Article Title: ARCHIVE | Criteria | Insurance | General: Measuring Capital Adequacy For Asset-Liability Risk At U.S. Insurance Companies Data: (EDITOR'S NOTE: —This criteria is no longer current. It has been superseded by the article titled, "Refined Methodology And Assumptions For Analyzing Insurer Capital Adequacy Using The Risk-Based Insurance Capital Model," published June 7, 2010. References to non-U.S. entities have been omitted from this previously published report. Factors for measuring capital adequacy for asset-liability risk outside the U.S. will appear in a separate report at a later date.) Standard & Poor's Ratings Services has revised its methodology for measuring the expected capital adequacy relating to possible economic losses of insurance companies and their subsidiaries, associated with asset-liability mismatches and certain embedded structural product features. This section of the model measures capital adequacy relating to products where the overall goal of the company is to generate spread income between the cost of funding and their reinvestment rates by issuing a potentially diverse range of products including fixed annuities, indexed annuities, funding agreements, guaranteed investment contracts (GICs), MTNs, and structured settlements. Standard & Poor's revised methodology to determine capitalization relating to asset/liability management (ALM) risk is designed to more accurately link capital adequacy to risk. It is also designed to increase transparency as to how our ALM factors are created by defining exactly what risks the factors encompass and the methodology used to stress the risk variables, which allows for easier comparison with a company's internal models. Each of the ALM factors will consist of an aggregation of various component subfactors. The subfactors that are aggregated will depend on the types of risks that the designated liability exposes the company to. Each of the component subfactors will be stressed based on a confidence level that is commensurate with the loss probability associated with the targeted required capital based on a five-year default probability. Therefore, when the factors are applied to the exposure amounts, the resulting numbers are the absolute levels of expected capital given the targeted rating and no additional stresses or ratios will be applied. Also, consistent with our modeling of other types of risk, the amount of capital expected for a specified asset-liability exposure amount will increase as the rating on the company increases and vice versa, as the rating on the company decreases. The various assumptions that Standard & Poor's makes relating to this modeling are designed to capture risk on a conservative basis relative to the industry and will not be adjusted by the analyst. Standard & Poor's expects the company to be capitalized for asset-liability risk with a degree of certainty associated with the targeted confidence interval for a period of at least one year. Because the period of time we consider for potential movements in the applied risk variables is one year, we apply annualized volatilities when stressing the risk variables encompassed in the model. However, the economic impact of these changes in risk variables potentially occurring over the annual period is derived based on the net present value (NPV) change considering the life of the instruments or liabilities they affect. This section of the updated model will consider the following types of risks: mismatch risk, spread volatility risk, basis risk, and risk relating to specified structural features in liabilities. The charges for ALM risk will be based on factors that are applied to the notional (book value) amount of liabilities. Although foreign exchange risk will not be directly addressed in the model, the analyst may make adjustments to the A-L factors to account for such risk, if applicable. As will be discussed, the subcharges relating to certain structural features in liabilities where liability cash flows are related to mortality will be considered under a different section of the model. In developing the updated capital model, Standard & Poor's recognizes that in the case of certain asset-liability mismatches, the company remains exposed to potential losses, but will only experience an economic loss if adverse movements in financial market variables occur and our methodology reflects this. In the case of some structural features, such as book value surrenders upon death in annuity contracts, economic losses may also only be experienced if certain financial variables, such as interest rates, move adversely. In other cases, such as the ability for plan sponsors to withdraw GIC deposits, losses may depend on investor or policyholder behavior. Gamma risk (sometimes known as negative convexity risk) relating to an insurance company's assets, which results from the nonlinear movement between price and yield in assets that contain embedded options, such as prepayment options in MBS or call features in corporate bonds, can be the source of mismatches relative to the liabilities. However, this risk will be captured in the asset risk section of our model and our methodology (convexity test) for analyzing this risk in the U.S. has not changed substantively, but the applied interest rate movements will now be based on the targeted confidence

