



SOCIETY OF ACTUARIES

**Market-Consistent Embedded Value Seminar
December 2008**

**Session 7: Case Study—Monitoring MCEV
Results**

[Richard D. Ash, Craig Buck](#)

MCEV ANALYSIS OF MOVEMENT

SUMMARY

The following slides step through one possible methodology for analyzing the basic analysis of movement of MCEV. The following steps are considered in sequence:

- Starting point—Prior Val. Date result
- Opening Adjustments
- Operating Assumption Changes
- Risk-Free Return
- Expected Return
- Changes in Economic Assumptions
- New Business Contribution
- Economic Experience Variances
- Operating Experience Variances
- Ending point—Current Val. Date result

The particular sequence shown here is not necessarily the only acceptable approach, and others may decide a different sequence is more appropriate. In addition, it is possible to define additional steps if more granular analysis is desired. Practical considerations come into play in that decision.

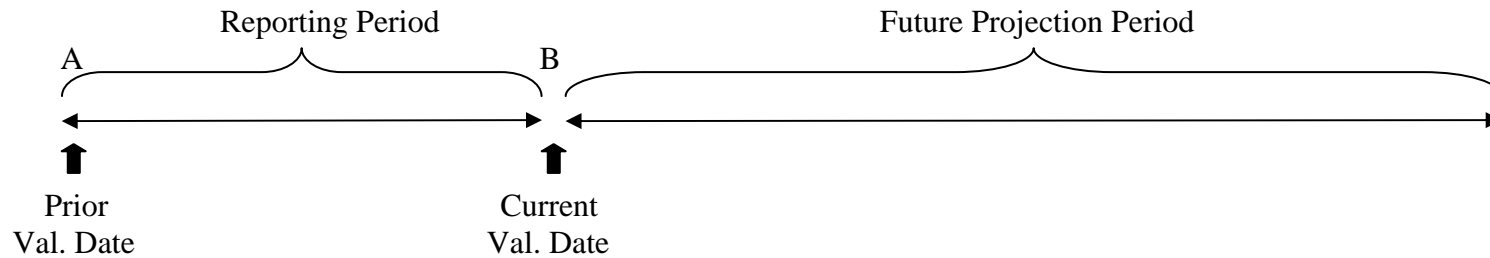
The diagram shown is identical in each slide and is included simply as a reference point for convenience in discussing the analysis at each step.

MCEV ANALYSIS OF MOVEMENT
STEP 1

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Prior Period Result	As of the Prior Val. Date "A"	As in effect at "A"	As in effect at "A"	Full Stochastic

Comments:

The prior year ending result is the beginning point for the analysis of movement for the Reporting Period.



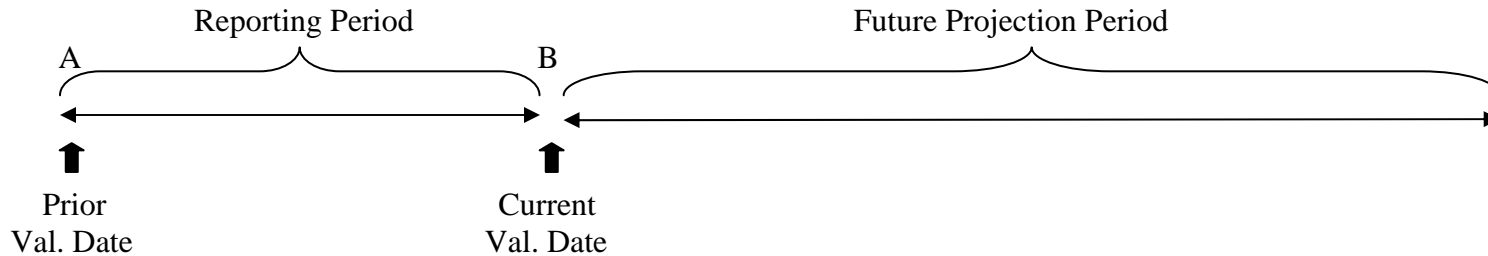
MCEV ANALYSIS OF MOVEMENT
STEP 2

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Opening Adjustments	As of the Prior Val. Date "A"	As in effect at "A"	As in effect at "A"	Typically Full Stochastic, but may depend on item being analyzed

Comments:

To the extent any modeling or other changes have been made since the Prior Val. Date, these are reflected as adjustments to the prior period ending result so as to not distort current year analysis. The best example of an opening adjustment might be a model run performed after the fact to "true up" values for an approximate method that may have been used for "live" reporting, such as a 9+3 approach.

