

INTRODUCTION TO PRT

Hartford Actuaries Club Spring Meeting 2022

Leah Thomas, ASA

Alex Yang

Tyler Keenan, FSA

PRESENTERS



Leah Thomas

Assistant Actuary, Legal & General Retirement America (LGRA)

Leah (Klejch) Thomas is an Assistant Actuary with Legal and General Retirement America (LGRA) which is based in Stamford. She is a member of the finance team and specializes in modeling and forecasting PRT business. Her main responsibilities include modeling future new business and calculating capital need.

Leah joined LGRA in March 2020. Prior to joining, she was heavily involved in a model conversion from Alfa to AXIS™. She has held roles at WTW in retirement consulting and Sammons Financial Group in corporate model development.



Alex Yang

Manager, Oliver Wyman

Siqi (Alex) Yang is a Manager with the Actuarial Practice of Oliver Wyman and is based in Seattle. His primary responsibilities are to provide actuarial consulting services to a variety of insurance entities and organizations. He has experience in AXIS model building for fixed indexed, deferred, and payout annuity products as well as in model validation of various life products.

In addition to AXIS modeling, Alex has built several experience study engines in R, R Shiny, and Python. These experience study engines have aided in automating assumption setting and speeding up benchmarking. Prior to joining Oliver Wyman, Alex was an Actuarial Consultant at MassMutual.



Tyler Keenan

Manager, Oliver Wyman

Tyler Keenan is a Manager with the Actuarial Practice of Oliver Wyman and is based in Boston. His experience has included actuarial modeling and financial analysis for various insurance products as well as enterprise risk management and pricing. He has most recently been leading a multi-year PRT model conversion from ProVal to Prophet for a large PRT carrier.

Tyler joined Oliver Wyman in 2020. Prior to joining, he worked at Unum and held various roles in individual disability pricing and modeling, enterprise risk management, and voluntary benefits financial planning.

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BASICS OF PENSION RISK TRANSFER

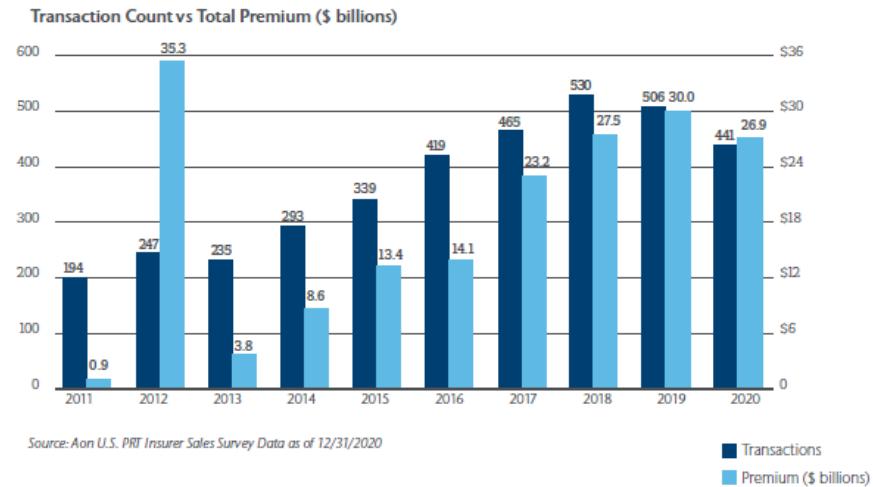
A HIGH-LEVEL OVERVIEW OF PENSION RISK TRANSFER

Pension risk transfer is a negotiated transfer of defined benefit pension liabilities between a plan sponsor and an insurance company. Plans may include in-pay participants (those who are already receiving benefits) and deferred participants (who are not yet receiving benefits).

Fortune 500 companies continue to transfer pension liabilities



Transactions have become more common over the last ten years and are expected to continue to trend upward



PENSION MECHANICS

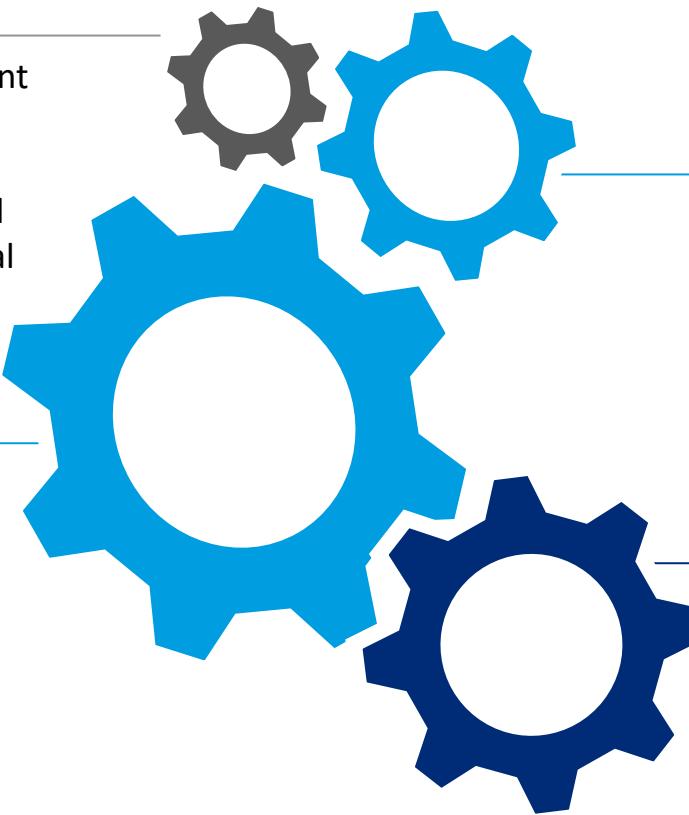
Defined benefit pension plans can be thought of as a type of payout annuity with some unique features

