OLIVER WYMAN

STAYING AHEAD OF THE PBR CURVE

Editor's words: The Fall 2016 edition of our AXIS modeling newsletter focuses on AXIS functionality that is becoming increasingly relevant for US insurance writers. This issue discusses how the Earnings by Source module can support source of earnings analysis and reflects on lessons learned from the implementation of PBR into AXIS models. You will also find helpful tips and tricks for navigating the system and highlights of new features in recent AXIS releases. We hope you enjoy the newsletter.

MARSH & McLENNAN COMPANIES

SOURCE OF EARNINGS ANALYSIS IN AXIS

SOURCE OF EARNINGS OVERVIEW

Source of earnings (SOE) analysis is a valuable tool for stakeholders to understand the underlying sources of an insurance organization's net income. Actual net income is compared to expected net income, where expected net income is derived from projecting seriatim business in force at the beginning of the reporting period as well as other transactions such as new business and reinstatements. Access to robust and granular policy-level transaction data is the primary determinant of an organization's ability to perform meaningful SOE analysis.

The life insurance industry has not yet converged on a standardized SOE definition or methodology. Exhibit 1 below presents the SOE approach recommended by the Office of the Superintendent of Financial Institutions (OSFI) in Canada.[1]

"Access to robust and granular policy-level transaction data is the primary determinant of an organization's ability to perform meaningful SOE analysis"

Exhibit 1: Sample SOE framework and components

Expected profit on inforce business	The portion of the consolidated net income for business in force at the start of the reporting period that was expected to be realized based on the achievement of best-estimate assumptions
Impact of new business	The point-of-sale impact on net income of writing new business during the year: this is the sum of 1) the premium received (income), 2) the expenses incurred as a result of the sale (outgo) and 3) the new liabilities established at the point of sale (outgo)
Experience gains and losses	Gains and losses attributable to differences between actual experience during the reporting period and best-estimate assumptions at the start of the reporting period
Management actions and changes in assumptions	Impact on net income resulting from changes in actuarial methods and assumptions or other management actions
Other	The impact of any source(s) of earnings not explained by the previous categories
Earnings on surplus	The net income earned on the company's surplus funds
Net income	The net income amount presented on the company's income statement

The remainder of this article discusses SOE AXIS functionality in the context of the above framework.

1   http://www.osfi-bsif.gc.ca/eng/fi-if/rg-ro/gdn-ort/gl-ld/Pages/d9_ifrs.aspx

PERFORMING SOE ANALYSIS IN AXIS

AXIS provides an integrated modeling platform to support SOE analysis. The Earnings by Source (EBS) modules in AXIS support the analysis of projected and actual earnings for both traditional life insurance products and fund-based life and annuity products. Exhibit 2 illustrates the flow of SOE analysis in AXIS. Exhibit 3 illustrates the broader SOE analysis process, given AXIS addresses only certain "actuarial" sources of earnings.