As appropriate, these items may later be allocated to different line items in the analysis or income statement presentation.

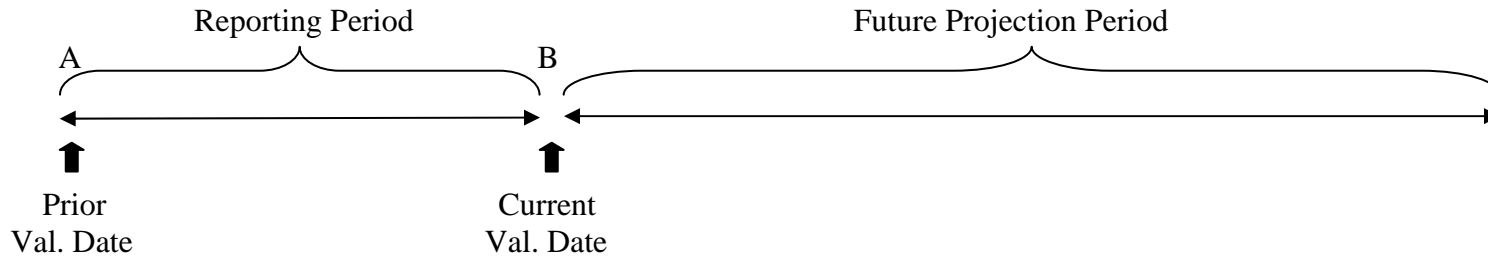


MCEV ANALYSIS OF MOVEMENT
STEP 3

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Operating Assumption Changes	As of the Prior Val. Date "A"	Determine at "B"; Implement retroactive to "A"	As in effect at "A"	Full Stochastic

Comments:

Assumption changes analyzed in this step might include mortality, morbidity, persistency, expense, spread, or premium persistency, for example. The beginning of year convention is not universal, but a matter of choice. If these changes are based on recent emerging experience, this approach may have the effect of eliminating what would otherwise appear as an experience variance and in that way serve as a validation of a correct assumption choice, at least for the Reporting Period.

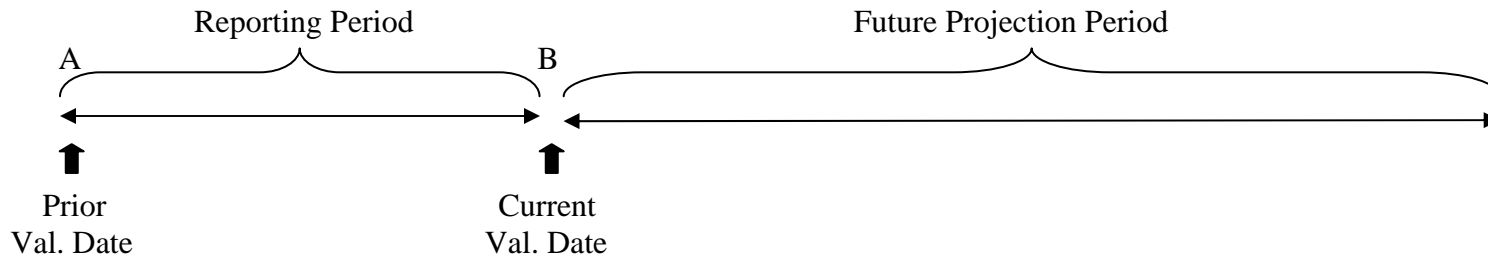


MCEV ANALYSIS OF MOVEMENT
STEP 4

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Risk-Free Return	As of Prior Val. Date “A” rolled forward to “B” at the risk-free rate	Determine at “B”; Implement retroactive to “A”	As in effect at “A”	Spreadsheet

Comments:

This is the “unwind of discount” step from traditional embedded value, where beginning of year values are rolled forward to the end of year at the risk-free rate of return. An amount is then transferred out of the value of in-force (VIF) into net worth at point “B” to capture the earnings emerging at year-end. As an approximation, this amount can be equal to the “Reporting Period” earnings that were projected in the start-of-year deterministic model run from Step 3, plus the year one earnings included in the deterministic adjustments outside the model, if any, when the start-of-year MCEV was prepared. Note that the VIF includes the cost of options and guarantees.