Defined Benefit Plans

The plan specifies the benefit amount that the employee will receive upon retirement. Benefits are generally based on length of employment and salary history, among other potential factors

Funding Contributions

Throughout the employee's tenure with the pension sponsor, the employer is making periodic payments into the plan. The employer assumes investment risk since they need to adjust contributions based on the fund performance



Employer Sponsored

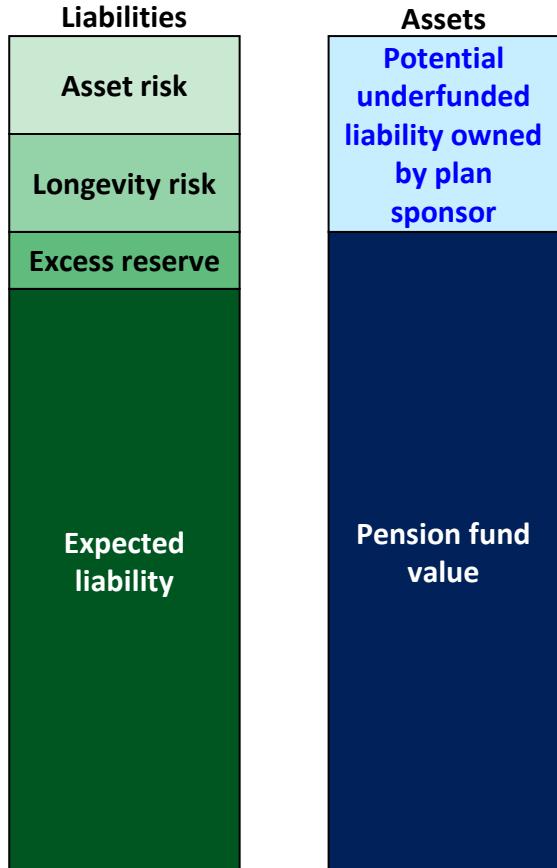
Unlike a traditional payout annuity that is underwritten through an insurer, pension plans are independently operated through employers

Benefit Form

Similar to payout annuities, pension participants can choose from multiple form options upon retirement (single life, joint, certain, etc.). Pension participants may also have additional options to consider such as lump sum payouts

PRT MOTIVATION – RISK TRANSFER

While plan sponsors may be managing well-funded pension plans today, future deviations from expectations may require additional funding to support liabilities



- **Expected liability** – assumed liability under best estimate assumptions
- **Pension fund value** – current value of assets supporting pension liabilities
- **Excess reserve** – extent to which pension fund value exceeds expected liability
- **Longevity risk** – potential additional liability due to plan participants living longer than expected
- **Asset risk** – potential additional liability due to fund investments not performing as favorably as expected
- **Potential underfunded liability** – additional funding needed to support asset and longevity risk

Third party insurers are well positioned to absorb adverse experience through diversified portfolios and robust experience analysis capabilities

PRT MOTIVATION - COST SAVINGS

Pension sponsors incur various additional expenses to maintain their pension plans. Reducing these costs is a key motivator for sponsors

Plan sponsors incur various expenses to maintain a defined benefit pension plan, including the following:

- Pension Benefit Guarantee Corporation (“PBGC”) premiums
- Actuarial consulting fees
- Expenses for internal or external plan administration

PBGC Premiums Over Time

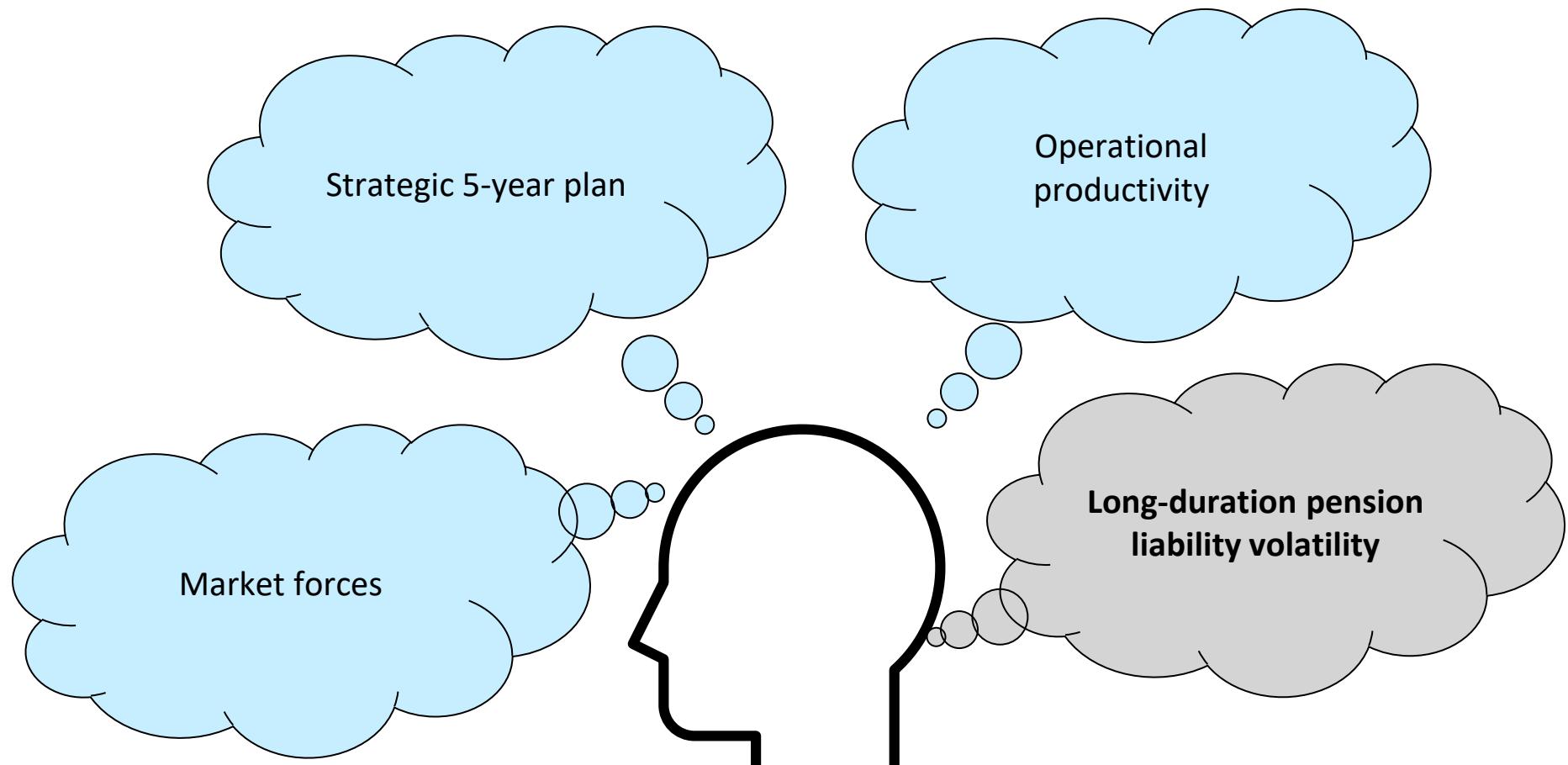
Plan Years Beginning In	Single-Employer Plans	Multi-Employer Plans
2021	\$86	\$31
2020	\$83	\$30
2019	\$80	\$29
2018	\$74	\$28
2017	\$69	\$28
2016	\$64	\$27
2015	\$57	\$26
2014	\$49	\$12
2013	\$42	\$12
2012	\$35	\$9
2011	\$35	\$9
2010	\$35	\$9
2009	\$34	\$9
2008	\$33	\$9
2007	\$31	\$8

