

*ACHS Meeting
Sturbridge, MA*

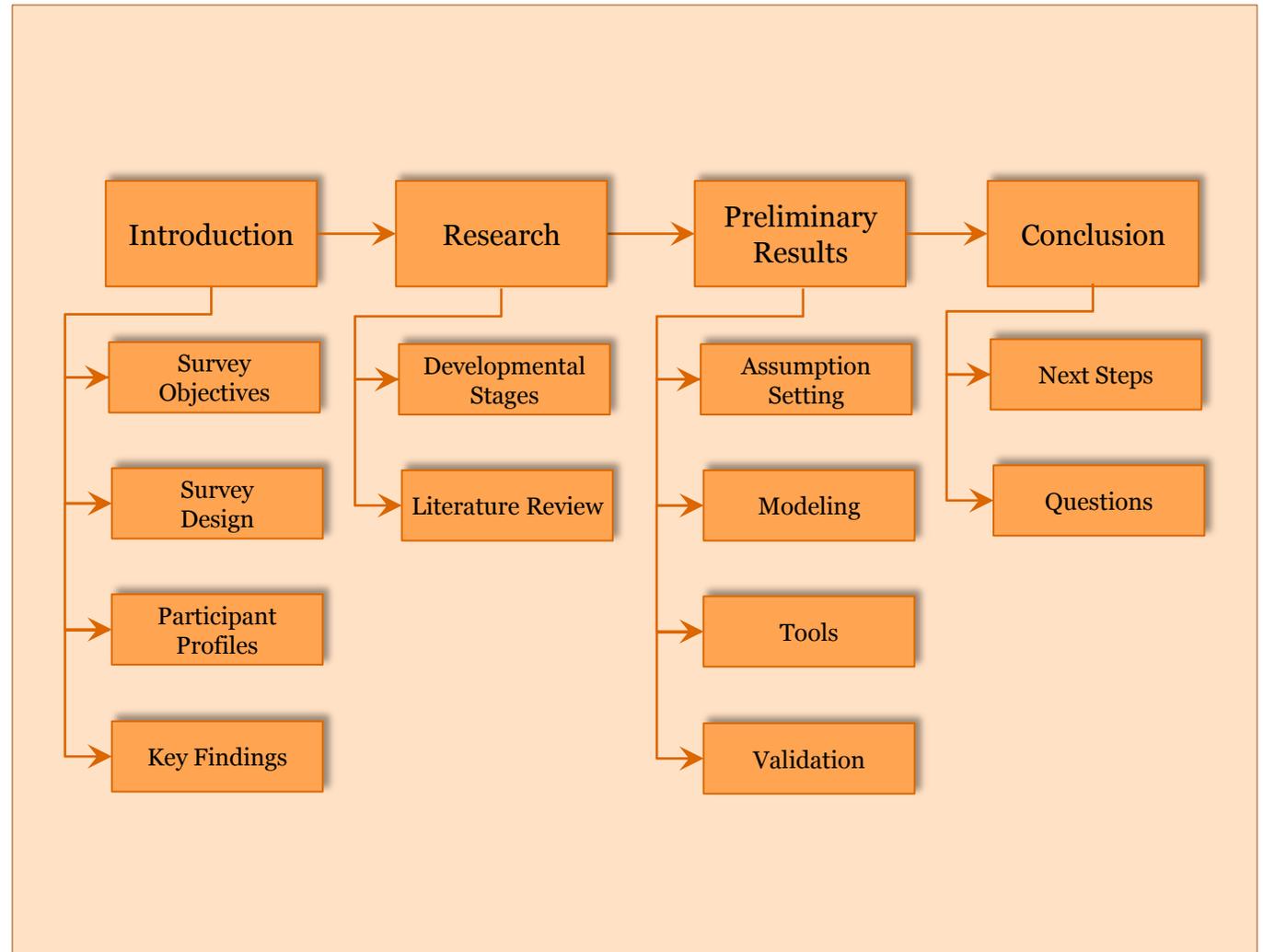
*Setting Dynamic Policyholder
Behavior Assumptions*

November 14, 2013

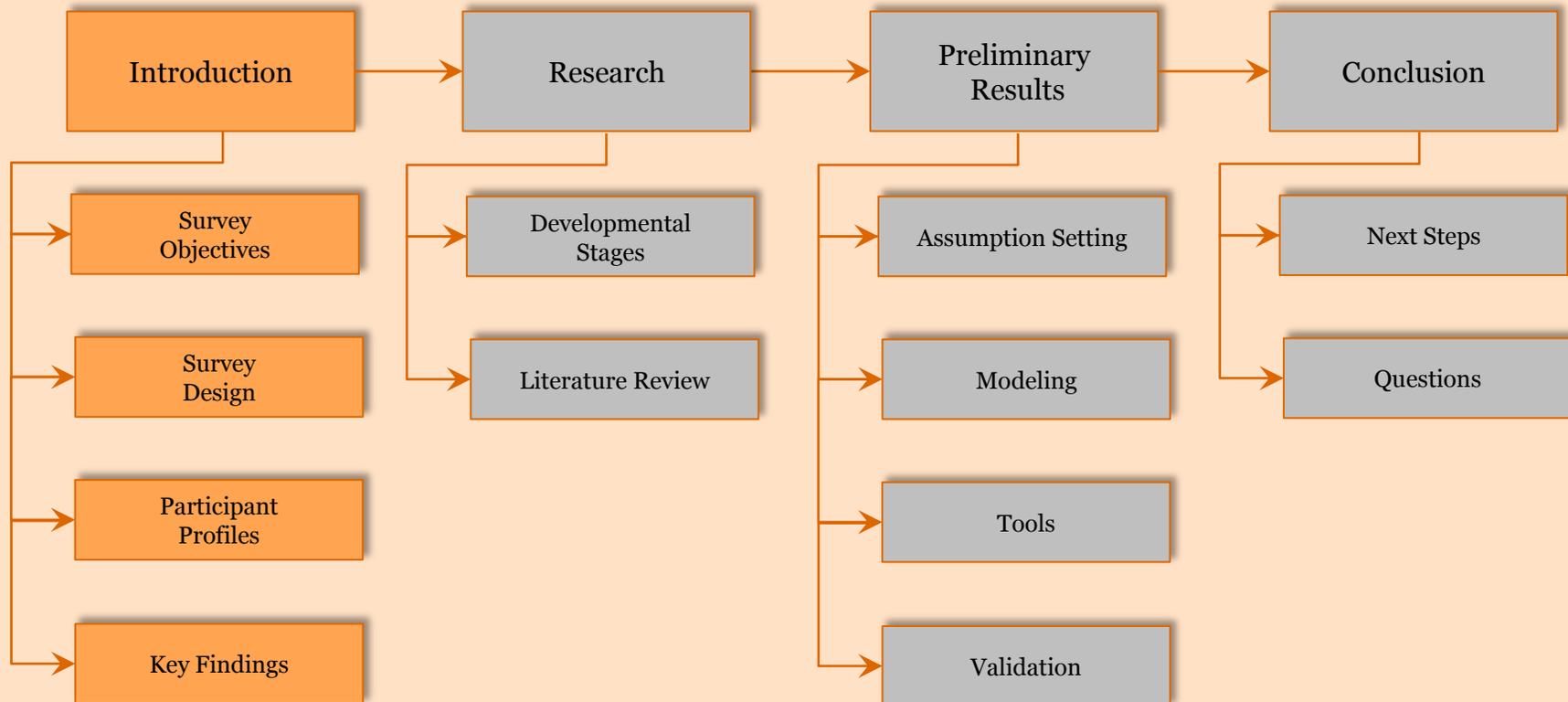


Purpose and topics

The purpose of this presentation is to share the preliminary results of an extensive survey sponsored by the Society of Actuaries on policyholder behavior.



Introduction



Survey objectives

“...Dynamic policyholder behavior is becoming an important aspect of modeling life insurance and annuity cash flows.”

Request For Proposal, Society of Actuaries, 2012

The purpose of this research is to educate actuaries and other interested parties on current actuarial practices around setting and applying dynamic policyholder behavior assumptions by:

1. Surveying and evaluating current practice in light of recent available research on the subject; and
2. Assessing the methods and application of setting dynamic policyholder behavior assumptions.

Another important purpose of this research was to identify new approaches or techniques used in other industries that:

1. Might be applied to insurers; and
2. Provide insights into enhancing current actuarial practice.

Survey Design

1

Literature Review

Reviewed over 100 articles, papers and books in the following general areas:

1. Academic
2. Actuarial
3. Industry

2

Quantitative Questionnaire

An electronic survey with over fifty questions was sent to over 100 life & annuity companies