MCEV ANALYSIS OF MOVEMENT
STEP 5

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Expected Return	As of Prior Val. Date “A” rolled forward to “B” on an expected real world investment return basis	Determine at “B”; Implement retroactive to “A”	As in effect at “A” except for the Reporting Year, where real world investment returns are used	Deterministic

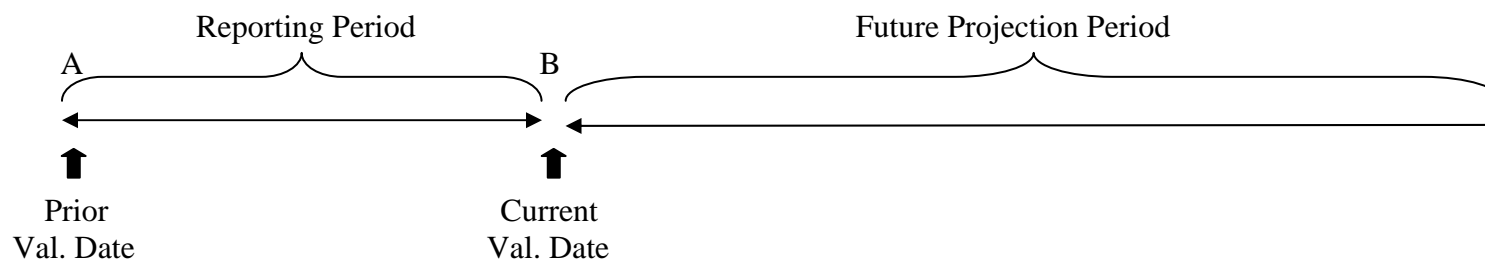
Comments:

The previous step captured only the risk-free return on MCEV. This step adds in an amount equal to what would have been expected under real world assumptions as of the beginning of the year, for the current year only, then reverting back to certainty-equivalent levels thereafter (i.e. from year 2 onwards) in a manner consistent with the beginning-of-year forward swap curve.

The expected returns for the various asset classes will be set appropriately based on predefined targets or rules. As examples:

- equity returns may be equal to 10-year Treasuries + X% risk premium,
- corporate bond yields may equal the risk-free rate plus expected spreads, less a provision for expected defaults,
- derivatives may be evaluated based on performance that would have occurred under the defined real world returns.

In this step, discounting of distributable earnings is now back to point “B” and will be done consistent with the initial forward swap curve from point “A.” The value attributable to this step is the difference in Reporting Period values (undiscounted) between this step and Step 4, plus the difference in the deterministic Future Projection Period values from this step and Step 4. Note that some slight difference in COG may be missed using this approach. If desired, an approximate adjustment to the COG may be added as well by comparing this run to the deterministic run from Step 1, and proportionally adjusting the Step 1 COG.



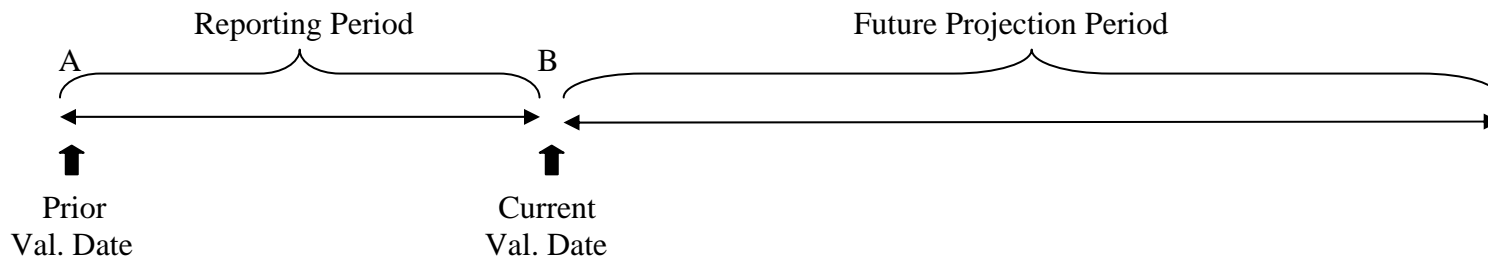
MCEV ANALYSIS OF MOVEMENT
STEP 6

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Changes in Economic Assumptions	As of Prior Val. Date "A" rolled forward to "B" on an expected real world investment return basis	Determine at "B"; Implement retroactive to "A"	As in effect at "B" with real world investment returns used for the Reporting Year	Deterministic

