Using Risk Analytics to Optimize the Value of a Pension Risk Transfer Business

Longevity 14

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pwc

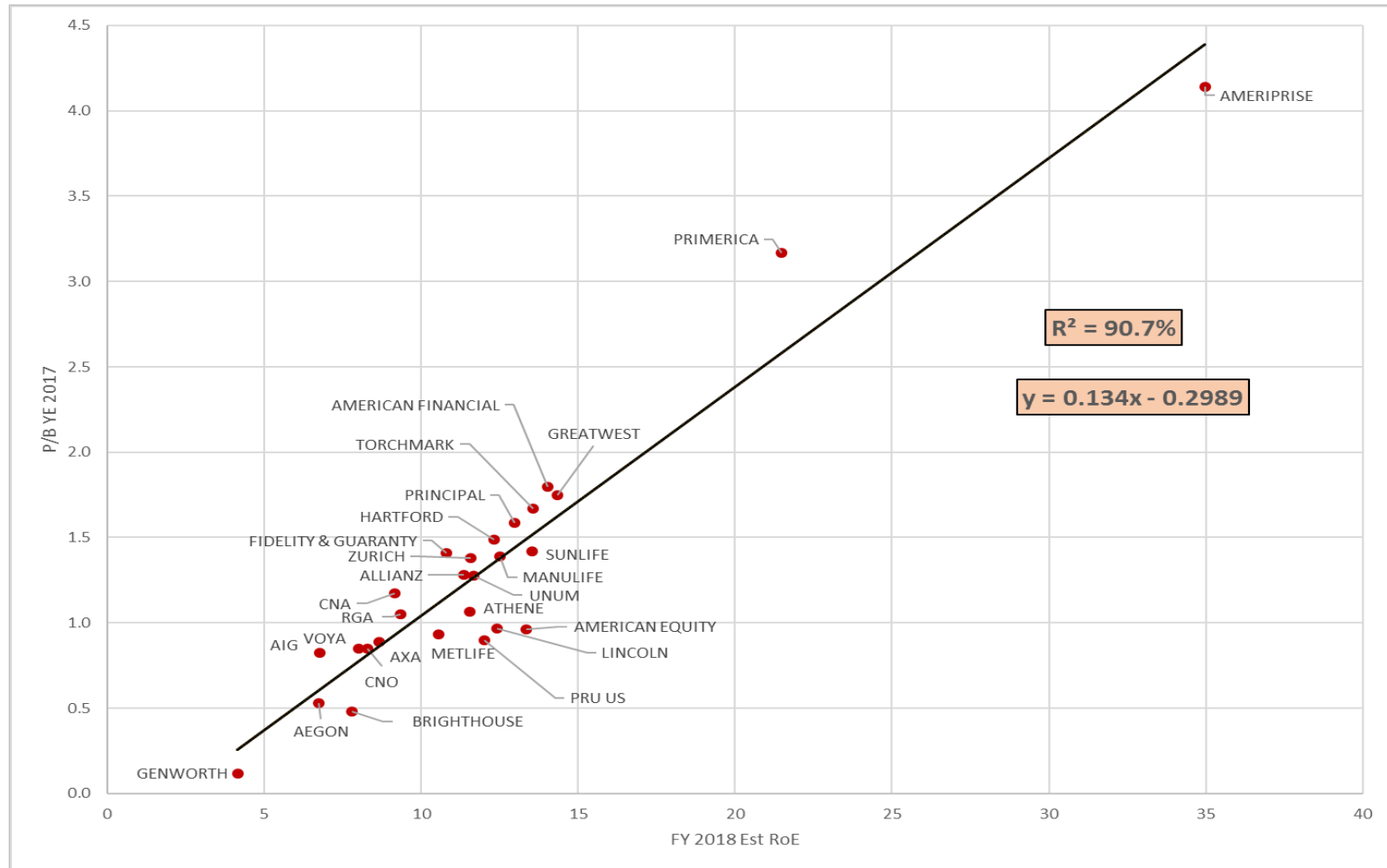# Table of Contents

The graph below shows a 91% R² between RoE and Price to Book ratio for US life (re)insurers, highlighting the importance of maximizing return on capital:

Source: Bloomberg; information as of September 2018; estimated RoE is the mean of sell-side analyst estimates.