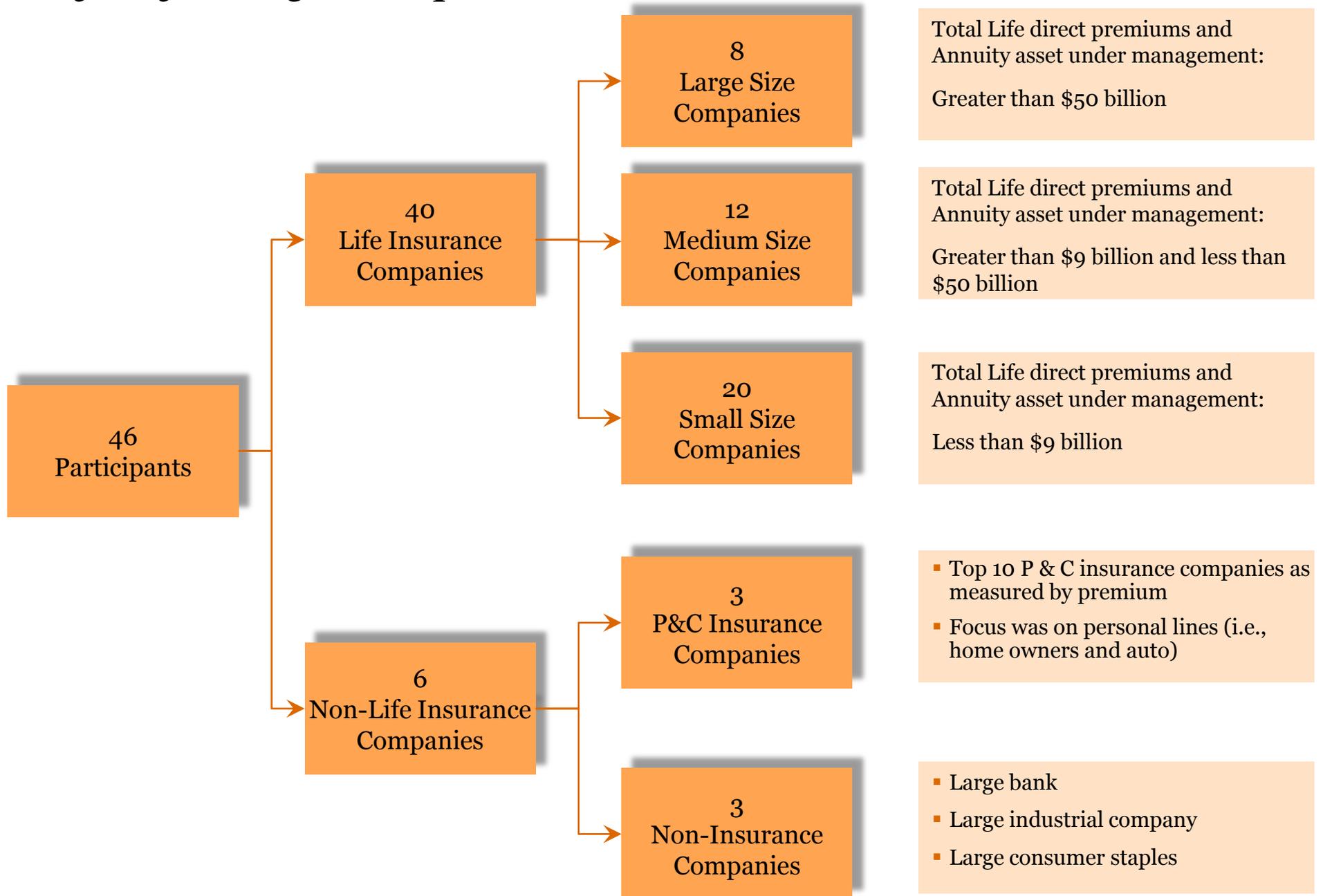
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Qualitative Interviews

To date, conducted in-depth qualitative interviews with:

1. 7 Life insurance companies
2. 3 P&C insurance companies
3. 3 Non-insurance companies

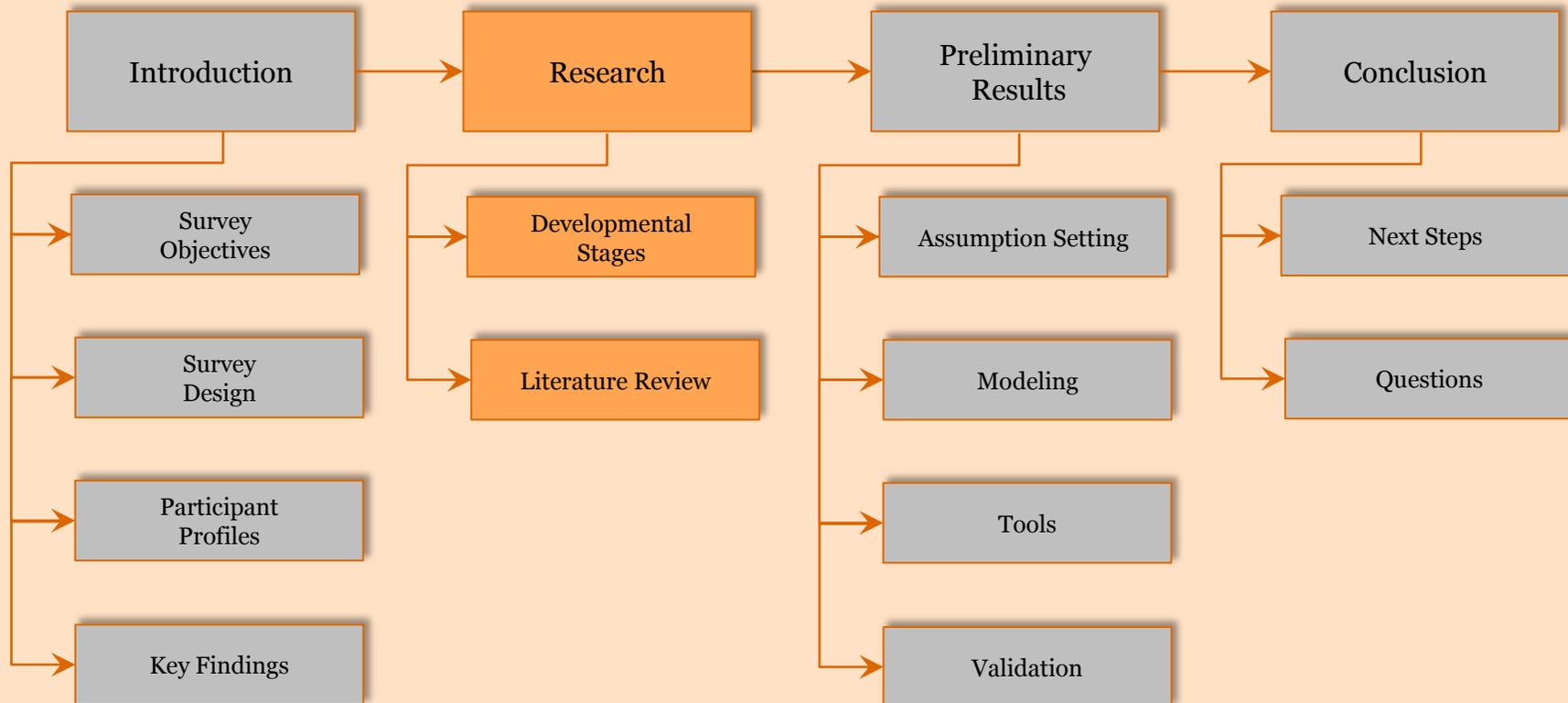
Profile of Survey Participants



Key Findings

1. The life insurance industry is behind the P&C insurance industry and other industries in using advanced analytical techniques to understand their customers (i.e., policyholders).
2. It is important that we view the policyholder not as a male age 40 preferred nonsmoker, but as the member of society and part of a household.
3. Actuaries have a very good quantitative understanding of policyholder behavior using traditional actuarial techniques, but often only a second-hand qualitative understanding.
4. Significant movement has been made in recent years toward a formal assumption setting process across a broad range of insurer functions, in some cases including those outside the actuarial area.
5. Data quality and credibility are a primary source of impediment to implementing greater dynamism in assumption setting and modeling.
6. Data sources are nearly universally limited to insurer experience data whether internal, industry or reinsurer sourced.
7. Level of financial efficiency of the policyholder is considered by nearly all companies in assumption development.

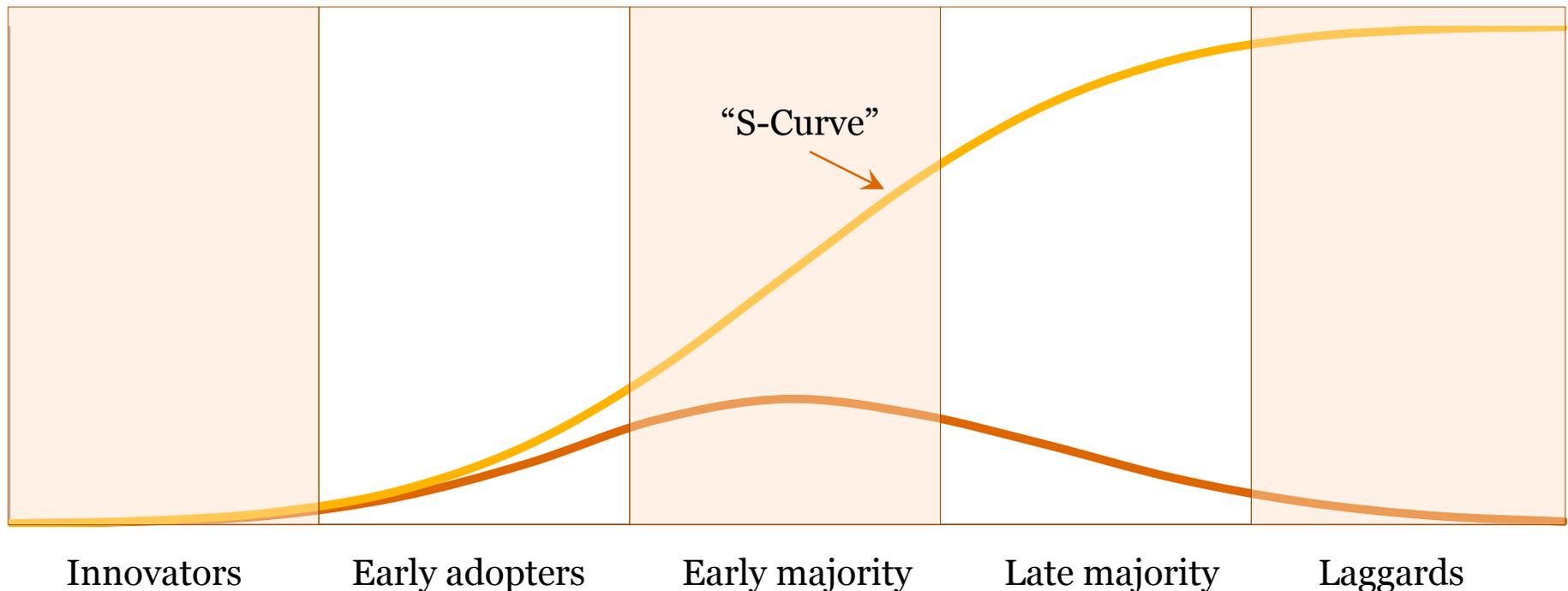
Research



Diffusion of Innovations

“The *innovation-decision process* is the process through which an individual or organization passes from gaining knowledge of an innovation, to forming an attitude toward the innovation, to making a decision to adopt or reject, to implementation of the new idea and to confirmation of this decision. This process consists of a series of choices and actions over time through which an individual or an organization evaluates a new idea and decides whether or not to incorporate the innovation into ongoing practice.”

