37 - PBR Attribution Analysis: How to Explain Reserve Movements

2019 Valuation Actuary Symposium

Session 37: PBR Attribution Analysis- How to Explain Reserve Movements

Mon, August 26, 2019 3:30-5:00 PM

Chris Whitney, FSA, MAAA, Principal, Oliver Wyman- Moderator

William M. Sayre, FSA, MAAA, Principal, Milliman

Kunal Kang, ASA, Associate Actuary, Prudential Financial

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Moderator Biography

Chris Whitney, FSA, CERA,MAAA
Principal, Oliver Wyman

Chris Whitney is a Principal at Oliver Wyman and is located in the Hartford office.
His primary areas of practice include life principle-based reserving, life pricing and product development, GGY AXIS financial modeling and mergers and acquisitions (M&A).

Prior to joining Oliver Wyman, Chris led the Assumption and Model Management and Product Operations teams within the Product Management Group at Liberty Mutual.

Chris is a Member of the Academy's Life Reserves Work Group and LTC Combo Valuations Work Group and is a frequent speaker at industry conferences on PBR topics.

He's a Fellow of the Society of Actuaries (FSA), and a Member of the American Academy of Actuaries (MAAA).

Presenter Biographies

William M. Sayre, FSA, MAAA
Principal, Milliman

Bill is a principal and consulting actuary with the New York office of Milliman. He joined the firm in 1989. Bill works with life insurance companies on a variety of matters including valuation, financial reporting, risk-based capital, asset modeling, asset adequacy analysis, and actuarial appraisals for mergers and acquisitions. Bill has significant experience working with smaller insurance companies, particularly in relation to valuation and financial reporting.

Bill is on the Board of the IAA Life Section and formerly served on the SOA Board, as well as a number of Sections, Committees and Task Forces. He is a frequent speaker at industry conferences on valuation-related topics.

Presenter Biographies

Kunal Kang, ASA
Associate Actuary, Prudential Financial

Kunal is an Associate Actuary at Prudential Financial and is a part of the Actuarial Leadership Development Program, Prudential's rotational program. His current rotation is in Individual Life PBR Valuation, where he is responsible for calculating and reporting quarterly reserves. Some of his other duties include conducting sensitivity analysis and building out analytics to explain the key drivers of PBR movements.

His previous roles include positions in Group Insurance, Retirement Forecasting, and Enterprise Asset Adequacy Testing, where he assisted with mortality and lapse experience studies, determined forecasted AAT reserves, and supported derivative modeling efforts for AAT reserve calculations.

Kunal became an Associate of the Society of Actuaries in 2018 and is close to obtaining his FSA.

Presenter Biographies

Dylan Strother, FSA, MAAA
Senior Consultant, Oliver Wyman

Dylan Strother is a Senior Consultant with the Actuarial Practice of Oliver Wyman and is based in New York. He is rooted in statutory and GAAP valuation and financial reporting across a variety of products and has extensive experience in modeling, model validation, and actuarial modernization projects.

Dylan has worked in the actuarial field since graduating from the University of Pittsburgh in 2010.

Prior to joining Oliver Wyman, Dylan was a Vice President within the Consulting Services group at PolySystems where he led development and implementation efforts for clients around emerging regulation and advanced modeling capabilities. Dylan is a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries.

Presenter Biographies

Leonard Mangini, FSA, FRM, FALU, MAAA
President, Mangini Actuarial and Risk Advisory LLC

Mr. Mangini brings clients over 29 years of industry expertise, holding senior Financial, Pricing, Reinsurance, and Risk Management roles at Manulife, ACE, AXA, and USLIFE, He has assisted clients with PBR, IFRS and US GAAP reporting, Product Development, Traditional/Accelerated Underwriting, Reinsurance, Risk Management, M&A, and Litigation-support at E&Y, Milliman, and now his own advisory firm.

In his last direct company role, Leonard was Deputy Global Corporate Chief Actuary supervising principles-based assumption and margin "unlocking" and Source of Earnings Analysis for 100+ products in 19 business units across the US, Canada, and Asia and also served on the Global Product Risk and Global ALM Committees. *In prior reinsurance roles,* he has served as an internal-Board member, President, Chief Actuary, Chief Pricing Officer, and Chief Risk Officer, and co-founded a US-domiciled life reinsurer. He is an external consulting Appointed Actuary for an IFRS-reporting insurer.

Leonard is heavily involved with the Academy of Actuaries serving as Chair of the PBR Life Reserve Work Group (LRWG), the Life Practice Council (LPC), Life Valuation Committee (LVC), PBR Assumption Resource Manual Work Group (PBRARM), and the PBR YRT Field Test Oversight and Design Groups.