Comments:

This step adjusts economic assumptions to those in effect at the Current Val. Date ("B"). Reporting Period values for this step and Step 5 are the same. In this step, discounting of distributable earnings is back to point "B" and will be done consistent with the initial forward swap curve from that point "B." The value attributable to this step is the difference in the deterministic Future Projection Period values from this step and Step 5. The purpose of the step is primarily to evaluate the impact of the new economic conditions (as revealed through the new scenarios) on the prior assets and liabilities. Other adjustments that might be considered in this step are to measure any impacts of economic conditions on portfolio yield or swap positions.

While new scenarios from point "B" have been added at this step, a certainty-equivalent approach is used for simplicity. Note that as in the prior step, some slight difference in COG may be missed using this approach. As before, an adjustment to the COG may be added by comparing this run to the deterministic run from Step 1, and proportionally adjusting the Step 1 COG.



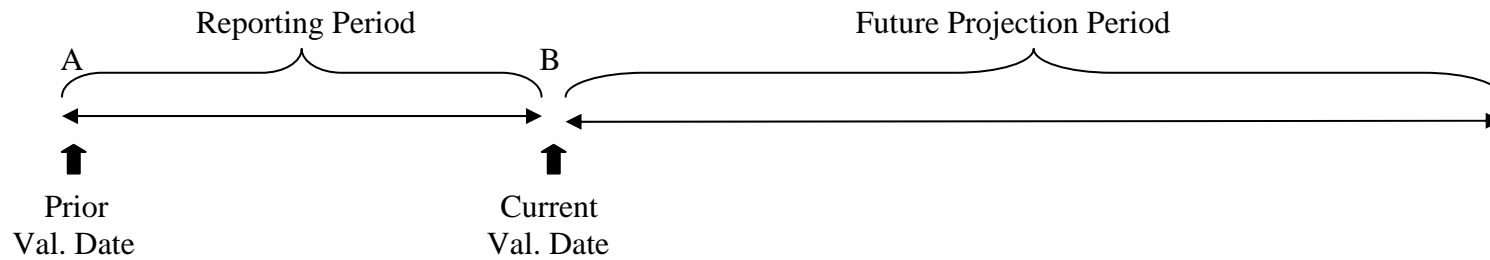
MCEV ANALYSIS OF MOVEMENT
STEP 7

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
New Business Contribution	Actual Sales during the reporting period	Determine at "B"; Implement retroactive to "A"	Point of Sale	Full Stochastic

Comments:

In this step, "point of sale" assumptions are used, and this concept can be defined in many ways. One approach is to average the pertinent economic inputs from each calendar quarter end, weighted by sales for that calendar quarter, and perform a single model run using these average inputs. An alternative approach would be to run separate valuations for each quarter's new sales, using the appropriate assumptions for that quarter.

New business values are the sum of the undiscounted results for the Reporting Period, plus the discounted values from the Future Projection Period. Note that in this step, new business is valued on a "marginal" basis, where the prior in-force file is supplemented with the new business and corresponding asset purchases entering the model somewhat as they would in real life.