level across the ratings spectrum (i.e. larger rate shifts will be applied when testing portfolios from company's with higher ratings). The factors we will default to for negative convexity risk in assets if actual testing results are not available will be based on applying our test to proxy portfolios with conservative weightings of asset types and interest rate stresses based on the targeted confidence level for the company's rating. The rationale for including these charges in the asset risk section is that Standard & Poor's views asset gamma risk as additive and the magnitude of convexity risk the insurance company is exposed to typically not affected whether or not the asset is funded by a particular type of liability. Finally, it is Standard & Poor's assumption that the positive convexity that typically exists in an insurance company's portfolio of vanilla fixed-income assets is largely offset by the same mirrored (roughly equal magnitude but opposite signs) convexity characteristics that exist in the liabilities. Therefore, for the purposes of this model, this positive gamma or convexity is ignored. Methodology For Deriving Subfactors The following section will explain Standard & Poor's methodology for developing each of the subfactors relating to ALM risk and the product's structural components. A description of the risks encompassed and the technique for stressing the relevant risk variables will be defined. The end of the section contains the actual risk factors that will be applied to the liabilities with a map of which subfactors were aggregated to derive each factor. Mismatch risk overview (defined) Mismatch risk occurs when the magnitude or timing of cash flows from the company's book of assets, funding liabilities, and hedge instruments do not exactly match or offset and, therefore, have different price sensitivities to changes in market values as interest rates move. The sources of net exposure include fixed-income assets, funding liabilities such as GICs, structured notes, and funding agreements and off-balance-sheet hedging vehicles, such as OTC or exchange-traded derivative products and any other financial instruments that change in value as interest rates move, including commercial mortgage loans. Net mark to market changes, given applied movements in market risk variables (largely interest rate risk), provides an indication of the net present value of the change in future spread (i.e., economic gains and losses) and Standard & Poor's will focus on this when determining expected capital adequacy for ALM mismatches. Standard & Poor's will assume each of the nonindexed funding type liabilities are exposed to the same amount of mismatch risk for a given targeted rating category. When determining expected capital adequacy for mismatch risk, we use a simplified assumption for durational mismatch to determine the expected loss given the applied (stressed) interest rate volatility, which will be embedded in the factors. Although some companies may report tighter durational mismatches, in the U.S. the company analyst will not make adjustments on this assumption. It is Standard & Poor's opinion, that, in general, duration reporting alone might produce an inaccurate measurement of exposure to changes in interest rates and our simple durational mismatch assumptions have been determined with this in mind (and intentionally made greater than typically reported). Also, it is simplistic to assume that mismatches occur at one spot on the yield curve and therefore, duration which is not viewed as a series of partial or "key rate" durations typically does not effectively measure exposure to relative changes in interest rates along the curve. Furthermore, since an insurance company typically does not control the exercise of options embedded in either the assets or the liabilities, using an option-adjusted duration measurement to compare the A-L matching may be misleading (In a nutshell, Standard & Poor's feels that unless more granular modeling is done, duration alone may not provide an adequate measure of first order market risk). Methodology for creating mismatch risk subfactors When determining the sub-factor for mismatch risk, Standard & Poor's assumes a simple durational mismatch, which provides a proxy for the net percentage change in market value, between the combined portfolio of assets, liabilities, and hedge instruments, given a 100 basis point (bps) change in rates (sometimes known as modified duration). The applied durations, which will vary by locality, but not by rating category, are illustrated in Table 