Exhibit 2: Source of earnings analysis – AXIS process
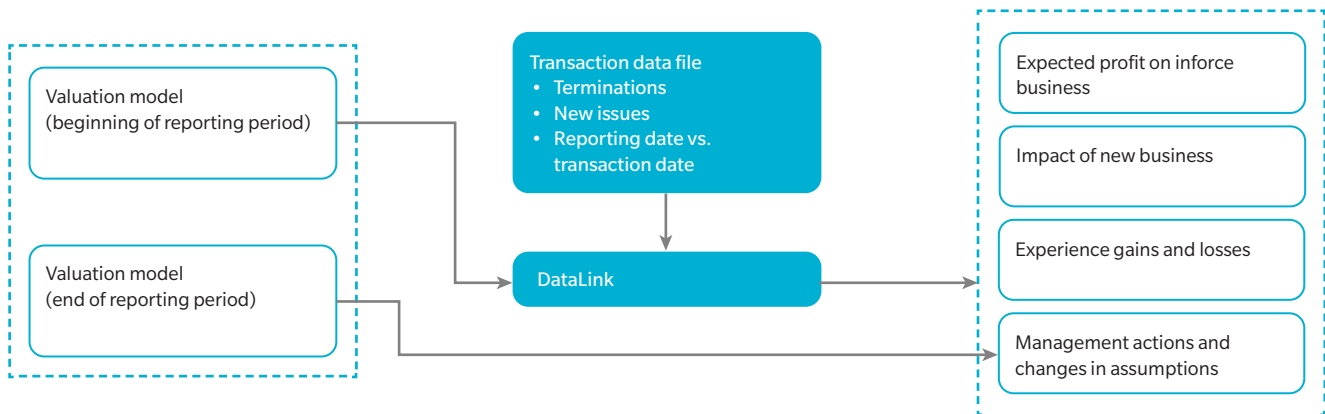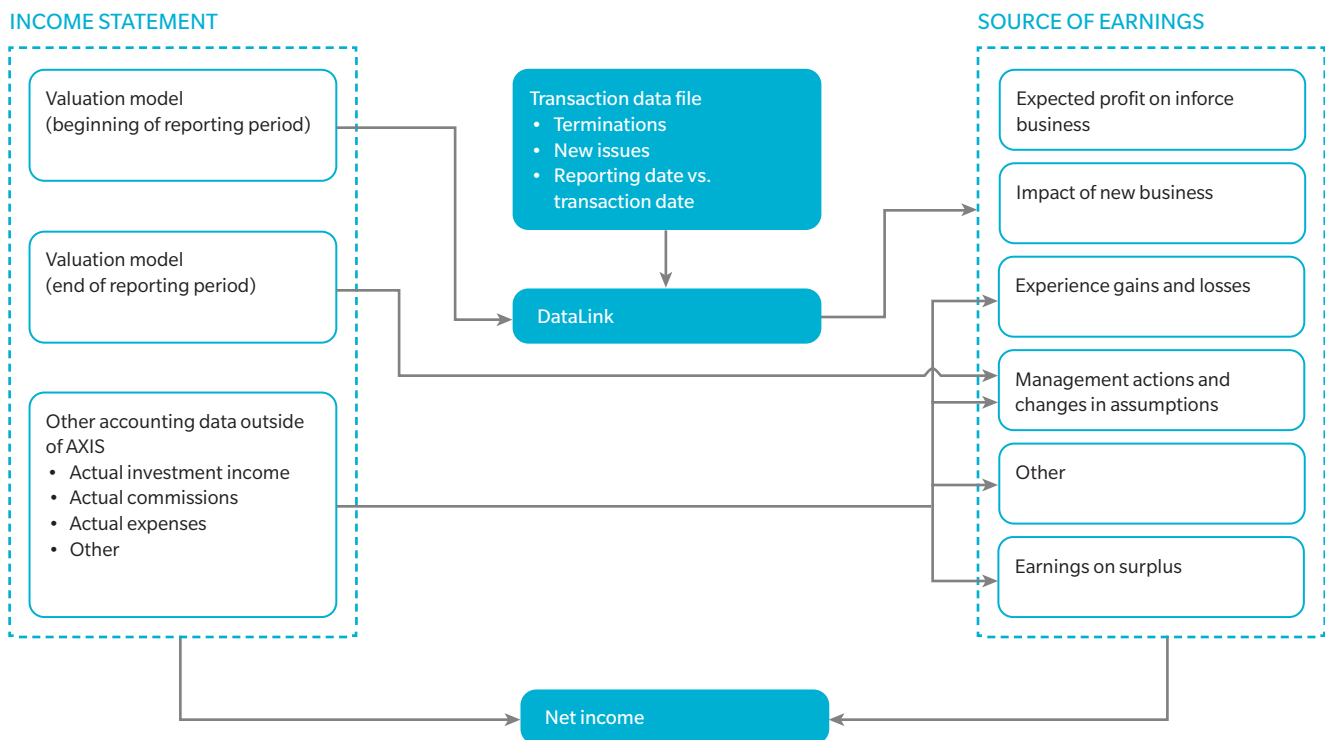

Exhibit 3: Source of earnings analysis – overall process

The following further describes how AXIS can support SOE analysis.

EXPECTED PROFIT ON INFORCE BUSINESS

Expected profit equals the margins that would be released during the reporting period assuming best-estimate assumptions were realized. AXIS splits the total change in reserves into detailed components, including the release of each margin component period by period. Analysis differs between traditional products and fund-based products. For traditional products, profits are viewed from a cashflow perspective. For fund-based products, profits are viewed from a margin perspective, taking into appropriate account 1) movement in the policyholder fund and 2) present value of future margins.

A robust valuation model can often be leveraged as a starting point for the incorporation of EBS functionality. DataLink transaction data files contain the actual change of status (i.e., death, lapse, recovery and other policy status changes) on a seriatim policy level. When clean DataLink transaction data files have been gathered, the model can be adapted to project expected profit.