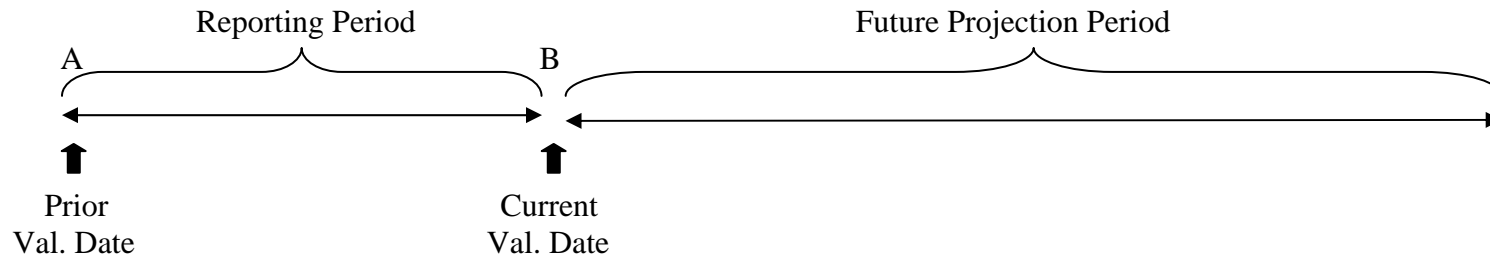


MCEV ANALYSIS OF MOVEMENT
STEP 8

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
New Business Contribution	Actual Sales during the reporting period	Determine at "B"; Implement retroactive to "A"	As in effect at "B" with real world investment returns used for the Reporting Year	Full Stochastic

Comments:

As the New Business has been valued using assumptions differing from those in effect on the Current Val. Date ("B"), it is necessary to capture the change in value arising from these differing assumption sets. While this amount is identified separately for analysis purposes, it might typically be combined with the next step (Economic Experience Variances) for presentation purposes.



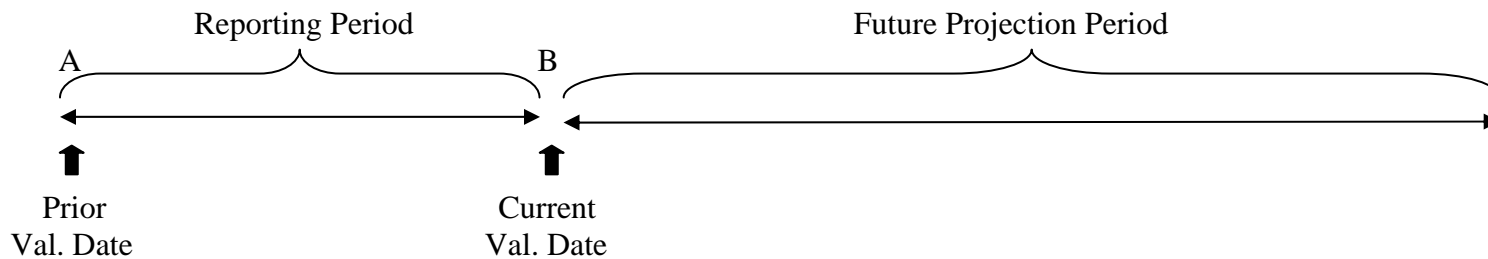
MCEV ANALYSIS OF MOVEMENT
STEP 9

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Economic Experience Variances	As of Prior Val. Date “A” rolled forward to “B” using actual economic experience for the Reporting Period	Determine at “B”; Implement retroactive to “A”	As in effect at “B” with real world investment returns used for the Reporting Year	Full Stochastic on VA’s; Outside-model analysis for short-term fluctuations

Comments:

At this step, individual company variations will be plentiful. In our case, variable annuity analysis is the key priority, so a model analysis is performed to determine the gain or loss due to variations in separate account returns versus expected. This gain or loss will be made up of both an undiscounted piece attributable to the Reporting Period, and a discounted piece attributable to the Future Projection Period.

Most other short-term fluctuations are outside-the-model investment items and therefore are quantified separately. These might include the mark-to-market on derivative or hedge positions, or other non-modeled investment items.