Diffusion of Innovations, Everett M. Rogers, 5th Edition, page 168



Diffusion of Innovations

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Diffusion of Innovations, Everett M. Rogers, 5th Edition, page 168

Stages of Implementation

The stages an organization follows in adopting or rejecting an innovation are:

1. Knowledge
2. Persuasion
3. Decision
4. Implementation
5. Confirmation

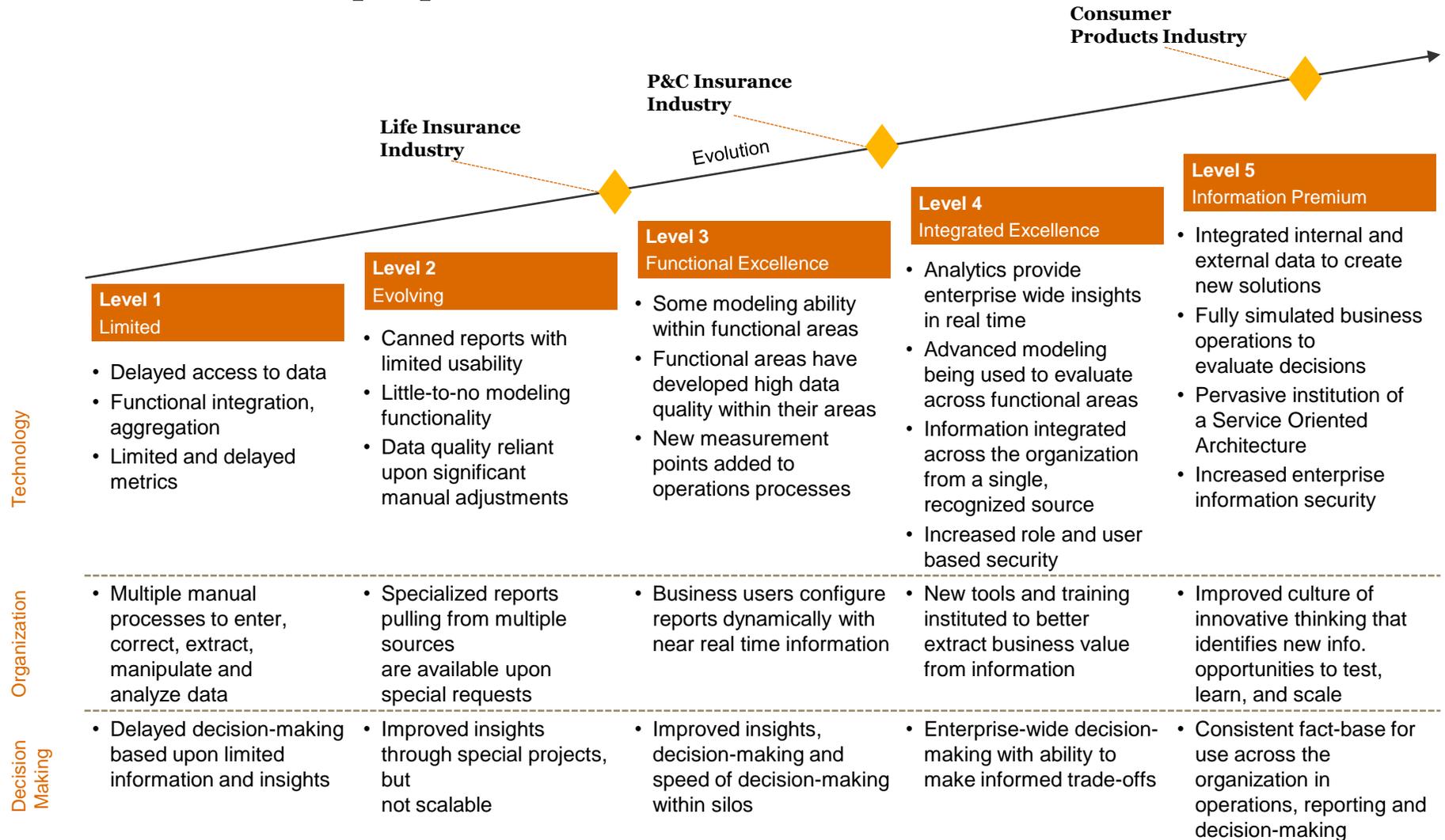
Factors Influencing Adoption

The intrinsic characteristics of an innovation that influence an organization's decision to adopt an innovation:

1. Advantages
2. Compatibility
3. Complexity
4. Visibility

“Information Advantage” Development Stages

Building an “IA organization” is a multi-phase process that requires sequential investments to develop capabilities over time

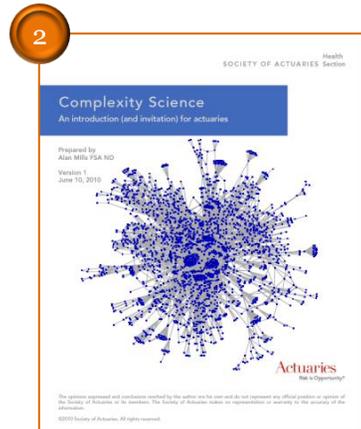


Literature Review: Behavioral Simulations



Agents of Change, The Economist, July 22, 2010

- The assumptions, including efficient financial markets and rationale expectations, are considered to be too simplistic.
- A new approach called agent-based modeling is being explored to help address lessons learned from the financial crisis.



Mills, Alan. *Complexity Science: An introduction (and invitation) for actuaries*, Society of Actuaries (2012)

- Understands the complex nature of social systems.
- To grasp and manage the systems in which actuaries work, we must augment our tools with the new methods of Complexity Science.



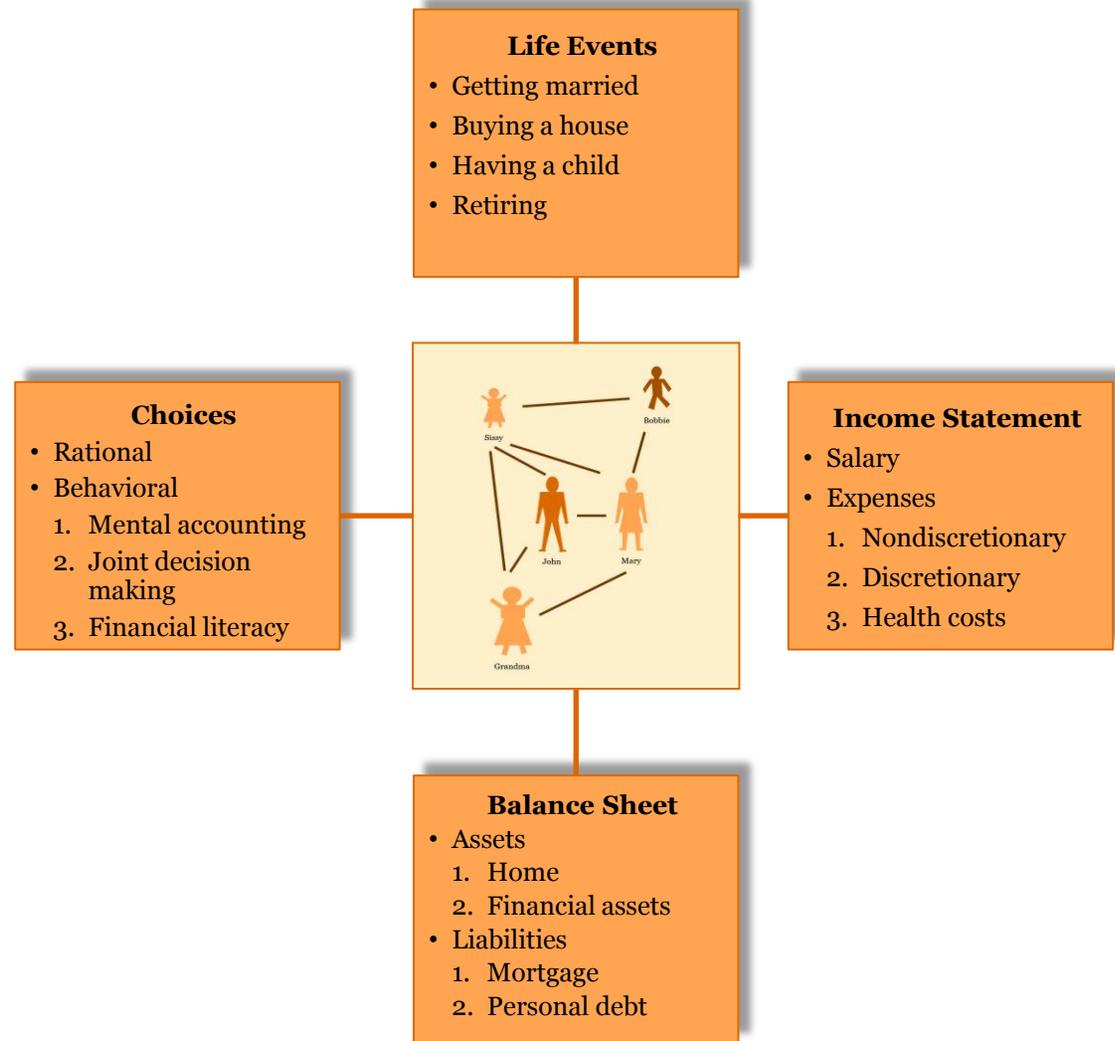
Mills, Alan. *Simulating health behavior: A guide to solving complex health system problems with agent-based simulation modeling* Society of Actuaries (2013)

- Agent-based modeling simulates agents' (e.g., individuals and companies) interactions with their environment and other agents
- The goal is to understand the emergent behavior of complex systems.