> *"A robust valuation model can often be leveraged as a starting point for the incorporation of EBS functionality"*

IMPACT OF NEW BUSINESS

The impact of new business is estimated by the reserve established at policy inception. Policies issued during the period are flagged as "new business" in the DataLink transaction data file for EBS calculations, and time zero reserves can be generated in AXIS for these policies.

EXPERIENCE GAINS AND LOSSES

Experience gains and losses arise from differences between realized experience and best-estimate assumptions at the start of the reporting period. Policy status changes can be fed through AXIS DataLink. The DataLink transaction data file will identify actual status changes, including deaths, lapses, recoveries and other policy status changes. AXIS is capable of associating these actual transactions with a seriatim file of inforce and new business records. For fund-based products, AXIS is able to capture additional transactions driving policyholder fund movement. However, AXIS does not incorporate actual investment income, commissions, expenses, taxes or other non-actuarial assumption-related items of income and outgo.

In addition to the actual transaction date, AXIS permits the association of a separate "reporting date" with each transaction, providing flexibility for the reserve movement and earnings to be based on transactions reported in a given period and allowing for better alignment between the SOE analysis and the actual income statement.

MANAGEMENT ACTIONS AND CHANGES IN ASSUMPTIONS

Management actions and changes in assumptions cover impacts on net income as a result of changes in assumptions and methodologies as well as other management actions. The regular basis change process can be leveraged to capture this component.

THINKING BEYOND SOURCE OF EARNINGS

A secondary application of the EBS functionality in AXIS is the development of experience studies. Once policy transactions are being captured in DataLink and linked to inforce policies, AXIS can generate seriatim reports that include census information and both actual and expected seriatim policy movement.

LESSONS LEARNED FROM MODELING PBR IN AXIS

INTRODUCTION

With the adoption of Valuation Manual 20 ("VM-20") on June 10, 2016, Principles Based Reserves ("PBR") will become effective on January 1, 2017, with an optional three year phase-in period. The new regulation has significant modeling implications for life insurance products. This article provides a general overview of PBR modeling in AXIS, as well as specific lessons learned from the practical implementation of PBR into AXIS models.

BACKGROUND ON PBR

VM-20 is the section of the NAIC's Valuation Manual that defines PBR requirements for life insurance products. VM-20 requires insurers to hold the maximum of three reserve components: a net premium reserve (NPR), a deterministic reserve (DR), and a stochastic reserve (SR). Exhibit 4 below summarizes the key characteristics of each component.

"Producing, understanding and communicating PBR results requires a significant time investment by experienced modelers and actuaries"
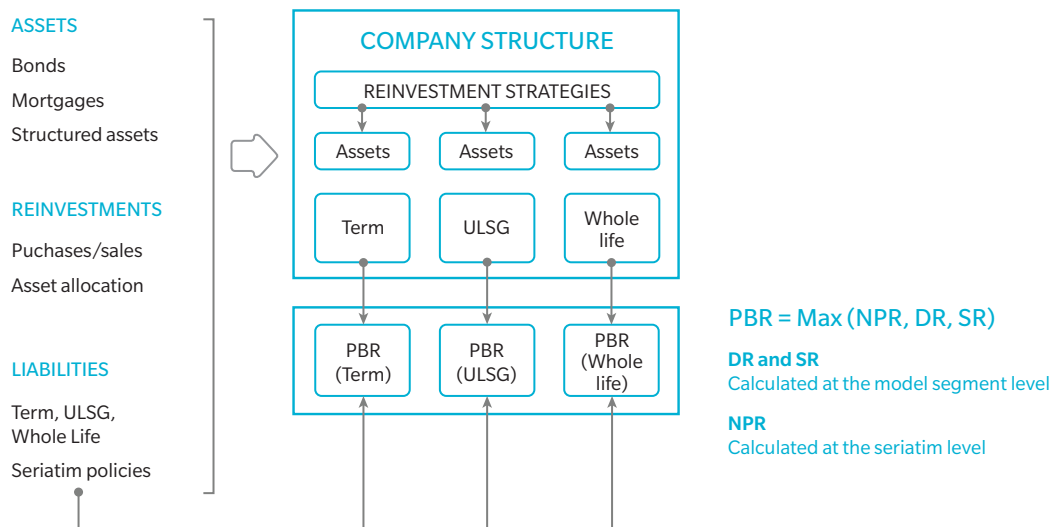