MCEV ANALYSIS OF MOVEMENT
STEP 10

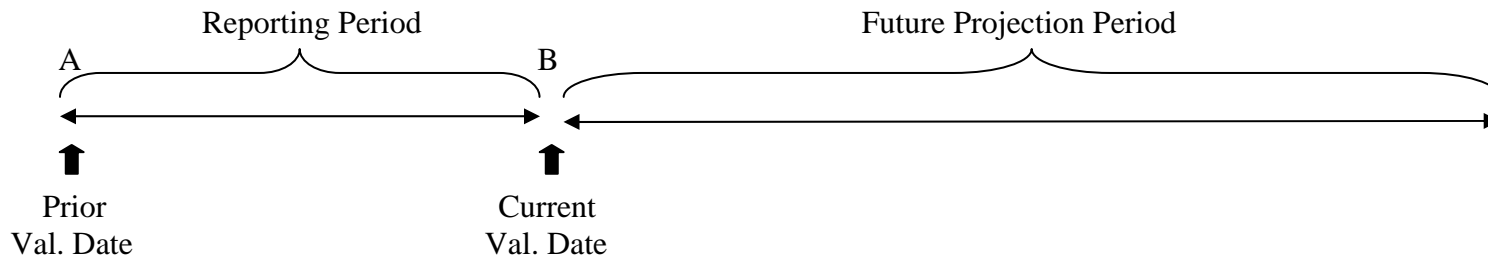
Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
Operating Experience Variances	As of Prior Val. Date “A” rolled forward to “B” using actual economic experience for the Reporting Period	Determine at “B”; Implement retroactive to “A”	As in effect at “B” with real world investment returns used for the Reporting Year	Model run for persistency variance; other calculations outside the model

Comments:

A variety of techniques are used to quantify the various operating experience variances. Certain items are considered Reporting Period-only with very little if any secondary impact in the Future Projection Period. These might include mortality, on the assumption that Future Reporting Period secondary impacts are minimal, and expense variances.

Persistency variance is measured taking into account Future Projection Period impacts, with a model evaluation performed for the block of lapsed policies relative to what would have been expected from the prior in-force. One simplified technique used is to first determine the ratio of VIF to account value for those policies who have lapsed during the Reporting Period. Then apply this ratio to the estimated account value for those policies expected to lapse under model assumptions to determine expected VIF lost due to terminations. Other techniques are also possible.

Variances that are candidates for analysis but that are not typically measured include those related to separate account to general account transfers, commissions, or statutory reserve increases, for example.



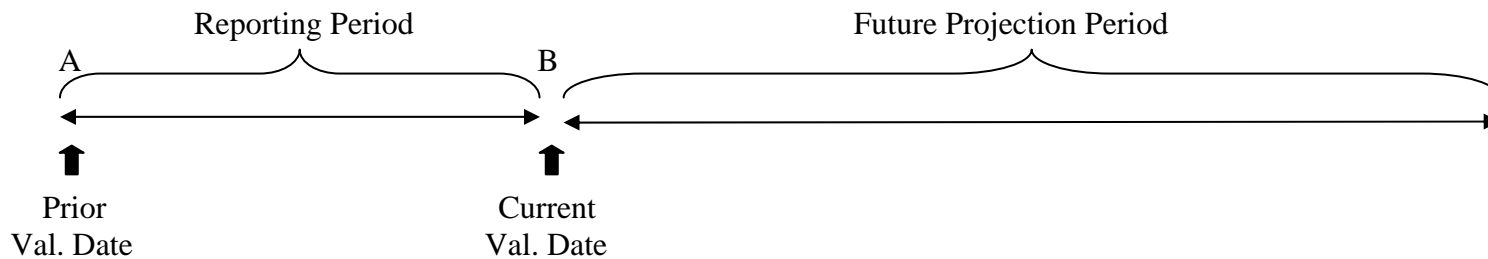
MCEV ANALYSIS OF MOVEMENT
STEP 11

Item	Data	Operating Assumptions	Economic Assumptions	Type of Run or Analysis
End of Period MCEV	As of the Current Val. Date "B"	As in effect at "B"	As in effect at "B"	Full Stochastic

Comments:

Finally, current valuation date assets and liabilities are modeled!

At this point, a complete reconciliation can be developed from the prior reported values. The result will be two reconciling "other" items. One will be related to the various deterministic model runs and related analysis. This might typically be labeled as an "other experience variance." The second will be related to the COG as developed through this framework and will be related to the various stochastic model runs performed. Tolerances would be set as to the allowed magnitude of these "other" items to see if further analysis is necessary. When the tolerances have been exceeded on either of these reconciling items, this could be an indication of the need for an additional reconciling item; however, as often as not, further investigation as often as not reveals a modeling error or oversight as the cause of the discrepancy.



watsonwyatt.com



MCEV – Monitoring Results

Craig A. Buck, FSA, MAAA
Watson Wyatt Worldwide

Market-Consistent Embedded Value
December 4-5, 2008 | Philadelphia, Pa.

