 bps
PV(NCF)	62.1	62.5	58.7	61.6
NCF duration	(2.7)	(1.6)	4.8	(4.0)
NCF convexity	(4.71)	(4.16)	(0.97)	(5.33)
NCF DV01	0.02	0.01	(0.03)	0.02
MVL	716.5	694.1	506.6	739.9
Liabilities duration	12.8	12.6	10.4	13.0
Liabilities convexity	2.52	2.45	1.77	2.60
Liabilities DV01	(0.92)	(0.87)	(0.53)	(0.96)
Surplus	62.1	62.5	58.7	61.6
Surplus DV01	0.02	0.01	(0.03)	0.02

Abbreviations: bps, basis points; MVA, market value of assets; MVL, market value of liabilities; NCF, net cash flow.

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

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). 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 (versus *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, which highlights the stability of this method over the current one.

Note that in the proposed method, MVL was not calculated directly but as the value of assets less value of surplus.

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. Unless one uses the same ESG and discounting assumptions in the calculation of assets and liabilities, one will introduce volatility in the surplus value.

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. Generally, assets that back liabilities are set based on a statutory reserve that is slightly larger than the best-estimate liability—say, about 10 percent larger. Thus, when net cash flows are discounted, the discount rate is applied to this 10 percent as opposed to the entire liability. This means that should there be disagreement about the spread used for discounting, it impacts only 10 percent

of the value as opposed to the entire liability, resulting in more stable surplus and liability values.

In conclusion, this article 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. ■

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ENDNOTES

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

2 American Academy of Actuaries, 2011.

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).

4 Koursaris, 2011; Hörig and Leitschkis, 2012.

5 American Academy of Actuaries, 2011.

6 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 percent, 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.

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.

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 percent. 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 percent (this assumes that investors require a 10 percent return and the company earns 4 percent on that capital, netting a charge of 6 percent). In this example, a present value of 6 percent of projected capital 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 American Academy of Actuaries, 2011.

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

11 American Academy of Actuaries, 2011.