He previously chaired the Society of Actuaries' Financial Reporting Section Council and served on four other Councils.

Leonard is a Fellow of the Society of Actuaries (FSA), a GARP-Certified Financial Risk Manager (FRM), Fellow of the Academy of Life Underwriting (FALU), a Member of the Academy of Actuaries (MAAA), and earned an MS in Computational Finance and BS in Mathematics and Physics and Minor In English.

Session Agenda

- Introduction and Overview of SOA PBR SOE Research
- Putting Attribution Analysis Into Practice
- Attribution Analysis Challenges and Model Architecture
- Integrating PBR Attribution Analysis with Other Company Processes

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Introduction and Overview of SOA PBR Source of Earnings Research

William M. Sayre, FSA, MAAA, Principal, Milliman

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Research Overview

Objective – To Identify and discuss:

- Factors influencing PBR statutory amounts (i.e. Sources of Change)
- Approaches to analyze periodic changes – from other regimes and from company interviews
- Provide a suggested approach for VM-20 reserve changes with a practical example facilitated through case studies

Approach

- Identify and discuss sources of change in reserve and volatility in general and for VM-20 specifically
- Inventory other reporting regimes for methods of analyzing changes in reserves
- Interview company actuaries to find out what attribution methods are used in practice
- Through case studies, develop a practitioner's How-To Guide and suggested VM-20 attribution analysis

Sources of Change in VM-20 Reserves

Four primary categories:

- Economic assumptions
- Non-economic assumptions
- Demographics
- Risk mitigation programs/ Management actions/ Reinsurance/ Other

Sources of Change in VM-20 Reserves

As a further example – VM-20 Mortality Assumptions – Examples of specific sources of reserve change

- Actual experience mortality emerges different from anticipated experience assumption – so company's assumption governance committee deems assumption must be updated
- Credibility different at time (1) versus time (0): margins change
- Sufficient data period could increase (or decrease): grading changes
- Industry mortality tables updated: 2015 VBT to 20XX VBT

Reporting Regimes that use Attribution Analysis

- Market Consistent Embedded Value (MCEV)
- Actuarial Guideline XLIII (AG 43)
- US Generally Accepted Accounting Principles (GAAP)
- International Financial Reporting Standards (IFRS)
- Canadian Asset Liability Method (CALM)

Company Interviews – How Attribution Analysis works in Practice

- 6 companies, of various sizes
- Financial Reporting Regimes used?

USGAAP	AG 43	CALM	IFRS	MCEV
5	6	1	2	2

Company Interviews – How Attribution Analysis works in Practice

- What analysis tool is most frequently used to understand period-to-period changes?
- Is there consistency in attribution analysis presentation between regimes, if more than one regime is used?
- What is the company's use of the attribution analysis and what kind of attention does it get?
- How would you improve your work in the attribution analysis area?
- What method of attribution analysis will be used for VM-20?
- What aspects of VM-20 valuations will be most challenging with respect to explaining volatility?
- Tools that could help?
- Educational Resources?
- Changes to Communicating VM-20 results to Management?

Suggested VM-20 Reserve Attribution

- 3 of 5 regimes surveyed generally adhered to this order:
  - Demographic
  - Non-Economic
  - Economic
  - Risk Mitigation; Management Action; Other
- The research report provides a comprehensive break-down of sub-steps under each category. As a company works with VM-20 results, it is anticipated that sub-steps are collapsed. This will vary by company and product.

Suggested VM-20 Reserve Attribution

Non-Economic: Experience Assumptions

- If company experience indicated a baseline assumption needs to be updated
- This change impacts future cash flows
- Update the assumption in model, process a Time 1 valuation and difference the reserve to prior step
- Mortality experience
- Mortality credibility
- Lapse experience
- Premium payment experience
- Expense factors

Not all will be necessary at each reporting period

Suggested VM-20 Reserve Attribution

Non-Economic: Prevailing Reserve

- Component of the VM-20 types that is the source of the minimum reserve
- Challenging to know where to place this step in the attribution flow
- Hypothetical case studies:
- Sample for how to assess when there is a switch

Attribution Category Step	NPR	DR	PBR	Volatility from Prevailing Reserve Type	Reserve Change From All Other Attribution Categories
Opening	10	8	10		
Step 1	12	10	12	0	2
Step 2	13	15	15	2	1
Step 3	14	16	16	0	1
End			16		