December 4, 2008



Agenda

- MCEV Movement / Source of Earnings
- TVOG Movement
- Value of New Business

Agenda

- MCEV Movement / Source of Earnings
- TVOG Movement
- Value of New Business

Movement Analysis

Opening MCEV

New Business Value

+ Expected EB Cont. (reference rate)

+ Expected EB Cont. (excess of reference rate)

+ Experience Variance

+ Assumption Changes

+ Other Operating Variance

= Operating MCEV Earnings

+ Economic Variances

+ Other Non-operating variances

= Total MCEV Earnings

Closing MCEV

Note: Each component of movement must be split between free surplus, required capital and VIF

ANW

- Adjusted Net Worth rolls with statutory surplus
- Simple rollforward (ignoring other adjustments such as DTA and AVR):

ANW BOY

- A1) + Stat Earnings - EB
- A2) + Stat Earnings - NB
- A3) + Stat Earnings on ANW
- A4) + Chng in URCG on surplus assets
- A5) + Capital Contributions
- A6) - Dividends

ANW EOY

PVFP

- Covered in previous presentation
- Quantify various impacts by moving to current model in steps

PVFP BOY

- P1) + Unwind (RFR x VIF BOY)
- P2) - Earnings Transfer
- P3) + VANB (PVFP on NB)
- P4) + Change in Economic Environment on PVFP
- P5) + Assumption Change Impact on PVFP

PVFP EOY

Frictional Cost

- Can be viewed in different ways much like cost of capital
 - Capital Charge: $FC = \sum RC_t \times (TR + IMF) \times v^t$ or
 - Distributable Earnings: $FC = [\sum RC_t \times (r_f \times (1 - TR - IMF)) \times v^t] - RC_0$
- Using Capital Charge approach, can be rolled as:

FC BOY

F1) + Unwind (RFR x FC BOY)

F2a) + RFR x Required Capital ('RC')

F2b) - Assumed RFR x (1-TR-AMF) x RC

F2) + Capital Charge [F2a-F2b]

F3) + FC on NB (EOY)

F4) + Change in Economic Environment on FC

F5) + Assumption Change Impact on FC

FC EOY

Cost of Non-Hedgeable Risk

- Simple roll of Cost of Non-Hedgeable Risk assuming a top down approach:

CNHR BOY

C1) + Unwind (RFR x CNHR BOY)

C2a) + RDR x Required Capital on NHR ('RCNHR')

C2b) - Assumed RFR x (1-TR-AMF) x RCNHR

C2) + Capital Charge [C2a-C2b]

C3) + CNHR on NB (EOY)

C4) + Change in Economic Environment on CNHR

C5) + Assumption Change Impact on CNHR

CNHR EOY

Movement Summary

ANW BOY	P1) + Unwind (RFR x VIF BOY)	
A1) + Stat Earnings - EB	F1) + Unwind (RFR x FC BOY)	
A2) + Stat Earnings - NB	C1) + Unwind (RFR x CNHR BOY)	
A3) + Stat Earnings on ANW	+ Unwind	
A4) + Chng in URCG on surplus assets		
A5) + Capital Contributions	F2) + Capital Charge [F2a-F2b]	
A6) - Dividends	C2) + Capital Charge [C2a-C2b]	
ANW EOY	+ Release of MVMS	
PVFP BOY	A3) + Stat Earnings on ANW	+ Expected at Reference Rate + Expected RW over Reference + Actual over Expected RW
P1) + Unwind (RFR x VIF BOY)	+ Return on ANW	
P2) - Earnings Transfer	A2) + Stat Earnings - NB	+ Expected at Reference Rate + Expected RW over Reference + Actual over Expected RW
P3) + VANB (PVFP on NB)	P3) + VANB (PVFP on NB)	
P4) + Change in Economic Environment on PVFP	F3) + FC on NB (EOY)	
P5) + Assumption Change Impact on PVFP	C3) + CNHR on NB (EOY)	
PVFP EOY	+ VNB	
FC BOY	A1) + Stat Earnings - EB	+ Expected at Reference Rate + Expected RW over Reference + Actual over Expected RW
F1) + Unwind (RFR x FC BOY)	P2) - Earnings Transfer	
F2a) + RFR x Required Capital (RC)	+ Experience Variation	
F2b) - Assumed RFR x (1-TR-AMF) x RC	A5) + Capital Contributions	
F2) + Capital Charge [F2a-F2b]	A6) - Dividends	
F3) + FC on NB (EOY)	+ Capital Contributions	
F4) + Change in Economic Environment on FC	A4) + Chng in URCG on surplus assets	
F5) + Assumption Change Impact on FC	P4) + Change in Economic Environment on PVFP	
FC EOY	F4) + Change in Economic Environment on FC	
CNHR BOY	C4) + Change in Economic Environment on CNHR	
C1) + Unwind (RFR x CNHR BOY)	+ Economic Variance	
C2a) + RDR x Required Capital on NHR (RCNHR)	P5) + Assumption Change Impact on PVFP	
C2b) - Assumed RFR x (1-TR-AMF) x RCNHR	F5) + Assumption Change Impact on FC	
C2) + Capital Charge [C2a-C2b]	C5) + Assumption Change Impact on CNHR	
C3) + CNHR on NB (EOY)	+ Impact of Assumption Change	
C4) + Change in Economic Environment on CNHR		
C5) + Assumption Change Impact on CNHR		
CNHR EOY		