Understanding the policyholder

It is important that we view the policyholder not as a male age 40 nonsmoker, but as the member of society and part of a household with a focus on:

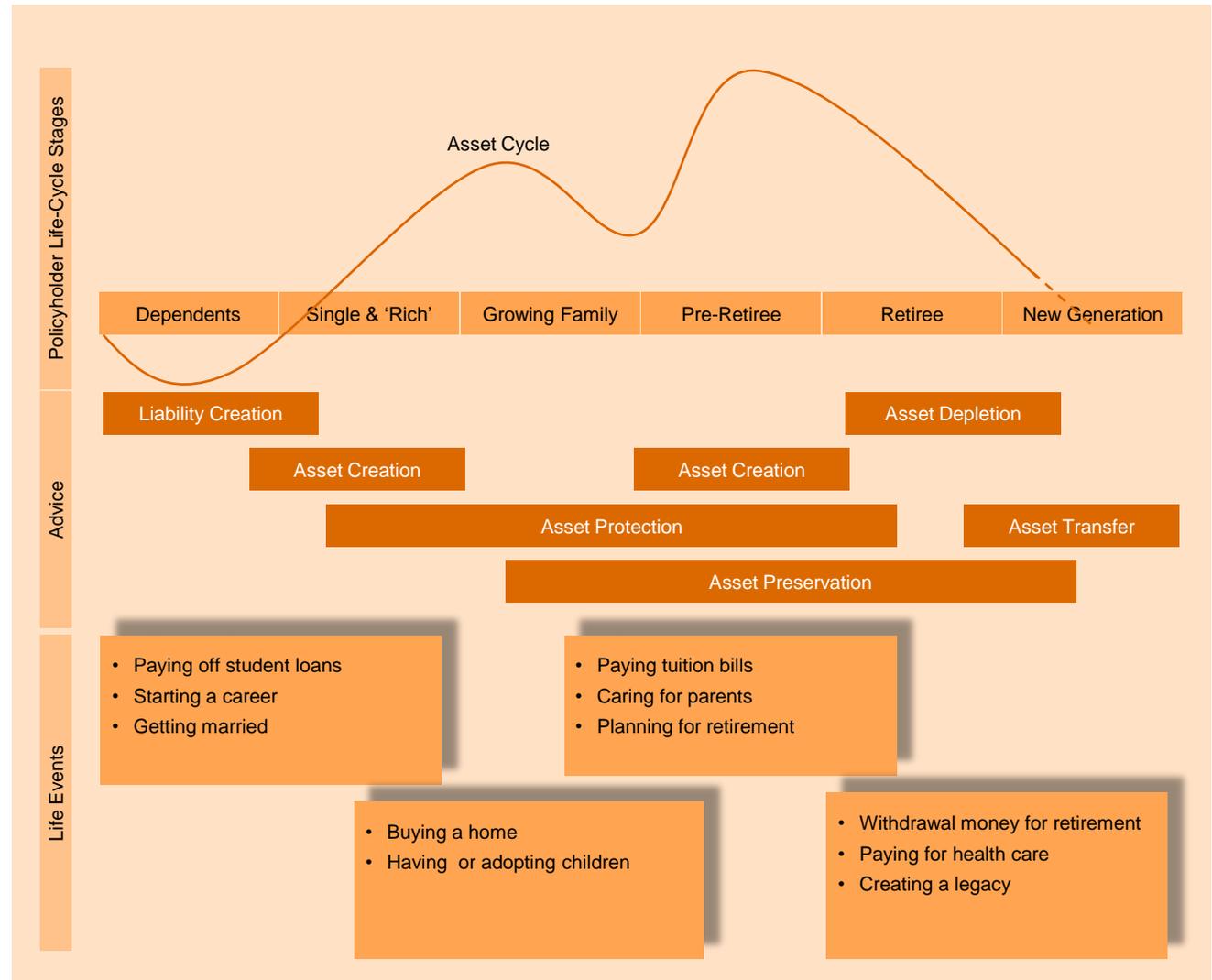
- *The composition of that household and how it changes over time;*
- *The life events that take place in the household such as having children;*
- *The household's income, spending, and savings habits;*
- *The type of assets the household owns and the liabilities the household owes; and*
- *The choices the household makes, both rational and behavioral.*



Understanding life events and choices

The goal is to understand how life events and the choices an individual make change over time such as when:

1. He or she graduates from college and gets a job;
2. He or she marries;
3. They have children;
4. They become “empty nesters”; and
5. They retire.

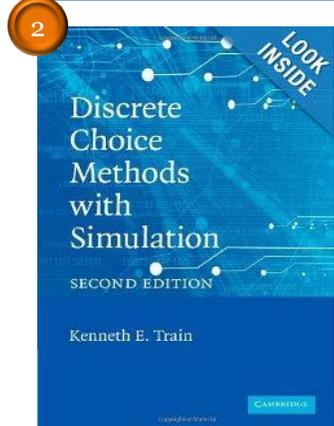


Literature Review: Decision Field Theory



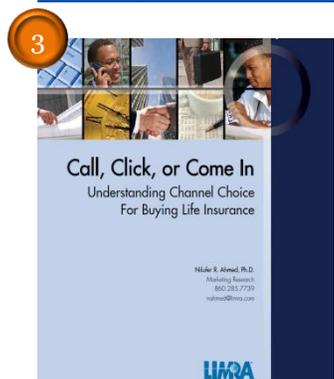
Bussemeyer, Jerome and Townsend, James. *Decision Field Theory*, Psychological Review (1993).

- Decision field theory (DFT) is a dynamic-cognitive approach to human decision making based on psychological rather than economic principles.
- Researchers use these statistical methods to examine the choices that consumers, households, firms, and other agents make.



Train, Kenneth. *Discrete Choice Methods with Simulation*

- Describes the new generation of discrete choice methods, focusing on the many advances that are made possible by simulation.
- Each of the major models is covered: logit, generalized extreme value, or GEV (including nested and cross-nested logits), probit, and mixed logit.

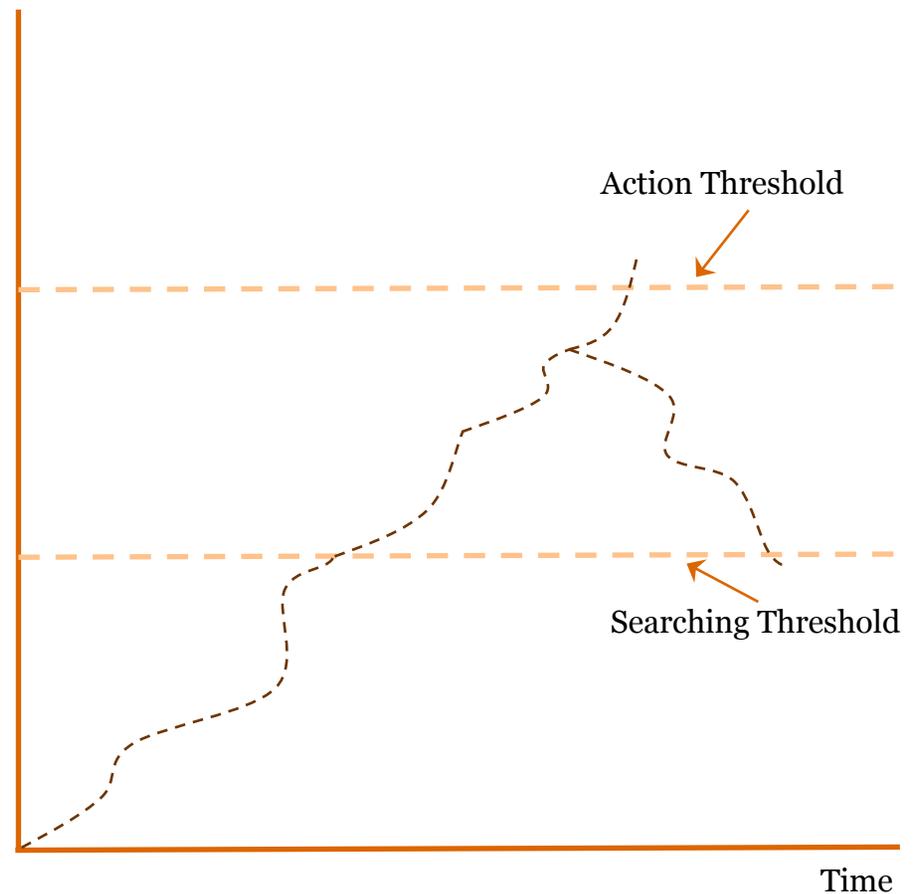


Ahmed, Nilufer. *Call, Click, or Come In Understanding Channel Choice For Buying Life Insurance*, LIMRA (2012)