Suggested VM-20 Reserve Attribution

Step	Definition	Reserve change characterized as:	Model Process Type
1	Time passage	Anticipated	Valuation
2	Account value changes	Volatility	Forecast
3a	Terminations – Expected	Anticipated	Forecast
3b	Terminations – Actual	Volatility	Valuation
4a	New Business – Plan	Anticipated	Forecast
4b	New Business – Actual	Volatility	Valuation
5	Experience Assumptions	Volatility	Valuation
6	Prevailing Reserve	Anticipated/Volatility	Valuation
7a	Starting Yield Curve – Time passage	Anticipated	Valuation
7b	Starting Yield Curve – Valuation date	Volatility	Valuation
8	Asset Spreads and Default Charges	Volatility	Valuation
9	Investment Strategy	Volatility	Valuation
10	Risk Mitigation – Reinsurance	Volatility	Valuation
11	Risk Mitigation – Hedge Program	Volatility	Valuation

Suggested VM-20 Reserve Attribution

- Case Studies include a Term block and ULSG block
  - Each constructed realistically, but not for purposes of the reserve outcomes
  - Focus is on a walk-through of the attribution
    - What needs to be done with the actuarial model to support the step
    - Whether the step represents ‘expected change’ or ‘volatility’
    - Keys to whether the step is processed as a valuation run or as a forecast run

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Putting Attribution Analysis Into Practice

Kunal Kang ASA, Associate Actuary, Prudential Financial

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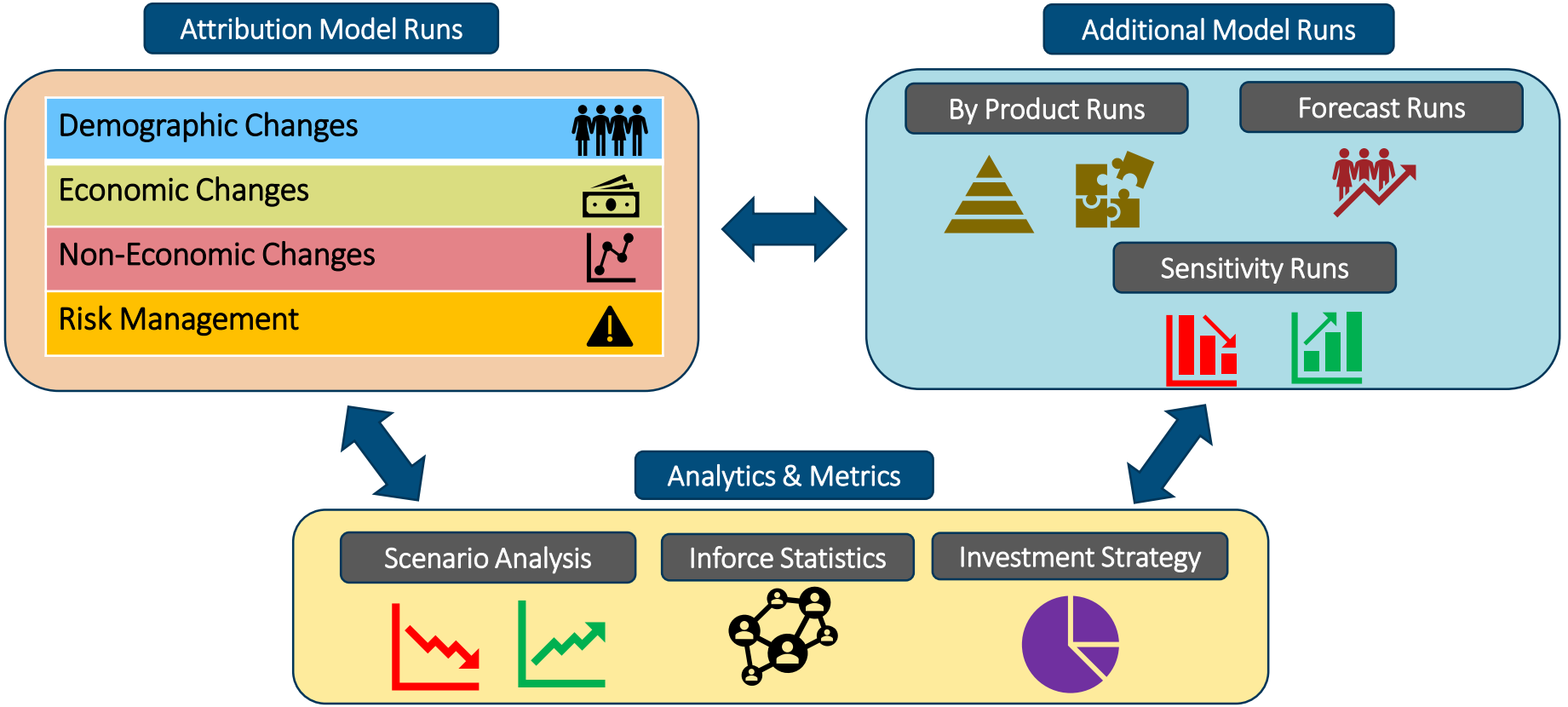
Comprehensive Analysis