Exhibit 4: Summary of VM-20 reserve components

RESERVE		METHODOLOGY	CALCULATION	ASSUMPTIONS	SCENARIOS
1	**Net premium reserve**	Formulaic reserve (Similar to CRVM for products other than Term and ULSG)	Seriatim	Prescribed	None
2	**Deterministic reserve**	Present value of liability cash flows	Grouped	Prudent	Single scenario
3	**Stochastic reserve**	CTE(70) of starting assets plus the greatest present value of accumulated deficiencies	Grouped	Prudent	Full scenario set from AAA ESG

Unlike formulaic reserves which are calculated at a seriatim policy level, the reserve under PBR is calculated at an aggregate level for each "model segment". As stated by VM-20, "the term 'model segment' means a group of policies and associated assets that are modeled together to determine the path of net asset earned rates".

Implementing PBR therefore requires structuring of the financial model to account for these segments. Exhibit 5 below summarizes the integration of PBR into an illustrative financial model.

Exhibit 5: PBR integration into an illustrative financial model

ASSETS
Bonds
Mortgages
Structured assets

REINVESTMENTS
Puchases/sales
Asset allocation

LIABILITIES
Term, ULSG, Whole Life
Seriatim policies

COMPANY STRUCTURE
REINVESTMENT STRATEGIES
Assets | Assets | Assets
Term | ULSG | Whole life
PBR (Term) | PBR (ULSG) | PBR (Whole life)

PBR = Max (NPR, DR, SR)

DR and SR
Calculated at the model segment level

NPR
Calculated at the seriatim level

In the above diagram, assets and liabilities are grouped into model segments to calculate the PBR. The NPR is calculated at the policy level, as shown by the line connecting the seriatim policies to the NPR values within each model segment.

In order to project reserves under PBR over time, the financial model needs to be equipped to perform an outer loop projection in which the business is projected forward using best estimate assumptions. At each valuation date, an inner loop projection must be performed in order to calculate the reserves for each segment. Additionally, the scenarios and prudent

estimate assumptions used to perform the valuations should be unlocked to account for the passage of time and emerging conditions in the outer loop. Without the ability to perform these calculations in a self-contained model, it is extremely challenging to produce and analyze results under PBR.

IMPLEMENTATION OF PBR IN AXIS

AXIS has built-in functionality to calculate the NPR, DR, and SR, and to set the final PBR equal to their maximum. Additionally, AXIS has self-contained inner/outer loop functionality which facilitates financial forecasts and pricing projections. Exhibit 6 summarizes the PBR AXIS implementation for the illustrative model shown in Exhibit 5.

Exhibit 6: AXIS PBR implementation for an illustrative model
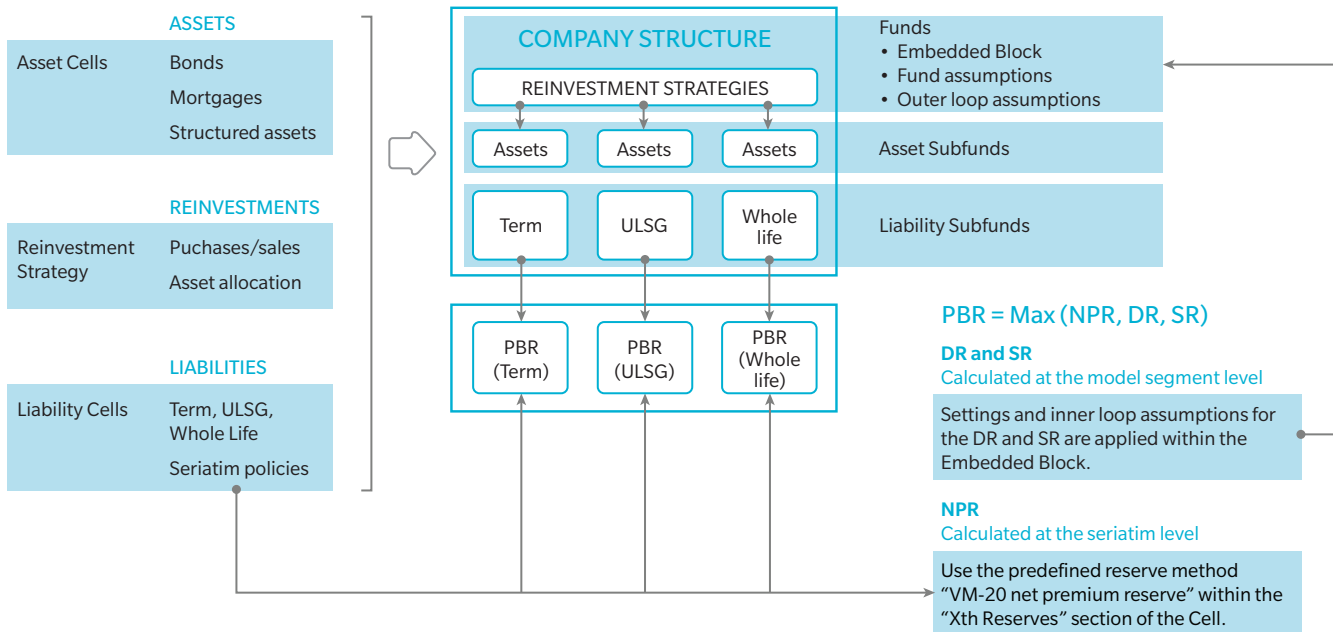
On the left, the relevant characteristics of inforce assets and liabilities are defined within AXIS Cells along with inner and outer loop assumptions and details on formulaic reserve calculations.