1. Table 1 Applied Durational Mismatches* (%) TARGETED RATING LEVEL U.S. AAA 1.00 AA 1.00 A 1.00 BBB 1.00 * Differential change in market value given 100 bps change in rates. Applied Interest Rate Volatility When determining the subfactor for mismatch risk, Standard & Poor's also makes an assumption for the applied interest rate movements (volatility), which are stressed in accordance with the company's targeted confidence interval. Standard & Poor's designates a financial instrument in each international locality to act as a proxy benchmark to use when measuring volatility based on empirical data. The proxies are chosen based on their tenor and other characteristics, which Standard & Poor's feels best represents the interest rate volatility we

are trying to capture. For example, in the U.S. model we use the 10-year constant maturity U.S. Treasury and in the U.K. we use the 10-year constant maturity GBP (Great Britain Pound) fixed rate swap as the proxy benchmark assets to determine applied volatility. Once the proxy benchmark asset is chosen, we determine the annualized standard deviation of monthly percentage movements (change in yield divided by previous yield) in rates observed over a representative time period, which would typically not be less than five years. The standard deviation, is then multiplied by the year-end yield on the proxy benchmark asset to equate the standard deviation to an applied basis point shift. Standard & Poor's rationale for deriving standard deviations based on percentage movements, rather than actual basis point movements, and then converting back to basis point, is to allow us to measure observed volatility under different rate scenarios and calibrate it to current rate levels. The final applied rate shifts are derived by taking the product of the standard deviation (in bps) and the Z-score that is consistent with the confidence level commensurate with the targeted rating category (the process as discussed at the beginning of the article). The applied interest rate volatilities are illustrated in Table 2. Table 2 Applied Interest Rate Volatilities (Bps) TARGETED RATING LEVEL U.S. AAA 235 AA 209 A 191 BBB 144 Mismatch risk subfactors The final subfactors for mismatch risk are derived by taking the products of the applied interest rate volatilities and the assumed durational mismatches. The Mismatch risk sub-factors are illustrated in Table 3. Table 3 Applied U.S. Mismatch Risk Subfactors MISMATCH RISK SUBFACTOR CALCULATION RATINGS LEVEL AAA AA A BBB Targeted confidence level (%) 99.90 99.71 99.41 97.17 (a) Associated Z-score 3.10 2.76 2.52 1.91 (b) 1 standard deviation movement 75.70 75.70 75.70 75.70 (c) Applied interest rate volatility = (a) * (b) (%) 2.35 2.09 1.91 1.44 (d) Applied duration mismatch 1.00 1.00 1.00 1.00 Mismatch risk subfactor = (c) * (d) (%) 2.35 2.09 1.91 1.44 Systemic Spread Volatility Risk Overview A systemic spread movement occurs when an entire market or market segment (e.g., bonds of a particular rating or sector) experiences a widening or tightening of spreads. A company will only incur an economic gain or loss due to a systemic spread movement when the tenor (or market value sensitivities) of assets and liabilities are mismatched or when no liability exists, such as in the case of surplus investments. Systemic spread volatility risk may exist whether or not an asset or liability pays its coupon on a fixed or floating rate basis (i.e. market values are impacted as systemic spreads widen and narrow). For example, suppose a company holds an asset with a tenor that exactly matches that of a liability. If market spreads widen on the asset and they sell it and buy a bond of the same credit quality and tenor, they would likely sell the asset for a price lower than the amortized or accrued purchase price (book price). However, if they reinvested the proceeds from the sale, they would largely replace the total NPV of the future cash flow because they would be investing less funds in an asset with higher yield than the original asset. Conversely, if systemic/spreads had tightened, the company would replace the total NPV of the cash flows by investing more funds at a lower yield. However, if a company holds an asset that is longer or shorter than the associated liability (or other cash flow differences create differences in MV sensitivities), the company would incur an actual economic gain or loss over the mismatched period due to the changes in spread. The magnitude of the gain or loss can be calculated by relating the price sensitivity of the asset to that of the liability for a given change in spread. In the case of surplus investments, the company would incur a gain or loss relating to the entire sensitivity of the investment. Methodology For Creating Systemic Spread Volatility Risk Subfactors Standard & Poor's will assume each of the nonindexed funding type liabilities in a given international jurisdiction will be exposed to the same amount of