Source: <https://www.pbgc.gov/prac/prem/premium-rates>

Plan sponsors can see significant expense savings by transferring liabilities to a third-party insurer that may not need to incur the same expenses to operate the plan

PRT MOTIVATION – CORE BUSINESS EXPERTISE

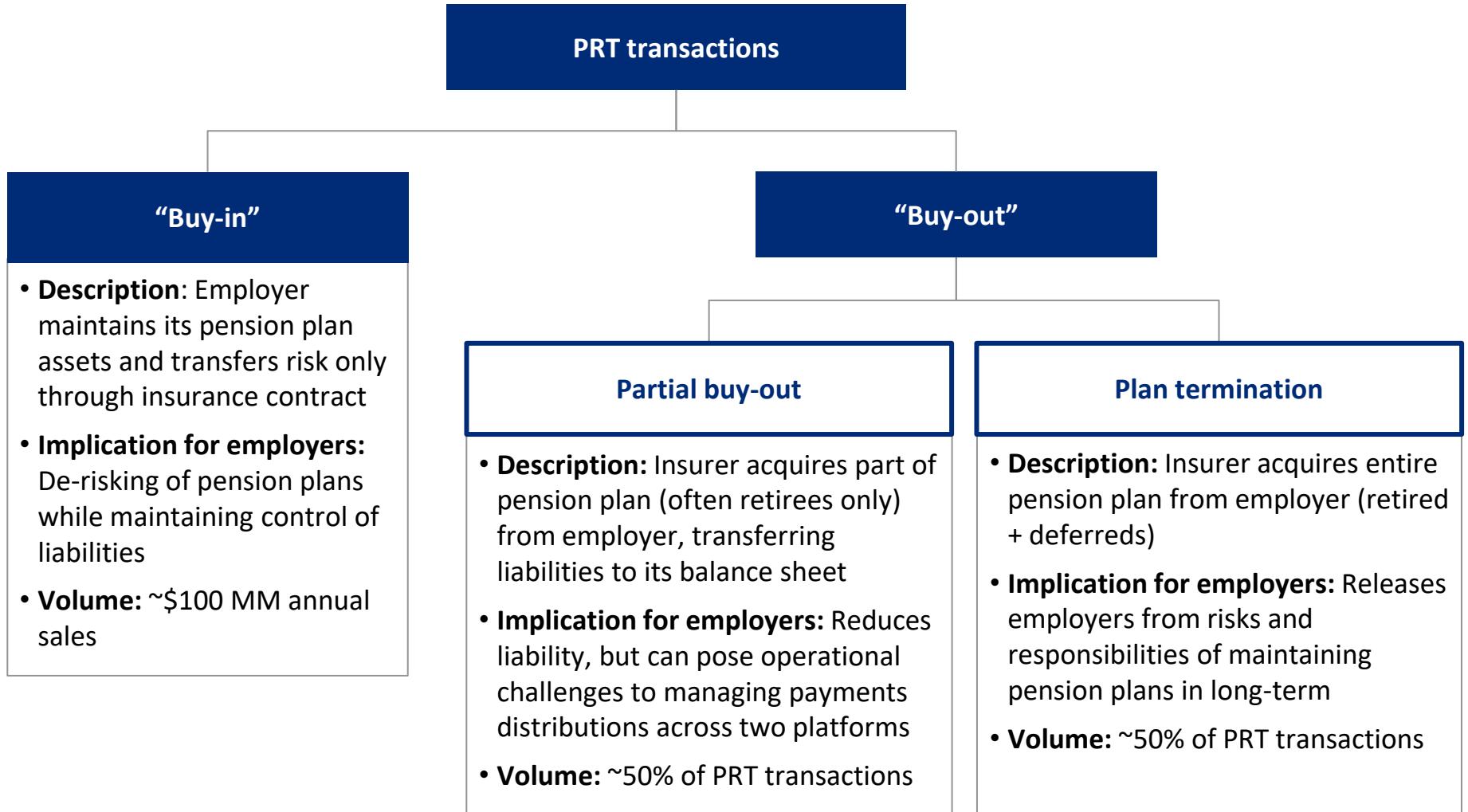
Maintenance of a defined benefit pension plan can distract a plan sponsor's leadership from focusing on core business competencies