On the right, different Funds are created for each model segment in which the Assets, Liabilities and Reinvestment Strategies are selected.

The Embedded Block functionality in AXIS is used to perform inner loop reserve projections. The inner loop assumptions are selected in the Embedded Block projection assumptions, along with the inner loop Reinvestment Strategies and Scenario.

The Reserve Revaluation table indicates at which future valuation dates the Embedded Block calculation will be performed.

The NPR is calculated within the AXIS Cell using the predefined Reserve Method "VM-20 Net Premium Reserve".

For a technical guide covering PBR set up and coding in AXIS, please see the GGY knowledge base article *Implementing VM-20 in AXIS*: https://www.ggyaxis.com/uploadwizard/rkbviewer. aspx?articleid=2032.

"… additional resources and time should be factored in to assess the impact of alternative PBR assumptions and communicate results to senior management"

LESSONS LEARNED MODELING PBR IN AXIS

A lot of the nuances involved in implementing PBR functionality do not become evident until experienced firsthand. Exhibit 7 summarizes key lessons learned through implementing PBR into AXIS models for a range of purposes including AG 48, reserve financing, valuation, forecasting and pricing.

Exhibit 7: Lessons learned from modeling PBR in AXIS

1	**Planning ahead is critical**	**Strategic analysis**	Because of the many elements to account for in a PBR model (such as product liabilities, reinsurance, assumptions, availability of financing and corporate tax), a robust projection model is needed to inform the decisions of how and when to implement PBR. Producing, understanding and communicating results (for ULSG in particular) requires a significant time investment by experienced modelers and actuaries.
		Modeling	The coding of PBR in AXIS may require additions to existing AXIS models including: ALM functionality, Embedded Blocks enabling differentiated inner/outer loop assumptions, and reserve valuation settings. Integration and confirmation of this functionality should be undertaken early in the PBR implementation.
		Assumption setting	The determination and modeling of PBR assumptions and related governance takes considerable resources. Within a strategic PBR implementation, additional resources and time should be factored in to assess the impact of alternatives and communicate results to senior management.
2	**AXIS is well suited to PBR**	**Inner loop functionality**	By using AXIS Embedded Blocks, different liability and reinvestment assumptions can be selected in the inner loops. For instance, mortality improvement can be applied up to the valuation date only, as permitted by VM-20. Assumptions can also be dynamically unlocked for sensitivity testing, e.g., it is possible to increase mortality for the outer loop only or to only stress the inner loop.
		Asset and reinvestment functionality	PBR requires explicitly modeling the assets backing the liabilities. The Asset and Reinvestment modules in AXIS can create a flexible and efficient asset-liability model.[2] Predefined AXIS functionality dynamically solves for assets to match the final deterministic reserve within the prescribed tolerance.
		Inner loop transparency	AXIS provides the ability to drill down into any scenario at any revaluation date with calendar year income statement reports and supplemental details.