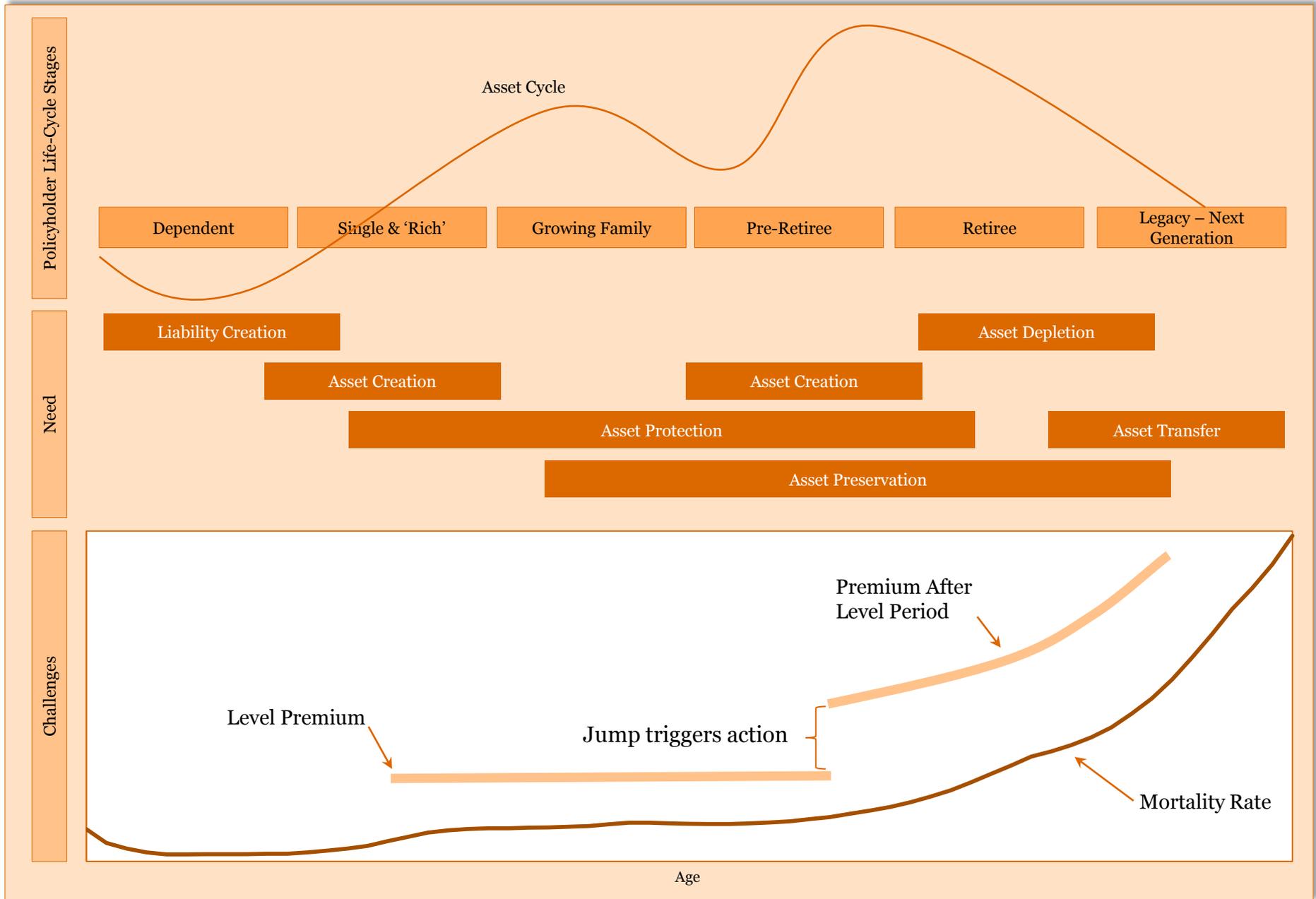
- Provides an understanding of the factors that consumers consider when considering a sales channel.
- Also looks at the relative importance of these factors to consumers that will subsequently affect their choice of channel for buying life insurance.

Understanding the purchase decision

- 1 A consumer is considered to be in a dormant state when they not actively considering purchasing an insurance policy.
- 2 A life event, such as the birth of a child, usually triggers the customer to begin searching for a life insurance policy.
- 3 The customer determines if a particular company will be evaluated.
- 4 Consumer determines if products from company are worth including in their consideration set.
- 5 Consumer makes a decision to pick from the consideration set, or...
- 6 ... Gives up.



Challenges to developing and managing renewable term products

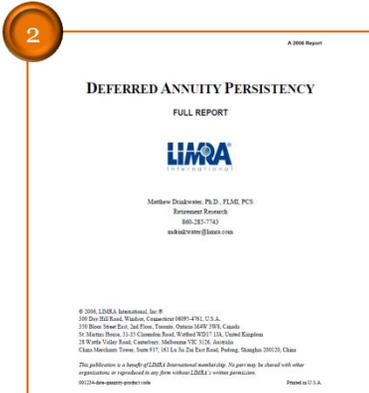


Literature Review: Understanding the Utilization Decision



Milevsky, Moshe and Salisbury, Thomas. *Financial valuation of guaranteed minimum withdrawal benefits*, Insurance: Mathematics and Economics (2005)

- Develop a variety of methods for assessing the cost and value of Guaranteed Minimum Withdrawal Benefit (GMWB).
- Main result is that the No Arbitrage hedging cost of a GMWB ranges from 73 to 160 basis points of assets.



Drinkwater, Mathew. *Deferred Annuity Persistency Study*, LIMRA (2005)

- Shows partial and full withdrawals for a variety of parameters
- Partial withdrawals for account balances below \$50,000 average 20% for ages older than 60.
- Partial withdrawals for account balances above \$50,000 average 5% for ages older than 60.

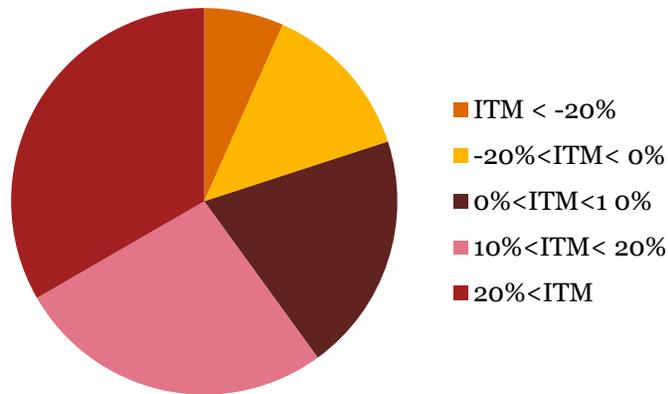


Fier, Stephen G. and Liebenberg, Andre P. *Life Insurance Lapse Behavior*, North American Actuarial Journal (2013)

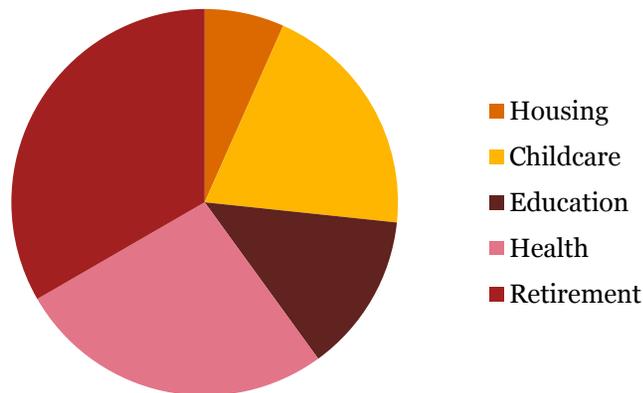
- Developed and tested a microeconomic model of voluntary life insurance lapse behavior.
- Provide some of the first evidence regarding household factors related to life insurance lapses.
- Found that voluntary lapses are related to large income shocks.