Additional Model Runs - By Product Runs

- Overview
  - ❑ Calculate the NPR/DR/SR for each product/product type within the prescribed product groups (ULSG, Term, Other)

- Advantages
  - ❑ Highlights risk profiles of different products within same product sub group
  - ❑ Can highlight materiality of certain cashflow items
  - ❑ May indicate which products have a dominant/non-dominant effect on each reserve
  - ❑ Can be used to test assumption impacts on individual products vs. in aggregate

- Challenges
  - ❑ Model runtime/time for analysis
  - ❑ Can create additional questions/work
  - ❑ Requires tools capable of granular analysis

Mainly supports analysis of:

- Demographic Changes
- Economic Changes
- Non-Economic Changes
- Risk Management

Additional Model Runs - Forecast Runs

- Overview
  - ❑ Perform a model run to estimate future reserves using a sales forecast and current inforce

- Advantages
  - ❑ Acts as an implicit feedback loop for how expected results compare to actual results
  - ❑ Can be used to show the effect of a change in product distribution strategy
  - ❑ Will estimate the effect of future new business

- Challenges
  - ❑ Model runtime/time for analysis
  - ❑ May be difficult to incorporate forecast input data for model projections
  - ❑ Can create additional questions/work to reconcile actual vs. expected results
  - ❑ Forecast simplifications may be required

Mainly supports analysis of:

Demographic Changes

Additional Model Runs - Sensitivity Runs

- Overview
  - ❑ Perform a model run based on shocks to economic (starting treasury curve, projected scenarios, etc.) or non-economic projection components (mortality assumptions, lapse assumptions, etc.)

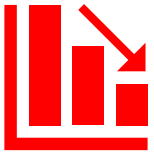
- Advantages
  - ❑ Highlights which assumptions are key drivers of the final reserve
  - ❑ Estimates the effect of future treasury curve changes
  - ❑ Most assumptions can be sensitivity tested

- Challenges
  - ❑ Model runtime/time for analysis
  - ❑ Number and magnitude of the shocks to be run will require significant judgment
  - ❑ Can be difficult to determine area of focus
  - ❑ Can create additional work/questions

Mainly supports analysis of:

Economic Changes

Non-Economic Changes



Analytics & Metrics - Scenario Analysis

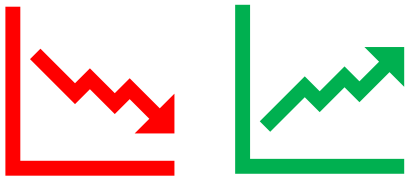
- Overview
  - ❑ Investigate patterns among the types of scenarios driving the aggregate/by product CTE70 calculation (falling rates, rising rates, etc.)

- Advantages
  - ❑ Will highlight sensitivity of results to different economic conditions
  - ❑ Can provide information into the risk profiles of different products
  - ❑ Can indicate patterns among the timing and severity of accumulated deficiencies for the stochastic reserve

- Challenges
  - ❑ Patterns among stochastic scenarios may be difficult to determine
  - ❑ Requires tools capable of granular analysis

Mainly supports analysis of:

- Demographic Changes
- Economic Changes
- Non-Economic Changes
- Risk Management



Analytics & Metrics - Inforce Statistics

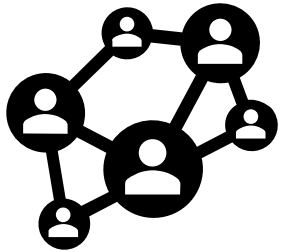
- Overview
  - ❑ Calculate different inforce statistics such as face amounts, cash values, net premium reserves, age distribution, etc.