systemic spread volatility risk for a given targeted rating category. Standard & Poor's subfactor for determining systemic spread volatility risk is designed to capture the amount of capital adequacy that is required to cover the impact of asset spreads widening relative to that of the liability or hedge instrument in cases where assets are longer than the liabilities (or MV sensitivity of assets is greater than MV sensitivity of liabilities) and spreads tightening in cases where assets are shorter than the liabilities (or MV sensitivity of assets is less than MV sensitivity of liabilities). In both cases, we seek to determine capital adequacy for such losses only over the period of time where a mismatch exists and make the determination that the mismatch can be a result of either case. If asset spreads widen by one basis point, the relative change in the value of an asset (fixed or floating) is roughly equivalent to the change in a fixed rate asset if absolute rates rise by one basis point, which may be captured by using spread duration as a proxy (spread duration provides the percentage change in price given a 100 bps change in yield, making the simplistic assumption that

price and yield move linearly). Therefore, to capture the relative amount of market value (price) sensitivity the assets have relative to the liabilities and hedge instruments, given an adverse spread widening or tightening, Standard & Poor's uses the same assumed durational mismatch we used when developing the subfactor for mismatch risk (see Table 1). As a simplistic example, assume a funding transaction creates a liability with a spread duration of 7% and the proceeds are used to provide funding for an asset with a spread duration of 8%. If asset spreads immediately widen out by 25 bps, the net economic loss due to spread widening would be approximately .25% or (8%-7%) * .25. (The 8% provides the full market value change in the asset for a 100 bps shift and the 7% sensitivity of the liability provides a proxy for the portion of the tenor where the shift will not have an economic impact on the company's future spread due to locked in funding). Incidentally, given the example, Standard & Poor's assumes the company would incur the same economic loss whether they sell the asset when the funding liability matures or instead incurs an opportunity cost by keeping the asset and creating new funding for it, rather than buying a new asset with the wider spread to support the new liability. Applied Spread Volatility As a proxy assumption for spread widening or tightening over the mismatched period (i.e. applied spread volatility), Standard & Poor's compared the empirically observed monthly spread differential between a US$ 'A' rated bond index created with a constant 10-year maturity and the 10-year constant maturity US$ swap index, over a representative time period. We separated the spread differentials by observation month to create 12 different sets of data (e.g. Spread differential observed in January of each year over the entire observed period). For each set of data we calculated the change in spread observed over each of the annual periods and divided by initial yield at the start of each year to derive the annual percentage change in spread relative to the asset yield. The standard deviation of the percentage change in spread was calculated for each of the 12 sets of data (a one-year period coincides with our targeted period for expected capital sufficiency). The standard deviations observed across each of the 12 sets of data were averaged to determine the applied standard deviation. To calibrate the percentage change in spreads to the current market and convert it to basis points, the product of the percentage change in spread and the current rate on the bond index was used as the applied standard deviation. The assumed spread widening or tightening applied is derived by taking the product of the standard deviation of the movement in basis points and the Z score associated with the company's targeted confidence interval. Although Standard & Poor's is aware that various sectors (e.g., ABS, MBS), ratings, and tenors will produce varying statistical spread relationships, we are comfortable that this methodology provides justifiable estimates of expected spread volatility given the targeted confidence levels. Table 4 details the assumed spread volatility applied by targeted level. Table 4 Applied Spread Volatilities (Bps) Targeted Rating Level U.S. AAA 55 AA 49 A 45 BBB 34 Systemic spread movement subfactors The final subfactors for systemic spread volatility risk are determined by taking the product of the assumed spread duration mismatches and the applied proxies for spread movement, which are illustrated in Table 5. Table 5 Applied U.S. Spread Volatility Risk Subfactors SPREAD VOLUME RISK SUBFACTOR CALCULATION TARGETED RATING LEVEL AAA AA A BBB Targeted confidence level (%) 99.90 99.71 99.41 97.17 (a) Associated Z-Score 3.10 2.76 