Understanding the Utilization Decision

Rational Expectations Perspective

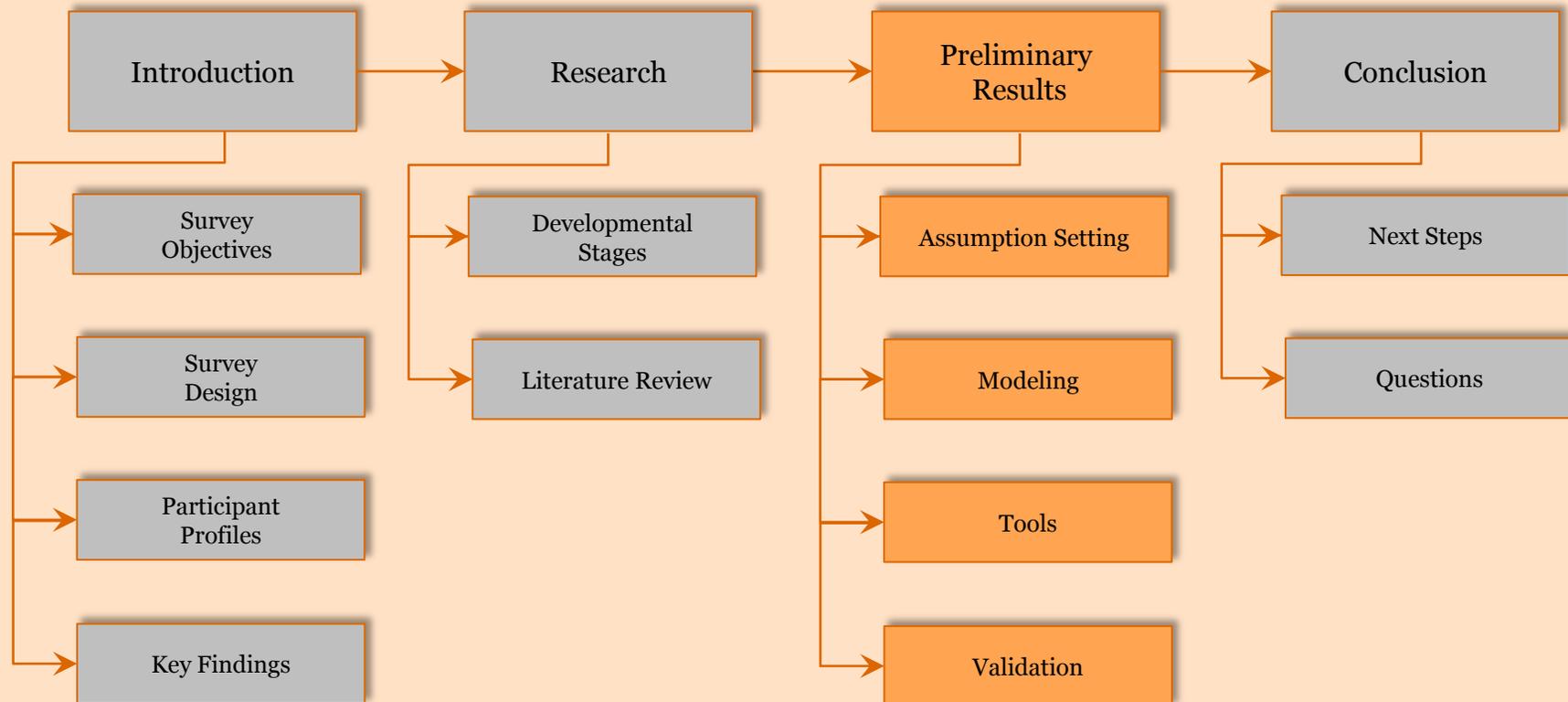


Behavioral Simulation Perspective



- Actuaries have a quantitative understanding of policyholder behavior but often only a second-hand qualitative understanding.
- For example, an actuary may only see a monthly report of the policy lapses that occurred, and it may be possible to analyze the lapses along different dimensions such as the policy size or in-the-moneyness of the contracts, but there is a gap in understanding each policyholder’s household situation and considerations that led them to lapse a policy.
- Classifying policyholder actions as “rational” or “irrational” can be misleading – certain perceived “irrationality” of policyholder behaviors may simply be due to the relatively limited view of each policyholder’s circumstances.
- Measurement of ‘rationality’ needs to be put in the context of the policyholder’s individual circumstances and needs.

Preliminary Results



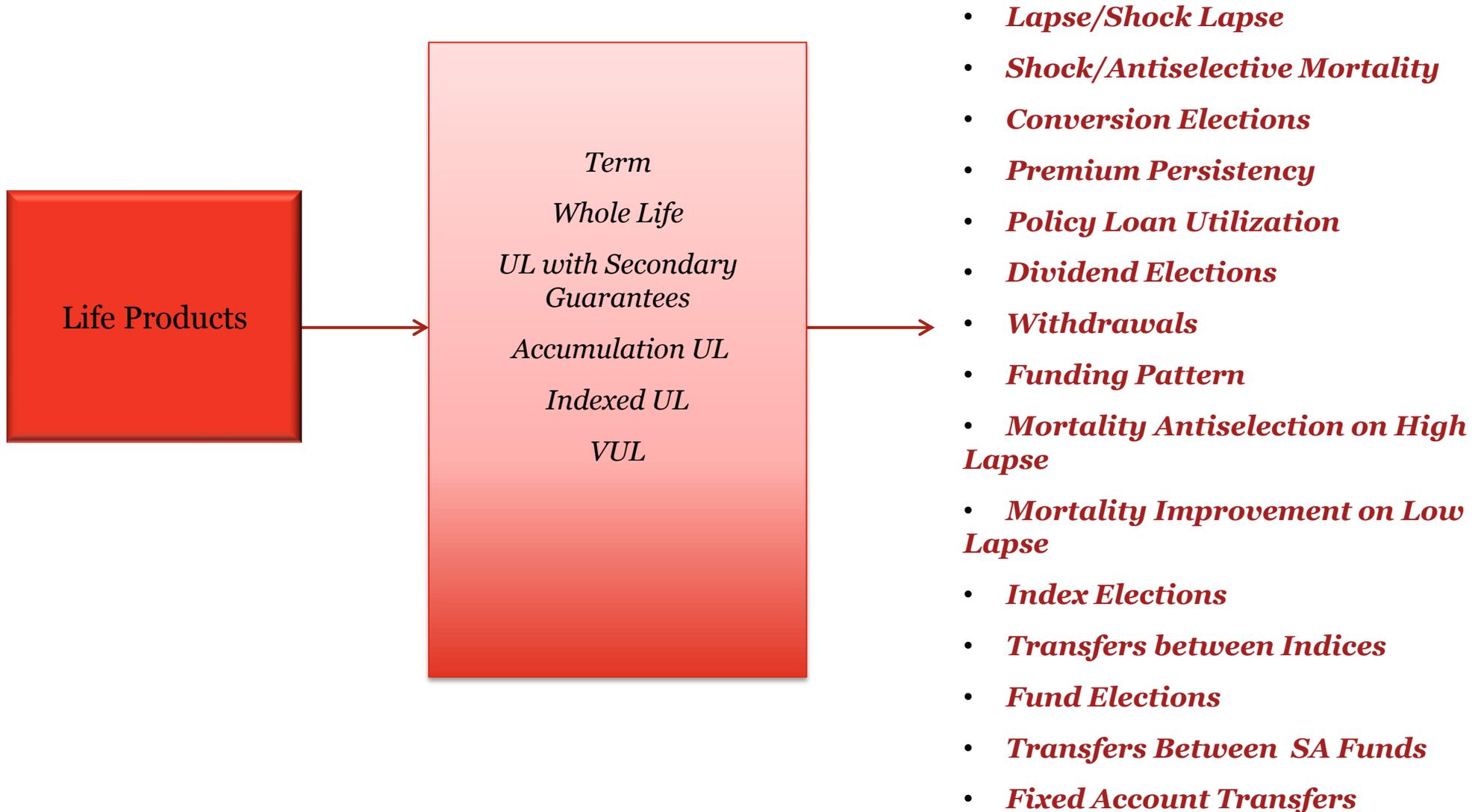
Definitions

- Policyholder Behavior
- Static Assumption versus Dynamic Assumption
- Election versus Utilization
- Modeled versus Non Modeled

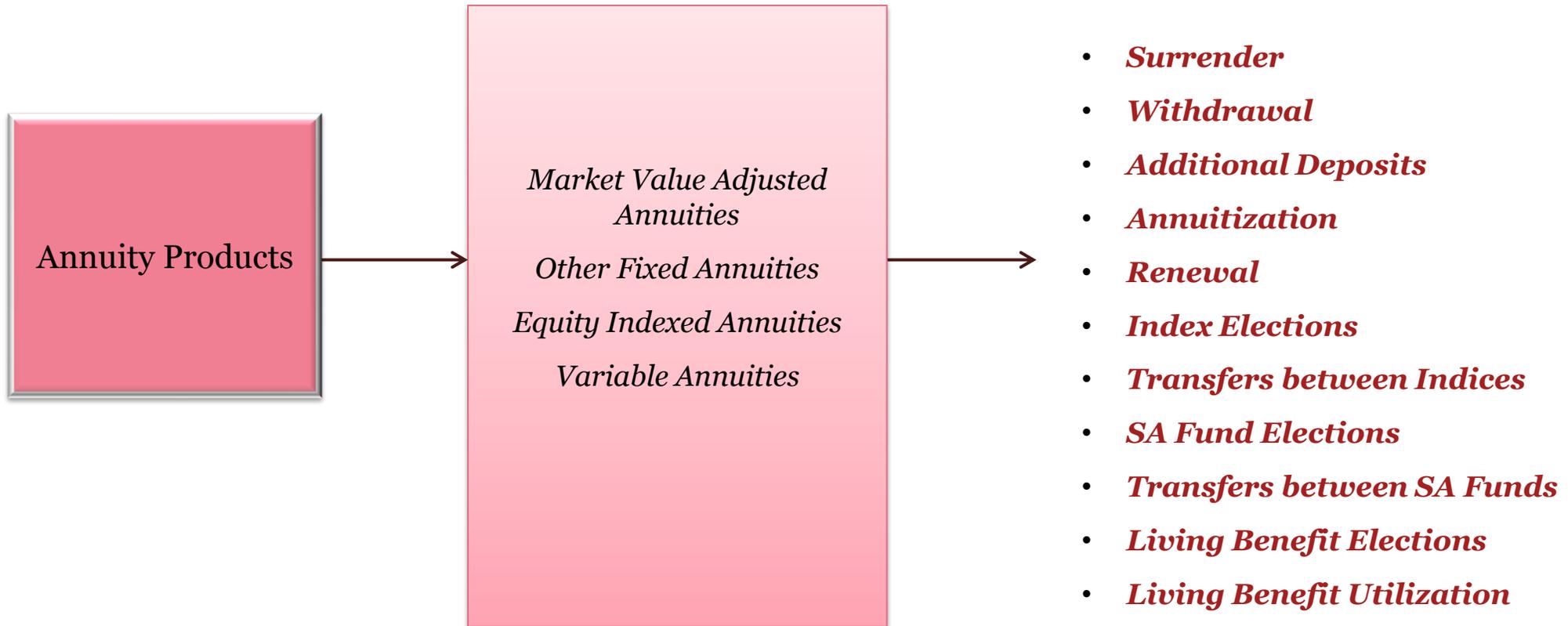
Actuarial Applications and Understanding Policyholder Behavior

- Static versus Dynamic assumption structures
- Views regarding policyholder financial efficiency
- Data sources for policyholder behavior assumptions
- Credibility of data
- Assumption and modeling governance
- Modeling methodologies and tools
- Validation methods and results
- Applications of policyholder behavior analysis and modeling to shopper/potential buyer behavior