Third-party insurers have the risk management experience and data to successfully administer and adequately capitalize a deferred benefit pension plan

DEAL PARTICIPANTS AND TRANSACTION TYPES

Market participants have PRT deal options to match their risk profiles



BROKERS & FIDUCIARIES

Brokers



Willis
Towers
Watson



Three large benefits brokers cover ~70% of deals (count) and nearly all large/jumbo transactions¹



Smaller benefits consultants are also active in the space

Independent fiduciaries



FIDUCIARY COUNSELORS

- Third-party independent fiduciaries are also involved in some transactions

Notes: 1. Investment banks, such as Morgan Stanley, are also involved in some jumbo transactions

GENERAL MODELING CONSIDERATIONS



Policy types

- Retiree (in-payout) participants are modeled as a payout annuity
- Deferred participants
 - Multiple points of uncertainty
 - **Retirement age**
 - **Elected form option**
 - **Multiple benefits** may be available

Sample deferred participant:

Possible
retirement 65-72
ages:

Available form options	Single life annuity Certain & life Joint & survivor
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Benefits offered	Retirement Disablement
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Total cashflows	48
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Features

- Deferred contracts contain provisions that affect the participant's eventual benefit. These provisions can include:
 - Benefit reductions for early retirement
 - Retroactive benefits for late retirement
 - Lump sum optionality
 - Pre-retirement death benefits
 - Cash balances
 - COLA
 - Disability benefits



Assumptions

- Actuarial assumptions are required for each of the following points of uncertainty
 - Mortality
 - Retirement likelihood at each age
 - Form election likelihood
 - Alternative decrements (such as disability)
- While some assumptions are readily available, others do not have reliable data
- There are several options for developing PRT mortality assumptions
 - Base mortality tables only
 - Base mortality + adjustment factor
 - Statistical modeling

2

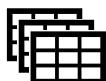
ZIP CODE USAGE IN PRT MORTALITY

PRT MORALITY ASSUMPTION APPROACHES

Method 1



Data for each participant
• Age, Gender, Status, etc.



Assign each participant a
base table
• PRI-2012, RP-2014, etc.

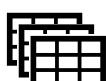


Apply mortality
improvement

Method 2



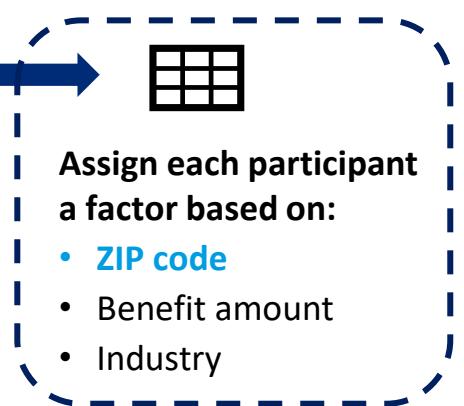
Data for each participant
• Age, Gender, Status, etc.



Assign each participant a
base table
• PRI-2012, RP-2014, etc.



Apply mortality
improvement



Method 3



Data for each participant
• Age, Gender, Status, etc.



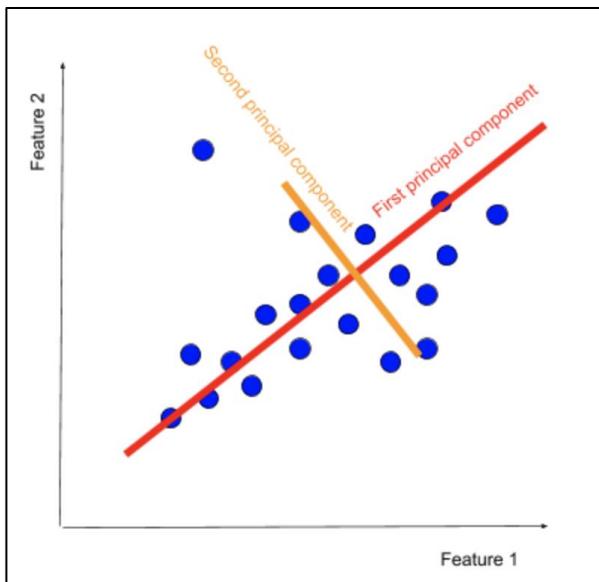
Use GLMs to predict mortality

ZIP CODE GROUPING – METHODOLOGIES

Introduction to principal component analysis (PCA) and K-means clustering

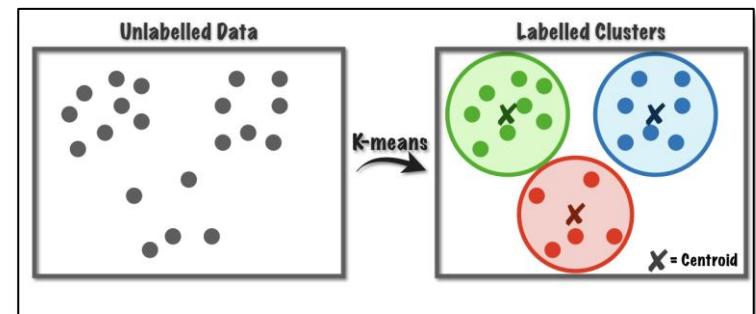
Principal component analysis (PCA):