- Advantages
  - ❑ Will indicate any dominant products within the insured population
  - ❑ Age distribution and cash values will inform period over period changes due to maturing business and account values

- Challenges
  - ❑ Can be difficult to determine how detailed inforce analysis should be
  - ❑ Not enough information alone to perform a dynamic validation/analysis

Mainly supports analysis of:

Demographic Changes



Analytics & Metrics - Investment Strategy

- Overview
  - ❑ Research the investment/reinvestment strategy used for model projections
- Advantages
  - ❑ Explanation of the basic investment/reinvestment strategy will be informative for stakeholders unfamiliar with PBR
  - ❑ Will help explain asset-liability interactions throughout projections
- Challenges
  - ❑ Requires tools capable of granular analysis
  - ❑ Patterns among stochastic scenarios may be difficult to determine

Mainly supports analysis of:

- Economic Changes
- Non-Economic Changes
- Risk Management

Key Points

- Beware of model runtime
- Be proactive rather than reactive
- Make sure your models and analysis tools are flexible, but controlled
- Use each step of your attribution analysis as an introduction, not a conclusion
- Develop your framework early on and maintain it as necessary
- In the early stages of PBR implementation, include educational material on PBR and/or model methodology with results to help further explain key drivers

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Attribution Analysis Challenges and Model Architecture

Dylan Strother, FSA, MAAA, Senior Consultant, Oliver Wyman

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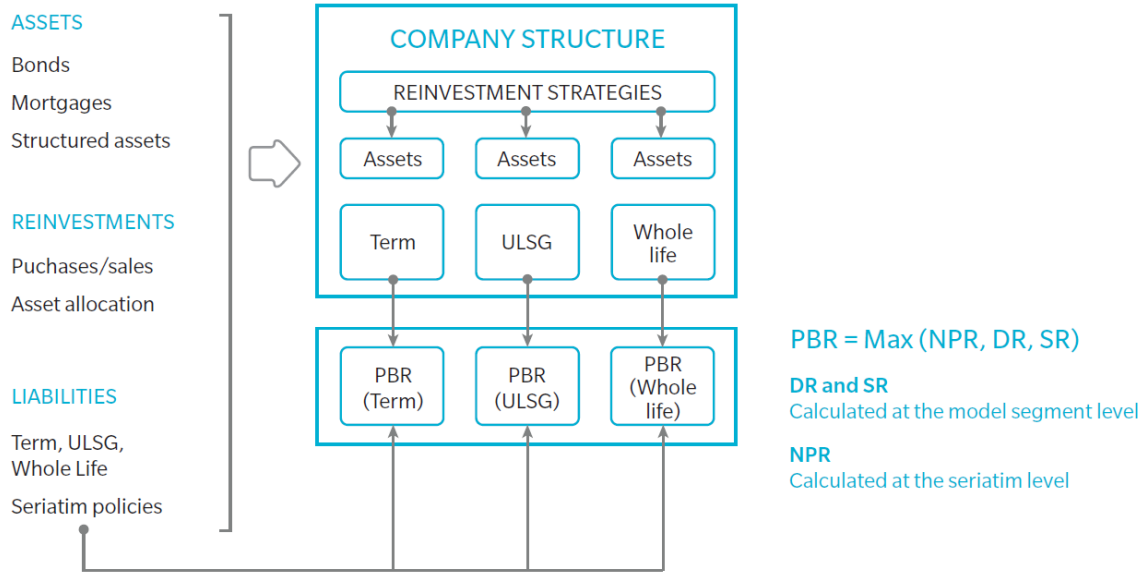
Agenda

1. Background and challenges 
2. Required analysis 
3. Sustainable modeling infrastructure 
4. Key take-aways 

Unlike formulaic reserves which are calculated at a seriatim policy level, the reserve under PBR is calculated at an aggregate level



PBR reserves are calculated at the Product Group level (Term, ULSG and Other). A Product Group may contain multiple Model Segments, which each require their own attribution analysis

The methodology and assumption requirements under PBR lead to increased model complexity and strain on the modeling infrastructure

1

Multiple reserve components

- Net premium reserve
- Deterministic reserve
- Stochastic reserve

2

Complex assumptions

- Multiple components to assumptions coupled with prudent margins
- Multiple runs may be required for each assumption due to correlation

3

Assets

- Requires modeling existing assets and reinvestments across a range of economic scenarios
- Interdependency between liabilities and assets