The graph below shows a 84% R^2 between RoE and Price/Book ratio for UK and European life (re)insurers, highlighting the importance of maximizing return on capital:
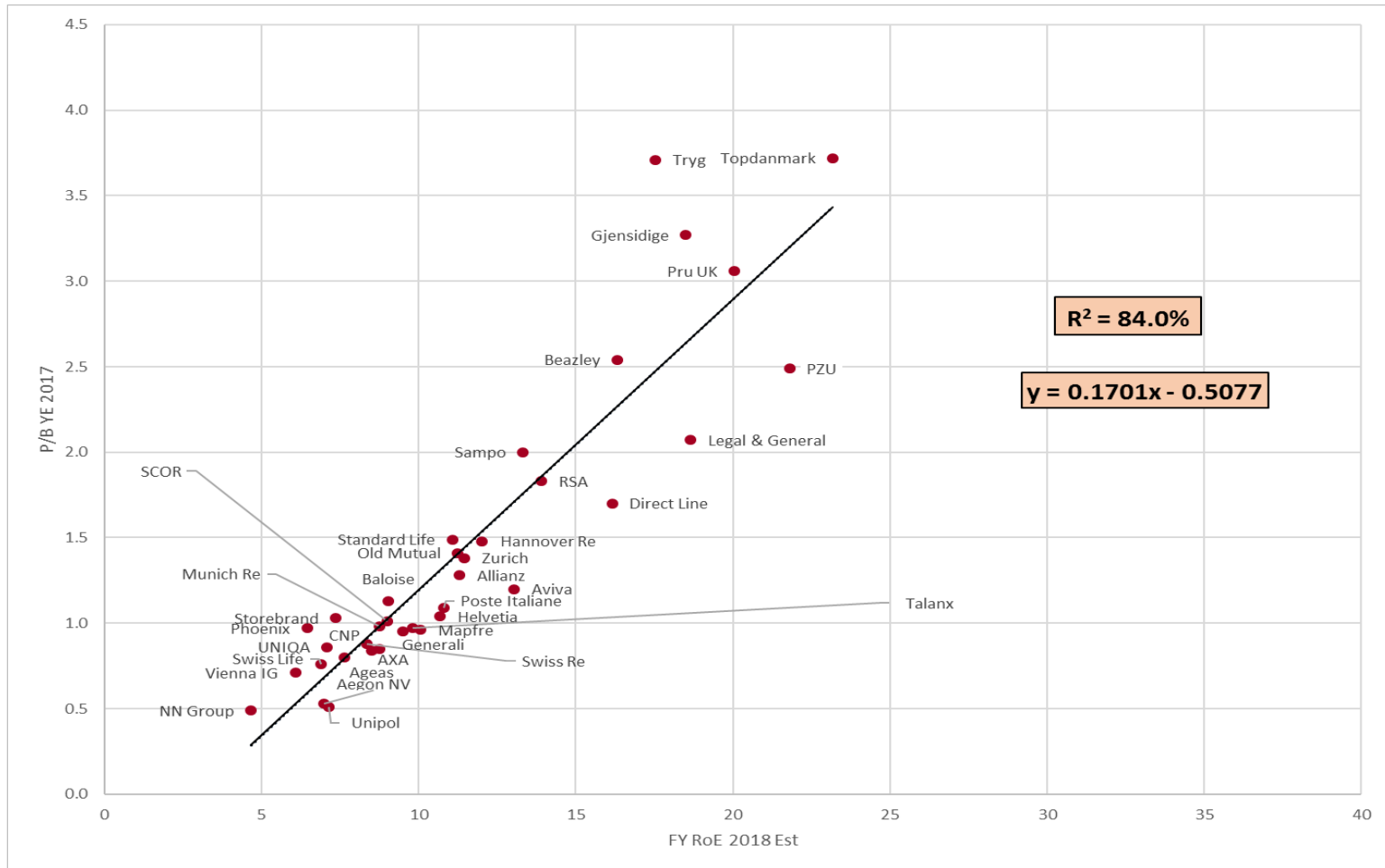

Source: Bloomberg; information as of September 2018; estimated RoE is the mean of sell-side analyst estimates.

Background for PRT Business Optimization Strategy

- In today's fast-changing business world, understanding, managing, and optimizing a PRT firm's financial performance relative to prioritized strategic objectives while considering appropriate constraints in real time is critical.

- Having holistic models that can measure the assets and liabilities in a consistently sophisticated manner allows for optimal decision making, including:

  o Strategic, dynamic or tactical asset allocation;

  o Hedging strategies (e.g. longevity, rates, inflation, spreads, forex, equities, etc.);

  o Use of reinsurance (e.g. longevity hedges, coinsurance, stop loss, etc.);

  o Diligence of potential acquisitions in a manner consistent with how the business would be managed post close;

  o Comparison of results under different bottom lines (e.g. economic, accounting, regulatory, rating agency, etc.); and

  o A deep understanding of the key drivers of performance, along with a dashboard for senior management to monitor performance relative to key performance metrics.

- Until now, run time issues and human capital issues have limited companies' ability to accomplish this.

- However, given the extensive advances in software and hardware technology that have occurred, in certain cases companies have already successfully implemented this approach, improving return on capital and their firm valuation substantially.

Key Components of Using Risk Analytics for a PRT Business

1.