- Feature extraction algorithm
- Reduces the dimensions of a feature space
- Creates new variables (principal components) using linear algebra
- New variables are less interpretable



K-means clustering:

- Groups similar data points together
- K defines the number of centroids or clusters
- The algorithm starts with a group of randomly selected centroids and then iterates to optimize the position of the centroids



ZIP CODE GROUPING – VARIABLE LIST

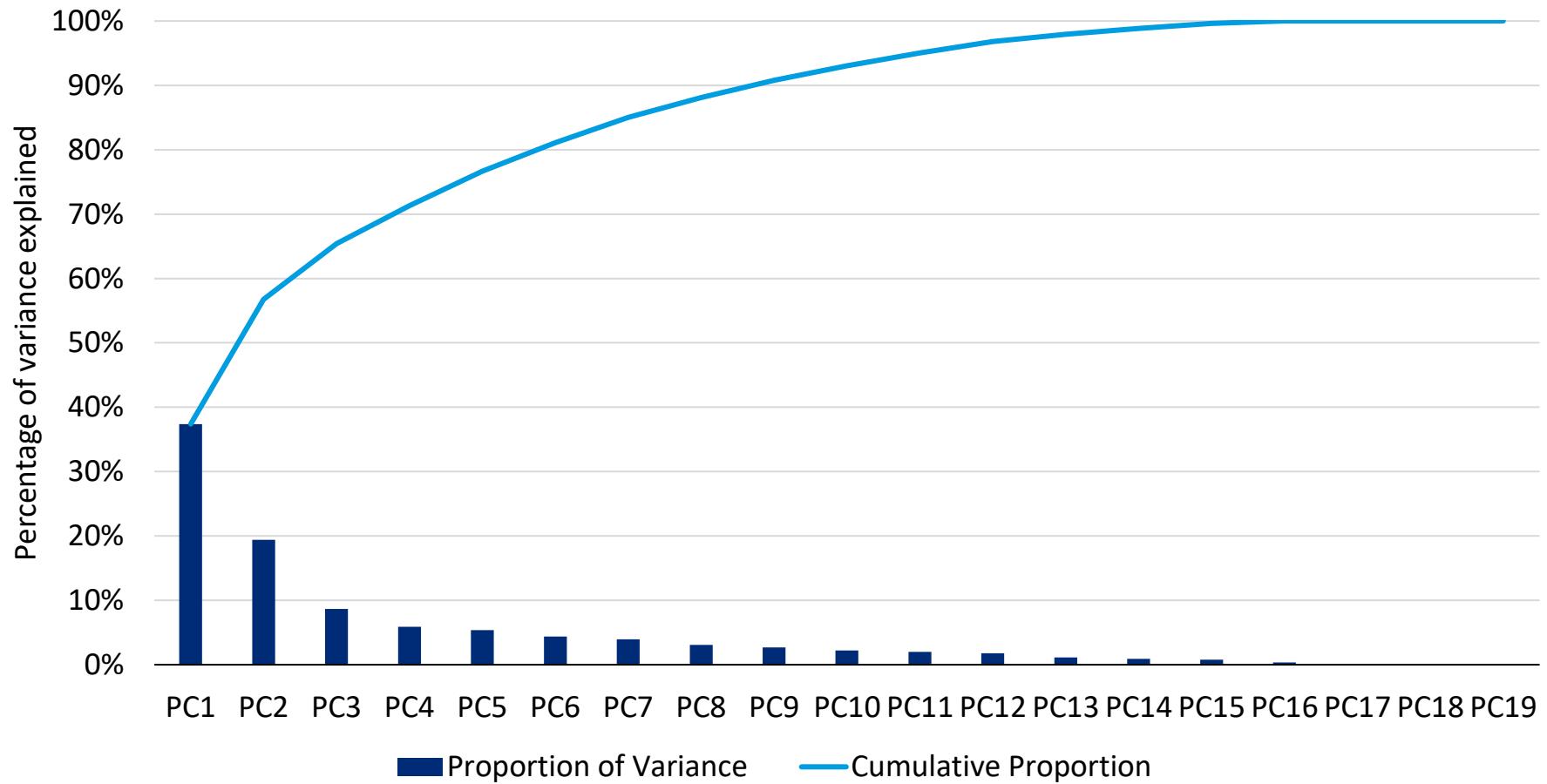
Both Principal Component Analysis and K-means clustering can be applied on publicly available datasets¹

Illustrative application using 19 socioeconomic variables to group ZIP codes into 10 affluence deciles

- Education (3 variables)
 - Less than HS diploma, HS diploma and/or some college, Bachelor's or higher
- Income (8 variables)
 - Family income: less than 15K, 15-30K, 30-50K, 50-100K, 100K+
 - Past 12 months income below poverty level
 - Public assistance income
 - Owner occupied house
- Age distribution (6 variables)
 - Under 18yrs, 18-29yrs, 30-39yrs, 40-49yrs, 50-69yrs, 70+yrs
- Employment (2 variables)
 - 16+ civilian labor force unemployed
 - 16+ civilian labor force employed in management/science/business/arts