2 AXIS's asset modeling capabilities were highlighted in the first edition of this newsletter: http://www.oliverwyman.com/insights/publications/2014/nov/getting-the-most-out-of-axis.html#.VtRoa0YU7OA

3	PBR analysis is complex	Validation and review	It is advisable to recalculate the PBR in Excel to increase transparency and confirm the AXIS calculations. As well, robust and reusable Excel tools should be used to provide end users with sufficient detail to understand the results, including the inner loops.
		Managing run time	Reserves can be revalued monthly; however, frequent stochastic revaluations are computationally intensive. It is important to recognize the purpose of the analysis and to balance the accuracy of projected reserves (scenarios per revaluation), the number of revaluations and run time. Between explicit revaluations, reserves can be interpolated linearly or using a proxy such as Cell-level reserves (e.g., NPR).
		Results and business narrative	Post-PBR, projected reserves are very dependent on emerging interest rates and the underlying assumptions utilized. The incorporation of reinsurance and captive financing structures and their impact on results is an additional layer of complexity. It is critical to develop a high-quality, reusable analytical package that stakeholders can visualize and understand.

CONCLUSION

AXIS users benefit from significant out-of-the-box PBR functionality that has been used in Canada for many years. Even so, an AXIS PBR implementation can require substantial efforts to augment current model functionality, such as asset modeling. Getting basic PBR calculations in place in AXIS is only the first step of an informed strategic PBR implementation, requiring the analysis of product and reinsurance cash flows, financing structures, assumptions and corporate tax under a range of economic scenarios.

WHAT'S NEW IN AXIS

US GAAP INPUT RESERVE FACTORS TABLE

Description

- New table sections added in the Regular Life, Par and Disability modules provide additional flexibility for reserve factor inputs:
  - The mean reserve factor can be input for each month
  - Reserve factors can be input for individual GAAP components:
    - Benefit reserve
    - Maintenance expense reserve
    - DAC
    - DPL

Details

- Version 20161101

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/21624/

"SERIATIM US GAAP COHORT" CATEGORY REPORT

Description

- New report pack available in the Annuity and Universal Life modules allows reconciliation of US GAAP Cohort results at the seriatim level
- Reports available:
  - US GAAP Cohort CY
  - Nested reports:
    - FAS 97 EGP Components
    - FAS 120 EGM Components
    - NLG Funded Balance
    - Supplementary US GAAP Cohort

Details

- Version 20161001

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/21571/

CEDED NAAR BY BENEFIT TYPE (BASE, DIVIDEND, ROP, OTHER)

Description

- New columns added to ceded face amount table section "Proportion of NAAR" in the Regular Life and Par modules
- Users can assign different weights to each component of NAAR when defining YRT face amount:
  - Base benefit
  - ROP
  - Other Benefits
  - PUA (Par module only)
  - OYT (Par module only)
  - Terminal/surrender dividend (Par module only)

Details

- Version 20161201

Learn more

- https://www.ggy.com/client/BugEnhance/UpdateDetail/21846/

ABOUT OLIVER WYMAN

Oliver Wyman is a global leader in management consulting. With offices in 50+ cities across 26 countries, Oliver Wyman combines deep industry knowledge with specialized expertise in strategy, operations, risk management, and organization transformation. The firm's 3,000 professionals help clients optimize their business, improve their operations and risk profile, and accelerate their organizational performance to seize the most attractive opportunities. Oliver Wyman is a wholly owned subsidiary of Marsh & McLennan Companies [NYSE: MMC], a global team of professional services companies offering clients advice and solutions in the areas of risk, strategy, and human capital. With 52,000 employees worldwide and annual revenue exceeding $10 billion, Marsh & McLennan Companies is also the parent company of Marsh, a global leader in insurance broking and risk management; Guy Carpenter, a global leader in risk and reinsurance intermediary services; and Mercer, a global leader in human resource consulting and related services.

The Actuarial Practice of Oliver Wyman has life, health and property & casualty actuaries that advise financial institutions, insurance companies, regulators and self-insured entities across a broad spectrum of risk management issues. With more than 200 professionals in 16 offices across North America and the Caribbean, the firm's consulting actuaries provide independent, objective advice, combining a wide range of expertise with specialized knowledge of specific risks.

For more information, please contact:

Dean Kerr, FSA, ACIA, MAAA
Principal
Dean.Kerr@oliverwyman.com
+1 416 868 7061

Rebecca Rycroft, FSA, FCIA, MAAA
Principal
Rebecca.Rycroft@oliverwyman.com
+1 416 868 2823

Scott Houghton, FSA, MAAA
Principal
Scott.Houghton@oliverwyman.com
+1 860 723 5619

David Weinsier, FSA, MAAA
Partner
David.Weinsier@oliverwyman.com
+1 404 239 6431

www.oliverwyman.com

OLIVER WYMAN