2.52 1.91 (b) 1 Std. deviation movement 17.72 17.72 17.72 17.72 (c) Applied spread volatility = (a) * (b) (%) 0.55 0.49 0.45 0.34 (d) Applied spread duration mismatch 1.00 1.00 1.00 1.00 Spread volume risk subfactor = (c) * (d) (%) 0.55 0.49 0.45 0.34 Liability Structural Feature Risk Overview The structural features embedded in insurance company investment products, such as payout schedules based on mortality, book value surrenders upon death, and benefit responsive withdrawals, can expose the company to risk or in some instances, such as in the ability to reset rates in an advantageous manner, can reduce the insurance company's exposure to risk. When present, Standard & Poor's will view these risks as additive to the other subcategories of risk relating to ALM and has developed subfactors for each of the major types of structural features that have the potential to create adverse economic losses. These risks will be aggregated with the other relevant subfactors. In some instances, more than one of these subfactors for structural feature risk will be added when deriving the factor for a given liability type. In liability types where mortality improvement will cause a detrimental economic impact, a charge will be added under the insurance risk section of our model, but for simplicity will be explained in this portion of our write-up. The factors are largely based on the results of Standard & Poor's advanced capital modeling process, which we have applied to a multitude of

insurance company books. In addition, the factors reflect internal and external industry expertise. Each of the sub-factors is stressed in accordance with the targeted confidence interval. We believe it is beyond the scope and purpose of this paper to discuss the techniques applied for deriving the expected capital adequacy for each of the various subfactors, but encourage parties that are interested in a broader discussion of the methodology to contact us. Table 6 lists the subcharges for liability structural features by type and rating category. Table 6 Subfactors For Risk Related To Options Embedded In U.S. Liabilities SUBFACTORS FOR EMBEDDED OPTIONS (%) TARGETED RATING LEVEL AAA A AA BBB OPTION TYPE Elective surrender covered by partial MVA 0.06 0.05 0.05 0.03 Elective surrender covered by full MVA 0.08 0.06 0.07 0.05 Elective surrender not covered by MVA 0.17 0.14 0.15 0.10 Death surrender with book value payout 0.56 0.46 0.50 0.35 Mortality improvement (current and delayed payout) 0.84 0.69 0.75 0.52 Optional early retirement benefit 0.51 0.41 0.45 0.31 Minimum guarantees 0.56 0.46 0.50 0.35 Benefit responsive withdrawals 0.28 0.23 0.25 0.17 Window GIC deposits 0.84 0.69 0.75 0.52 No surrender charges 0.56 0.46 0.50 0.35 Aggregate asset-liability factors Table 7 provides the aggregate total factors that are applied to liabilities to capture asset-liability risk. Table 7 Asset-Liability Risk Charges Applied To U.S. Insurance Companies TARGETED RATING CATEGORY LIABILITY TYPE AAA AA A BBB FUNDING LIABILITIES WITH NO EMBEDDED OPTIONS MTN's 2.91 2.58 2.36 1.79 Funding Agreements 2.91 2.58 2.36 1.79 F/A backed MTNs 2.91 2.58 2.36 1.79 STRUCTURED SETTLEMENTS Structured Settlements with life contingencies 3.75 3.33 3.05 2.31 Structured Settlements without life contingencies 2.91 2.58 2.36 1.79 BENEFIT RESPONSIVE GICS Window GICs 3.75 3.33 3.05 2.31 Nonwindow GICs (deposits certain) 3.19 2.83 2.59 1.96 INSTITUTIONAL FIXED RATE DEFERRED ANNUITIES Institutional fixed rate deferred annuity with life contingencies 4.90 4.35 3.98 3.01 FIXED RATE DEFERRED ANNUITIES—RETAIL Partial market value annuity (with surrender charge) 4.37 3.88 3.55 2.69 Full market value annuity (with surrender charge) 4.39 3.90 3.57 2.70 No market value annuity (with surrender charge) 4.48 3.98 3.64 2.76 Partial market value annuity (without surrender charge) 4.94 4.38 4.01 3.03 Full market value annuity (without surrender charge) 4.96 4.40 4.03 3.05 No market value annuity (without surrender charge) 5.05 4.48 4.10 3.10 FIXED RATE IMMEDIATE PAYOUT ANNUITIES (SINGLE PREMIUM IMMEDIATE ANNUITY) Retail single premium immediate annuity with life contingency 4.32 3.83 3.51 2.65 Retail single premium immediate annuity without life contingency 3.47 3.08 2.82 2.13 Pension annuity—with life contingency 4.32 3.83 3.51 2.65 Pension annuity—without life contingency 3.47 3.08 2.82 2.13 INDEXED ANNUITIES Indexed Annuities 2.49 2.21 2.02 1.53 TWO-TIERED ANNUITIES Indexed deferral period 3.26 2.89 2.65 2.00 Fixed rate deferral period 4.39 3.90 3.57 2.70 OTHER LIABILITIES Synthetic GICs—less than $500 million 0.57 0.51 0.46 0.35 Synthetic GICs—$500 million to $2 billion 0.49 0.43 0.40 0.30 Synthetic GICs—more than $2 billion 0.33 0.29 0.26 0.20 For more on the way Standard & Poor's is updating the way it assesses the capital adequacy of insurance companies worldwide, please refer to the RatingsDirect article, "Request For Comment: Revisions In The Risk-Based Insurance Capital Model."