1. <https://www.openicpsr.org/openicpsr/project/120462/version/V1/view>

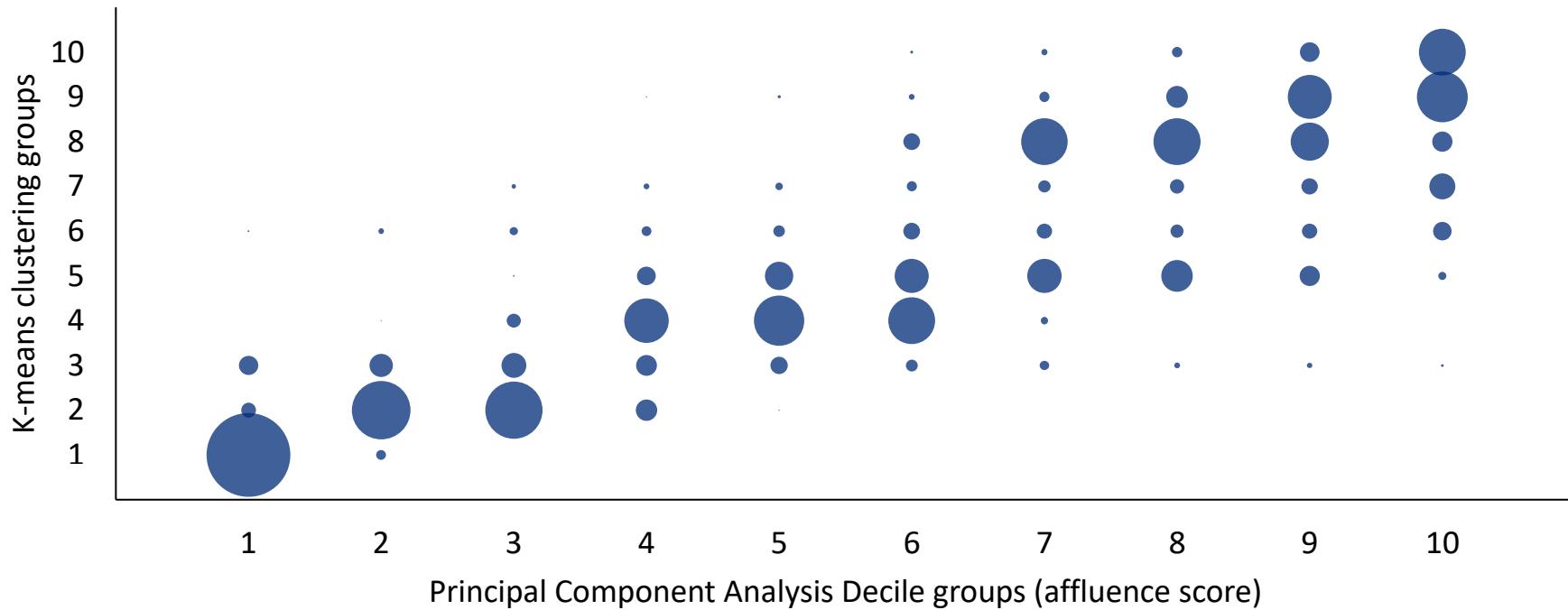
ZIP CODE GROUPING RESULTS – PRINCIPAL COMPONENT ANALYSIS (PCA)



Strength of the first component is consistent with previous SOA research; the first principal component (an affluence score) is sufficient for ranking and grouping ZIP codes

ZIP CODE GROUPING COMPARISON – K-MEANS CLUSTERING AND PCA

The following chart uses area to denote the relative consistency between the two grouping methods; larger bubbles denote more ZIP codes



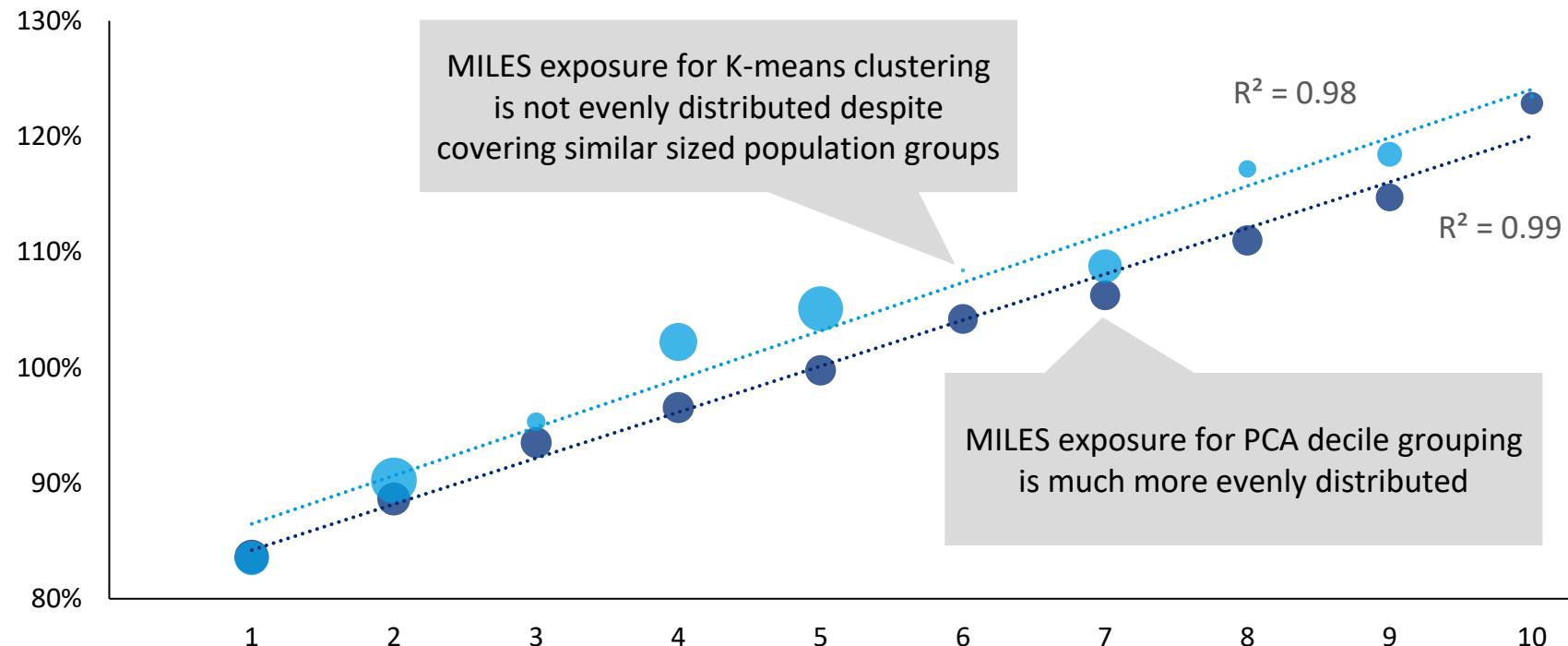
Observation: Both approaches are practical to implement and show a strong correlation. However, it is not clear if the two approaches are materially different, or which one is better