4

Regulatory requirements

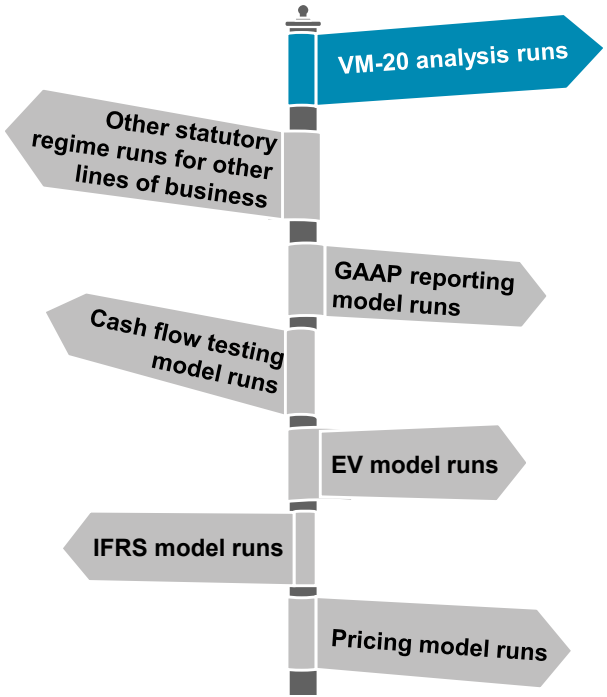
- The regulation is ever-evolving and changes are anticipated to be retroactive

5

Increased model strain

- Robust asset liability model capable of tracking the movement in multiple reserve components at various aggregation levels
- Analysis and drill down capabilities are required

There are many required model runs to produce baseline PBR results. Additional runs are required in order to understand and attribute changes in these results



Required baseline model runs

- NPR, deterministic reserve, stochastic reserve
- Deterministic and stochastic exclusion tests
- Pre- and post-reinsurance
- Required testing (e.g. reinvestment strategies, PLT profits)
- Required sensitivities (e.g. flexible premium)

Attribution, sensitivities and ad-hoc

- Waterfall attribution (each assumption updated sequentially)
- Management required sensitivities and additional margin sensitivities
- Simplification / approximation validation and testing
- Validation runs

The PBR Actuarial Report is not simply a reserves documentation exercise

PBR actuarial report contents (1/2)

1. Overview
2. Qualified actuary
3. Life PBR summary
4. Assumptions and margins
5. Cashflow models
6. Mortality
7. Policyholder behavior
8. Expenses

PBR actuarial report contents (2/2)

9. Revenue-sharing assumptions
10. Reinsurance
11. Non guaranteed elements
12. Exclusion tests
13. Additional information
14. Reliance descriptions and statements
15. Certifications
16. Closing Paragraph

An efficient framework for producing results and analysis supporting assumptions and methodology decisions is required in order to meet PBR reporting and disclosure requirements