Policyholder Behavior Assumptions Included in Actuarial Modeling



Policyholder Behavior Assumptions Included in Actuarial Modeling



Assumptions Setting: Life Insurance

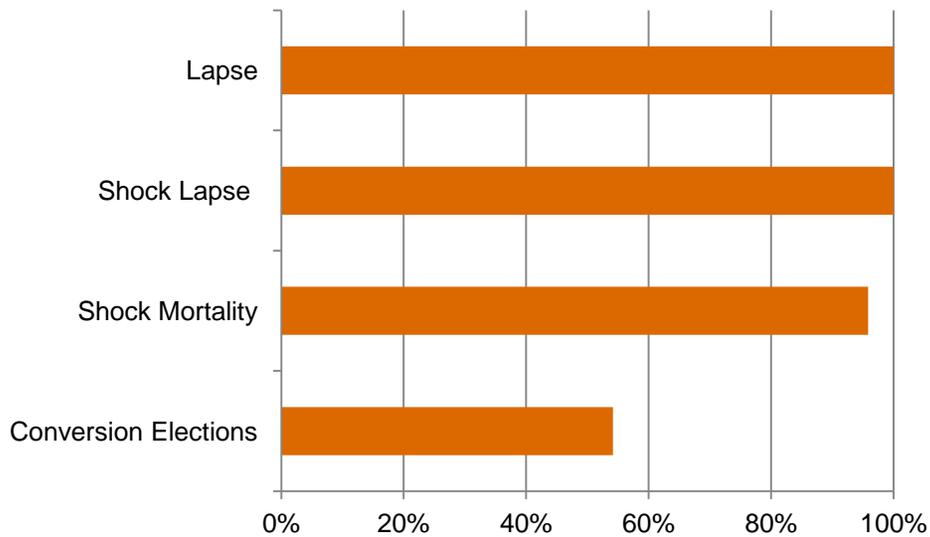
Policyholder Behavior Assumptions Modeled

Question B-2:

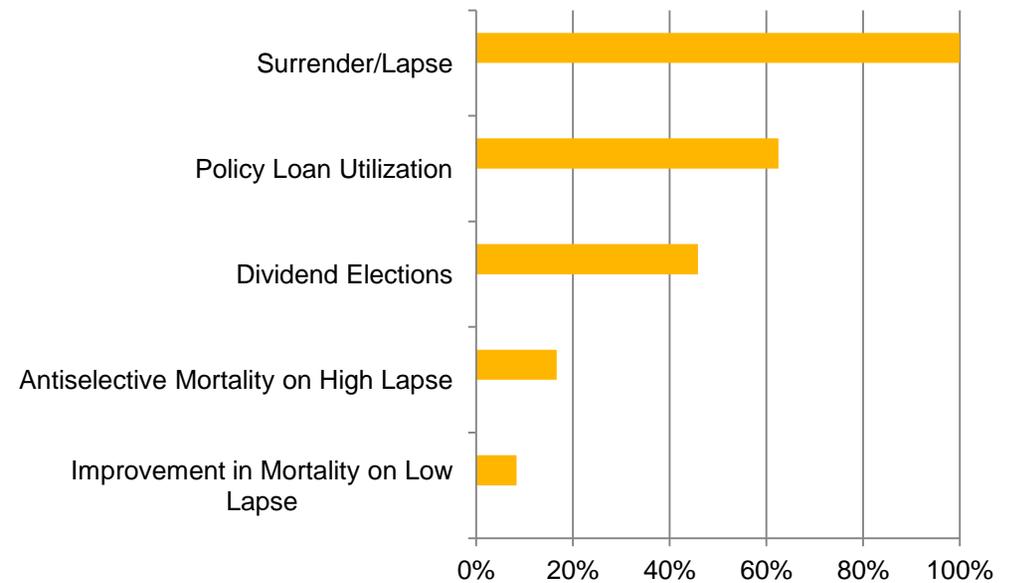
What PH behavior assumptions are currently included in life insurance actuarial modeling work?

Responses:

Term



Whole Life



Assumptions Setting: Life Insurance

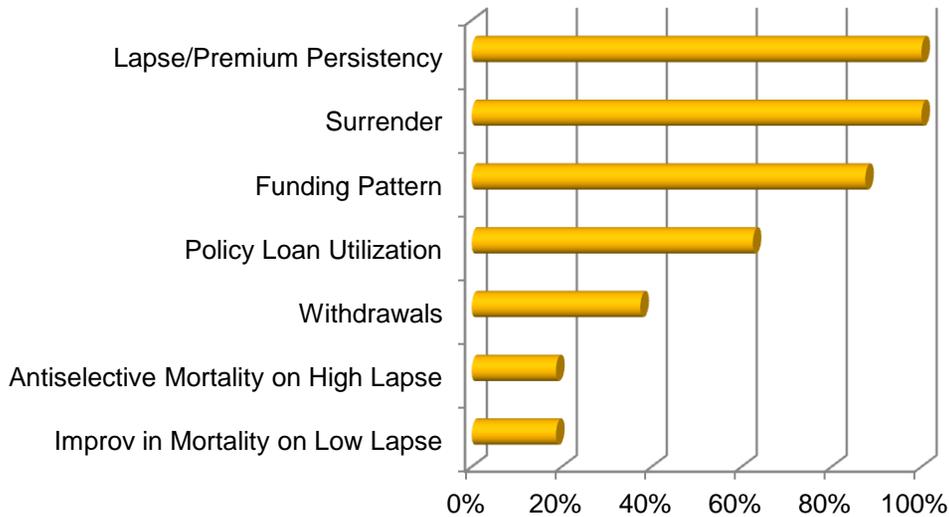
Policyholder Behavior Assumptions Modeled

Question B-2:

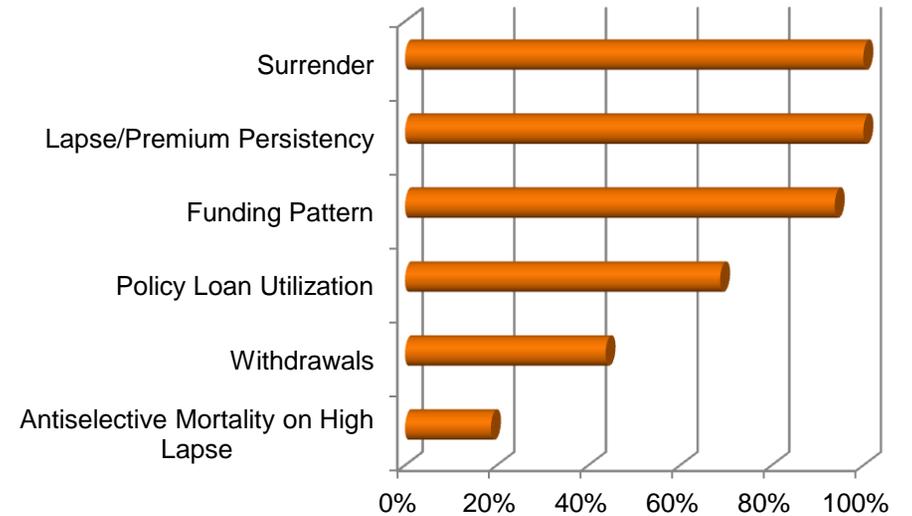
What PH behavior assumptions are currently included in the life insurance actuarial modeling work?

Responses:

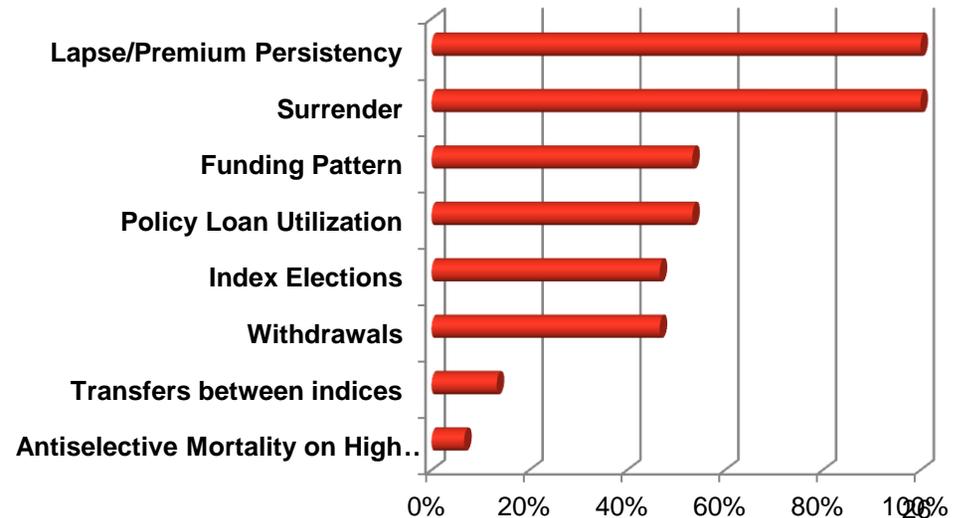
Universal Life with Secondary Guarantees



Universal Life without Secondary Guarantees



Indexed Universal Life



Assumptions Setting: Life Insurance

Dynamic Assumptions

Question B-2:

Of those assumptions included in PH behavior modeling work, which are modeled dynamically?