Recommendation: Test both approaches by calculating average mortality by age and gender and see which method produces more consistent results (i.e., mortality steadily increases when moving from high to low affluence groups)

ZIP CODE GROUPING COMPARISON – K-MEANS CLUSTERING AND PCA

Using Mercer's MILES pension experience dataset, the approaches demonstrate strong ability to segment the mortality A/Es of the population

Average A/E (amounts across age and gender)



Deaths (count)

PCA	11,000	14,000	13,000	14,000	16,000	16,000	17,000	19,000	16,000	12,000
K-means	11,000	27,000	5,000	22,000	40,000	<500	21,000	8,000	13,000	<500

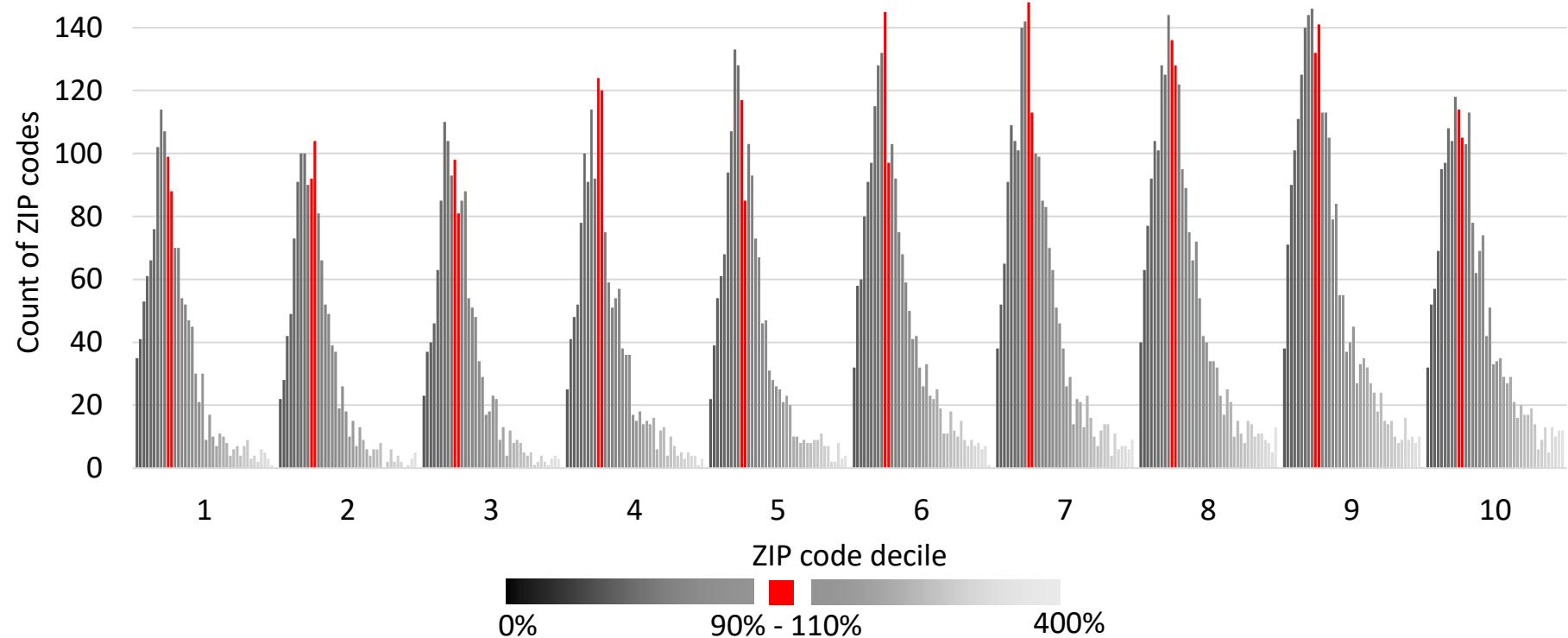
ZIP CODE GROUPING VALIDATION

Two approaches were used to further validate the ZIP code grouping results from PCA

Approach 1: Spot check known ZIP codes for reasonableness

- 06103, our current location, is group 1 (most affluent)
- 01103, my previous residence in Springfield MA, is group 10 (least affluent)

Approach 2: Check for normally distributed residuals



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FP&A FOR PRT

LEGAL AND GENERAL RETIREMENT AMERICA

Our Story

- Parent Company – Legal & General Group Plc
 - Established in 1836
 - PRT for over 30 years
 - 3,500 transactions globally
- Legal & General Retirement America (LGRA)
 - Founded in 2015
 - 83 deals written as of 12/31/2021