Optimization approach relative to key performance metrics
The optimization approach should provide an efficient non-linear optimization taking into account:
- Prioritized key performance metrics; and
- Appropriate constraints.

2.

Consistent, shared assumptions among blocks of business for the key risk drivers
Results should be modeled consistently using shared assumptions across all blocks of business, and combined using certain correlation assumptions, including:
- Interest rate, equity, inflation, and forex scenarios;
- Credit market performance;
- General population mortality scenarios by cohort (with basis risk distributions specified for each business); and
- Policyholder behavior (e.g. age at retirement, etc.).

3.

Robust parameterization of scenario generation model
The solution should involve an equally sophisticated and consistent evaluation of the assets, liabilities, derivatives, and reinsurance with:
- Assumptions based on best-estimate business experience and credibility weighted with industry or general population experience where necessary;
- Appropriately parameterized risk-neutral and/or real world stochastic assumptions for the relevant variables;
- Consistent underlying mortality scenarios for all business lines to understand the longevity exposures; and
- To properly produce the tails of the combined distribution in a rigorous manner, non-Gaussian copulas for the correlation assumptions applied in simulating the interest rate, equity, credit, mortality, and applicable policyholder behavior outcomes for each time period for each scenario.

4.

Innovative software and hardware approach
The approach should utilize state-of-the-art software and hardware including efficient coding, the cloud, and an appropriate approach to distributed computing to reach the desired performance.

Identifying Strategic Objectives and Constraints

The capital optimization strategy entails:

- Articulating and prioritizing strategic objectives to help define the objective functions for the optimization.

  o As an example, one could seek to optimize return on economic capital.

  ➢ The graph on pages 3 and 4 demonstrate a high correlation between return on equity and price to book ratios for US and UK and European life (re)insurers.

  ➢ A similar relationship holds for US and UK and European property and casualty (re)insurers.

- Constraints must also be identified, potentially including:

  o The amount of available capital (with respect to economic capital, regulatory capital and/or rating agency capital);

  o The amount of required liquidity over time;

  o The amount of available collateral;

  o The amount of financial and operating leverage;

  o Counterparty credit risk limits; and

  o Any applicable regulatory or legal restrictions.

- Cutting-edge modeling capabilities can then be applied to build the analytical platform to optimize decision making, and thus financial value, across the prioritized strategic objectives reflecting the constraints.

Sample Algorithm for Optimizing Return on Economic Capital

A potential approach for optimizing the return on economic capital for a PRT business involves:

- Calculating the economic earnings for each time period for each scenario as the economic return on the assets (interim cash flows plus the change in value during the period) minus the economic cost of the liabilities (the interim cash flows plus the change in value during the period).

- For each time period for each scenario, calculating the required capital using a deterministic 1-in-200 year shock for each variable (e.g., rates, equities, spreads, mortality, lapses, etc.) with the individual capital requirements combined using appropriate diversification assumptions. (This calculation can be further refined using a more complete capital calculation by variable, and ultimately in the aggregate.)

- The economic income and required economic capital could be accumulated over time at the interest rates simulated for each scenario for each period to the end of the business.

- Finally, these accumulated amounts could be present valued back to time zero to produce a distribution of the present value of the accumulated sum of the economic earnings over time divided by the present value of the accumulated required capital over time.

- The present value weighted return on capital can be calculated for the combined business as both the economic earnings and the required capital can be calculated across all businesses using the same scenarios and combined using non-Gaussian copulas for correlation.

- This combined distribution could then be optimized using a Sharpe Ratio-like statistic (akin to a Modern Portfolio Theory approach to optimizing the Efficient Frontier), and could also be subject to certain constraints.

  - **Optimization Metric** $= \dfrac{\text{Average of the PV Weighted Return on Capital minus Risk Free Rate}}{\text{Standard Deviation of the PV Weighted Return on Capital}}$

Pros and Cons of the Described Approach

Pros

- Creates ability to solve advanced questions in a sophisticated, transparent manner
- Optimizes return on capital for the combined business and thus the value of the company
- Accommodates optimization across multiple prioritized objective functions
- Facilitates a dynamic optimization of the hedging strategy based upon a daily re-measurement of the overall strategic optimization and the resulting exposures
- Non-Gaussian copulas provide for sophisticated approach to considering tail outcomes for the combined business
- Allows for risk management constraints to be considered explicitly in the optimization (e.g., ruin probability, skewness and kurtosis of performance distribution)
- Can be used to optimize relative to certain constraints (e.g., can be used to develop optimal liquidity and collateral strategies)
- Resource efficient approach to optimizing business, as one consistent optimization process as opposed to many individual ones

Cons

- Substantial data may be required to parameterize the approach
- Parameter uncertainty for some variables may be significant, which may be addressed with sensitivities and/or implementing a Bayesian approach to avoid false precision
- Introduction of a new analytic approach to the organization may require education

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