Principles of efficient model architecture

EFFICIENCY

FLEXIBILITY

AUTOMATION

CONTROLS

DOCUMENTATION

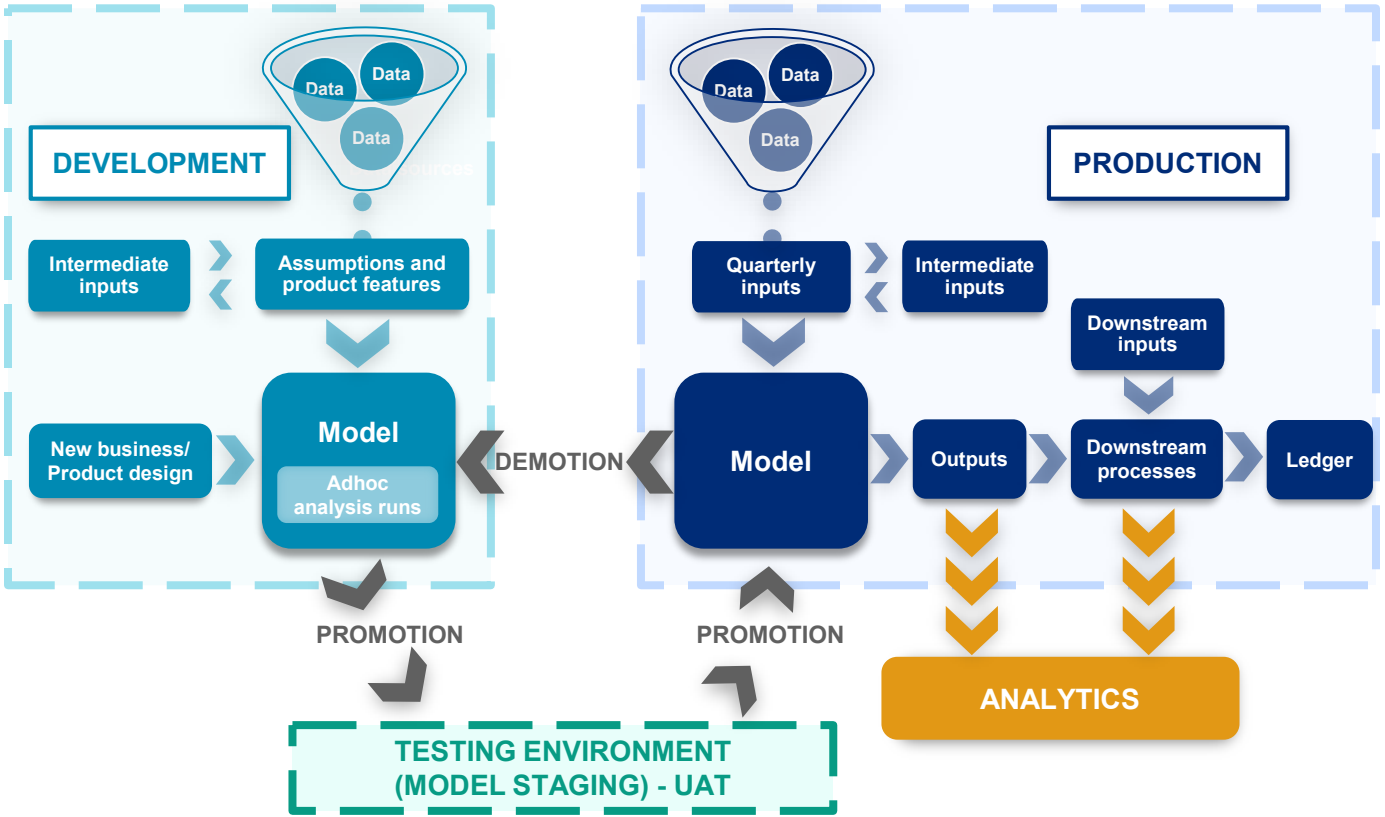
TRANSPARENCY

SIMPLICITY

SEGREGATION OF DUTIES

CENTRALIZATION OF SOURCES

A well designed model architecture allows for less time spent on producing results and more time spent on analysis



Key takeaways

1. The nature of VM-20 calculations requires more time and analysis

2. Modernized model architecture can save time in performing analysis and reduce potential errors

3. A modernized model architecture requires buy-in from various areas and coordination is essential

4. A clear vision is necessary, modernization projects can be difficult and require a lot of resources over a long timeline

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Integrating PBR Valuation and SOE into Other Company Processes

Leonard Mangini, FSA, FRM, MAAA,
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Integrating PBR Valuation and Earnings Attribution Analysis Into Broader Company Processes

- Feedback Loops from SOE into Pricing and Valuation Assumptions
- When Might Assumptions be Updated?
- Who Should Set/Update PBR Assumptions and Margins?
- Who Should Maintain Models?
- Who Should Analyze Results?
- Sensitivity Testing and Storing Results

Feedback Loops from SOE Into Pricing/Valuation Assumption Setting

Once SOE Analysis and Attribution Has Been Performed

- Ideally have broken out “actual” emerging “biometric” experience from other drivers and “noise”
- A natural starting point to inform whether experience has drifted and “best estimates” need revision
- Best estimates form the core of all assumption setting- pricing, valuation, and capital
- There is “one version of the truth” as to what the company expects to happen
- Can reflect differences in focus of regime Management Reporting, GAAP, Statutory, Capital via Margins
- Useful for GAAP Targeted Improvements where assumptions no longer will have margins
- “anticipated” experience under the VM prior to adding margins to produce prudent estimates
- Capital before presumably adding shocks or margins that go even “further into the tail”
- Useful for the annual business plan or longer forecast usually performed in the fall for setting sales goals and objectives, expected earnings, executive comp, capital planning etc.

→ Suggests trying to integrate the SOE/Attribution Process with Other processes

Optimizing Timing of Assumption Updates and SOEs Results?

VM requires reviewing assumptions at least annually→ Timing is Not Specified

At 9/30/YY or 12/31/YY quarter-ends? Earlier?