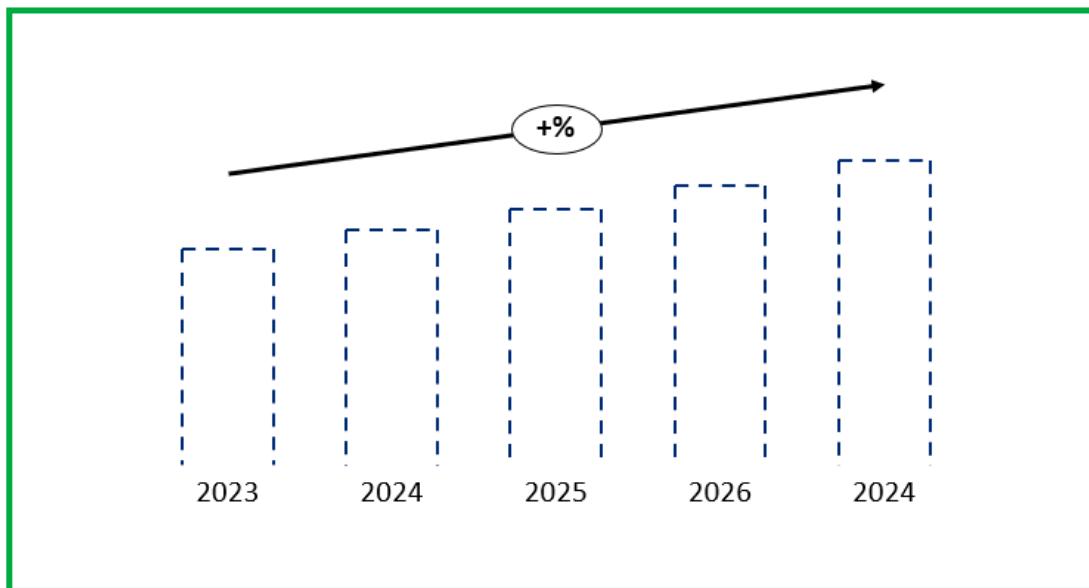
PRT structure



WHAT IS FP&A?

Financial Planning and Analysis

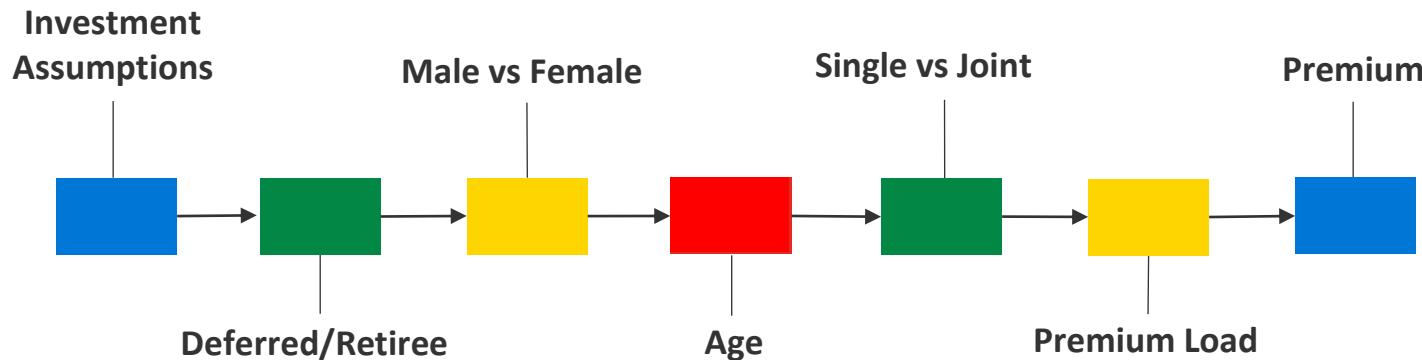
- Project financials over a specific planning period (ex: 5 years, 2023-2027)
- Estimate inforce policy performance
- Forecast future new business
- Calculate capital need
- Collaborate with many functional areas to set assumptions



CHALLENGES

Common issues

- GOAL: All calculations within the same modeling system, AXIS
 - Reliable
 - Less prone to user error
- Assumption Setting
 - Generic New Business Distribution
 - Interest rates
 - Asset Allocation/Reinvestment
 - Premium load
- Balance of complexity vs. simplicity
- Future modeling functionality



FP&A MODELS

Actuarial Modeling Software	Excel	Hybrid Models
AXIS, ALFA, Prophet, etc.	Ex. Projected Rate Calculations	Combination of AXIS generated Cashflows and Excel (e.g., high level models)
Pros: <ul style="list-style-type: none">• Valuation and Plan functionality• Produces detailed cashflows for all projection years• Creates reports for Financial Statements• Controlled, closed vendor maintained-system Cons: <ul style="list-style-type: none">• Not transparent• Specific functionalities• Long wait time - Vendor implements requests	Pros: <ul style="list-style-type: none">• Transparent• Flexible• Easily understood by stakeholders Cons: <ul style="list-style-type: none">• Cannot handle large amounts of data• Very manual• Not controlled – prone to calculation errors	Pros: <ul style="list-style-type: none">• Fast• Transparent• Reliable Cashflows• Replication of AXIS results Cons: <ul style="list-style-type: none">• Not controlled – prone to error• Still relying on AXIS

HIGH LEVEL MODEL

Hybrid Model

Calibrated
using AXIS

Quick
calculation for
scenarios

Creates
deliverables

Easily
absorbed

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CLOSING AND Q&A

PRESENTER CONTACT INFORMATION



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