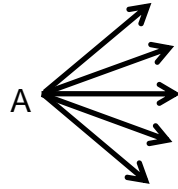
Agenda

- MCEV Movement / Source of Earnings
- TVOG Movement
- Value of New Business

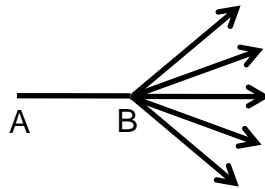
Definition of Earnings

- TVOG represents an average of a range of scenarios in excess of baseline scenario
- Each scenario will roll identical to PVFP
 - Average unwind will be equal to 1 year forward discount rate
- Alternatives with respect calculation of 'earnings'
 - Back into earnings by calculating unwind
 - Calculate earnings directly
- Need to separate into impact of assumption change, expected earnings, experience variance, economic impact
 - Need to complete a series of stochastic projections to isolate impact of each

TVOG Projections



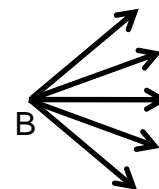
Step 1: Original TVOG on BOP Val Date



Step 2: Expected Rf from det scen for A→B, A economic assmpts

Step 3: Expected RW from A→B, A economic assmpts

Step 4: Step 3 + Rev Assmpts



Step 5: A economic assumptions, B inforce models

Step 6: B Economic assumptions, B inforce Models

Expected EB Contribution (reference rate): Step 2 – Step 1

Expected EB Contribution (excess of Reference Rate): Step 3 – Step 2

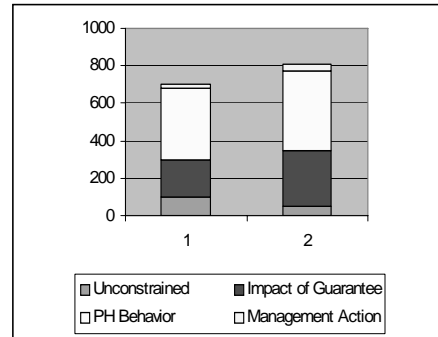
Assumption Changes: Step 4 – Step 3

Experience Variances: Step 5 – Step 4

Economic Variances: Step 6 – Step 5

TVOG Analytics

- Analytics discussed in earlier presentations
- Can be helpful in explaining change in TVOG in practical terms
 - Impact of change in economic environment on in-the-moneyness of policyholder guarantees (e.g., interest guarantees, equity puts) and options (e.g., surrender options)
 - Can test impact of alternative management actions and investment strategies on each of these items



Agenda

- MCEV Movement / Source of Earnings
- TVOG Movement
- Value of New Business

Allocations

- TVOG, CNHR, FC
- Ideally will be consistent with manner in which the business is managed
- Need to balance theory and pragmatism
 - Stand alone
 - Marginal

VNB Analytics

- Although not required in group presentations, separate analytics on new business written can provide useful insights
- Separately analyze experience variances on new business
 - VNB is point of sale
 - Need to be able to capture new business cash flows from ledger

Presenter's Contact Details

Craig Buck

U.S. Life Actuarial Leader

Watson Wyatt Worldwide

610-232-0402

Craig.Buck@watsonwyatt.com

www.watsonwyatt.com