- If publicly traded, a change in assumptions made *too early*, i.e. before the 6/30/YY earnings call, can trigger disclosures, reserve provisions, or even restating earnings if they conflict with the assumptions that are the underpinning of the 6/30/YY GAAP or IFRS financial statements!
- If use 12/31/YY SOE to update assumptions, may need to redo Asset Adequacy Analysis (AAT) in a crunch if it has already been performed based on 9/30/YY assumptions
- *Naturally 12/31/YY SOE and Attribution Analysis would be critical to inform the Appointed Actuary's Opinion and Memorandum where one asserts whether or not material changes have occurred between the AAT testing date and the date the Opinion letter is signed which might modify the AA's Opinion on Adequacy.*
- Next Year's Business Planning commonly occurs in the August-October time frame- so undesirable to examine and update assumptions later and then have to redo Business Forecasts if there are material changes

→ May be advantageous to do experience studies in Q3 with "Assumption Updates Validated by SOE Analysis at 9/30/YY for CFT, Management Forecasts with 12/31/YY follow-ups as an AOMR check

Who Should Set PBR Assumptions: 2 Practical Approaches Defensible under VM

1) Company sets assumptions

- Do the actuaries (QAs, AAs, others) agree? If not, document and disclose per ASOP 41
- QA under VM-G verifies assumptions/margins ***appropriately*** reflect VM requirements and certify that they are prudent estimate assumptions under VM-31
- AA under VM-30 tests and opines on whether ensuing reserves are truly adequate

→ Within QA's "Low and High"?? → Actuaries are picking what they feel comfortable with

2) An actuary sets assumptions on behalf of Company

- Self-police that comply with Code of Conduct, ASOPs, laws, regs- document per ASOP 41
- QA under VM-G ensures complies with VM-20 or VM-21
- AA under VM-30 tests and opines on whether ensuing reserves are truly adequate

→ Range: Low and High?? → Company picks what they feel comfortable with

Both are defensible implementations since ultimately the Company has chosen the assumptions, models and methods; a QA and AA have fulfilled their legal roles and ASOP disclosure duties; and if the two parties don't agree there is documentation about how and why for intended users!

Who Should Maintain PBR Models and SOE/Attribution Ownership

Each Functional Unit?

Centralized Teams with Pricing, Valuation and ERM clients?

Centralized vs Business Unit PBR Modeling/SOE Analysis

Pros

- Develop team that knows how to model all business lines
- Rotate in junior staff and rotate out “gurus” for Pricing, Valuation, or ERM
- Easy to maintain controls for QA and satisfy VM-G for Board and Management
- Perform Attribution Steps in Same Order so have “Apples-Apples” roll-ups of impacts of “biometric”, economic, and other drivers across the company

Cons

- Key person risk
- Black-box syndrome unless there is Disclosure and Documentation
- Concentration of errors- methodology problems have “contagion”

Who Might Perform the SOE Analysis?

Who Should Analyze Results?:

- Modelers?
- QA/AA?

Model Audit Rule- Reporting Requirements

QA thrown into "Controls World" since must verify that controls and standards *appropriately* reflect VM requirement, but fortunately enters into an Existing Framework

- Model Audit Rule (MAR) Legislation- eff. 1/1/2010 *(or when domicile adopts)*
- Detailed Requirements- Controls, Reporting on Controls for Statutory Accounting
- Section 17: $500 Million Direct/Assumed Premium Threshold on Report on Controls
- Section 17.D.5: Defines two terms- "Significant" and "Material Weakness"
  - Former- warrant attention of governance, Latter- reasonable probability of material misstatements
- Insurer MUST report "Material Weakness" to domicile within 60 days Audited Financials
- Model Law DOES NOT prescribe particular framework for review/evaluation of controls
- MAR Guide indicates most SEC registrants adopt COSO Internal Control-Integrated framework and that COSO ERM-Integrated framework and PCAOB Guidance for Smaller Companies are relevant

Available Resources:

- **NAIC Audit Rule Implementation Guide (MAR Guide)**- clarifies MAR *(without changing contents)*
- **Academy MAR Practice Note (Nov 2010)**- guidance preparing documentation/controls for reserves

Who Might Perform the SOE Analysis- What does the VM Say?

Who Should Analyze Results?:

- Modelers?
- QA/AA?

VM-G/VM-31 and VM-30:

- QA must certify that VM has been followed
- Note prior comments on Model Audit Rule and SOX
- VM-31 PBR Actuarial Report
- AA must certify that reserves are adequate in AOMR

→Suggests QA and AA should analyze results

ORSA/ERM "3 Pillar" World:

→ suggests Business Units do Analysis and Corporate has oversight and final authority in C-Suite

Practical Implementation- The Importance of Data Warehousing

Centralized Databases of Baseline and Sensitivity Runs

- With “One Version of the Truth” on Expected Assumptions then variability would tend to be around size of margins and shocks
- VM requires sensitivity tests of key reserve drivers
- ERM and CFT would tend to involve shocks

→ Store these runs centrally to save effort, ***need to protect access sensitive data/hacking***
→ Perform SOE Analysis and “Unlocking” in Context of results

Contact Information

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