Responses:

	Term	Whole Life	ULSG	Accum UL	Indexed UL
Shock Mortality	0%				
Shock Lapse	0%				
Conversion Elections	0%				
Surrender		25%	44%	38%	33%
Lapse/Premium Persistency		0%	38%	19%	13%
Dividend Elections		0%			
Policy Loan Utilization		20%	0%	18%	0%
Antiselective Mortality on High Lapse		25%	33%	0%	0%
Improvement in Mortality on Low Lapse			33%		
Funding Pattern			33%	13%	0%
Withdrawals			33%	0%	0%
Index Elections					0%
Transfers between indices					0%

Assumptions Setting: Data

Life Insurance – Primary Data Source

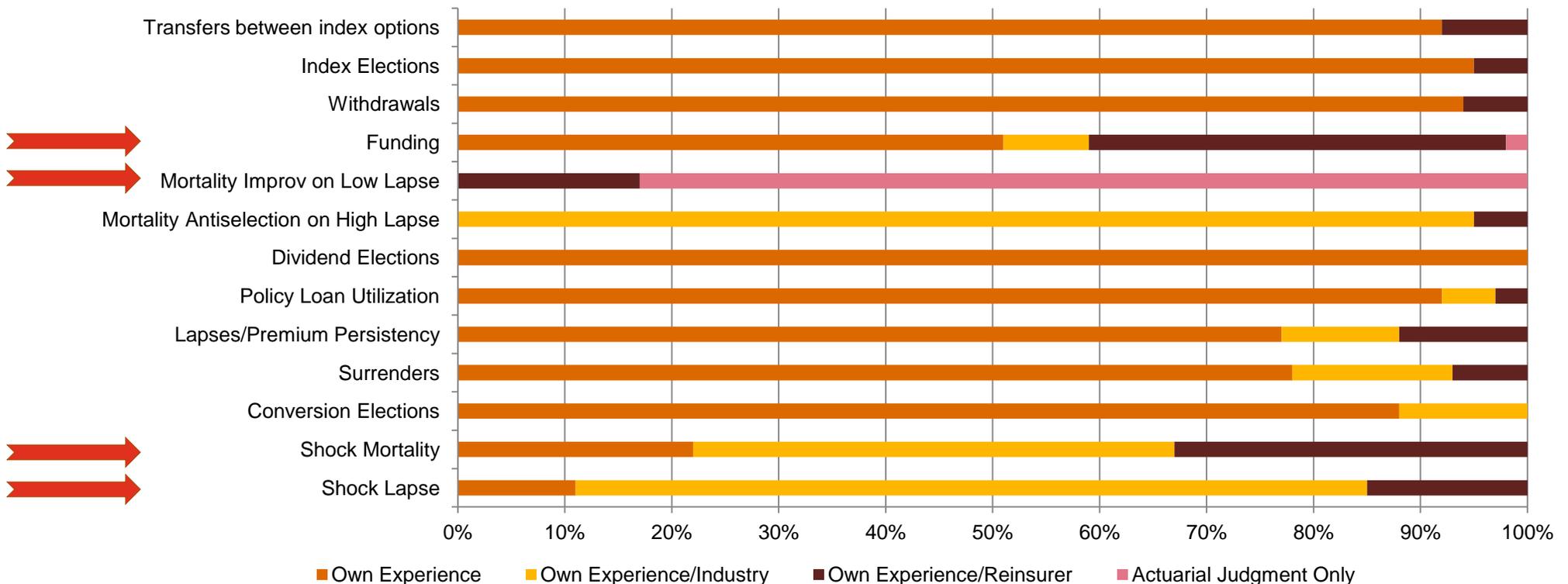
Question B-7:

For this product, what data sources does your company use to study policyholder behavior? Please think about both primary and secondary data sources for each. Please include all that apply.

Responses:

Observations:

- For the most assumptions for life products, companies are relying on their own experience combined with a review of industry level results.
- Only area where significant actuarial judgment is being applied is on assumptions for mortality improvement on low lapse in few cases where this is modeled.
- Shock lapse, shock mortality, and funding patterns for universal life products rely on greater use of outside data.



Assumptions Setting: Data

Life Insurance – Credibility of Primary Data Source

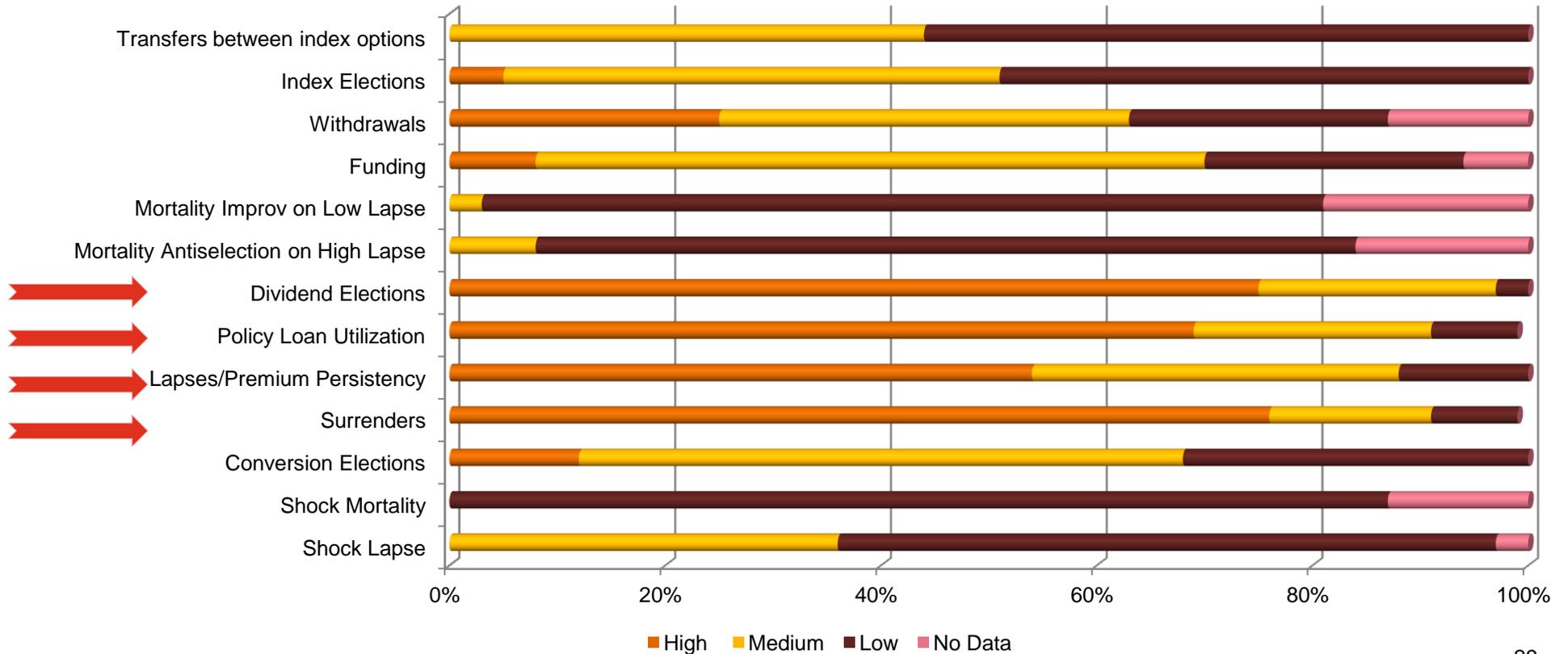
Question B-8:

How credible is the data that is used to study policyholder behavior for this product type?

Responses:

Observations:

- Comparison of data sources used with views regarding credibility of those data sources indicates credibility is a material issue for policyholder behavior assumptions.
- Most companies have not defined credibility in any formal way for assumptions other than mortality.

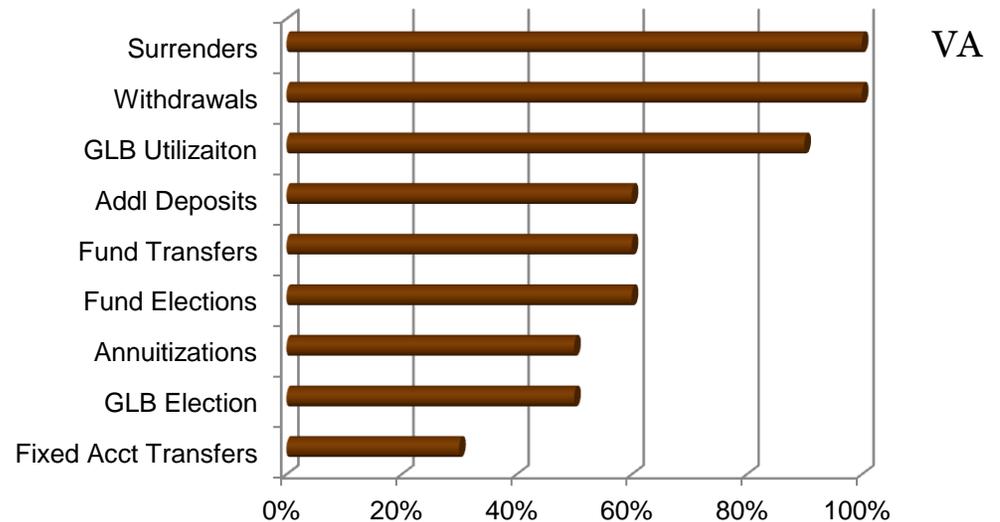
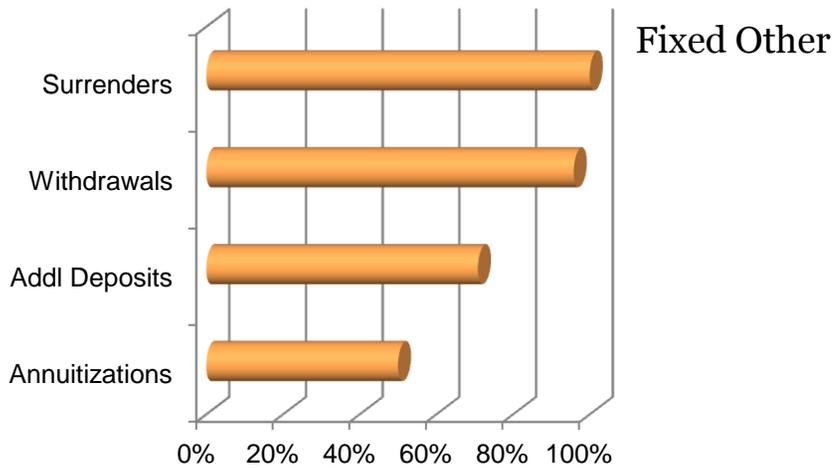
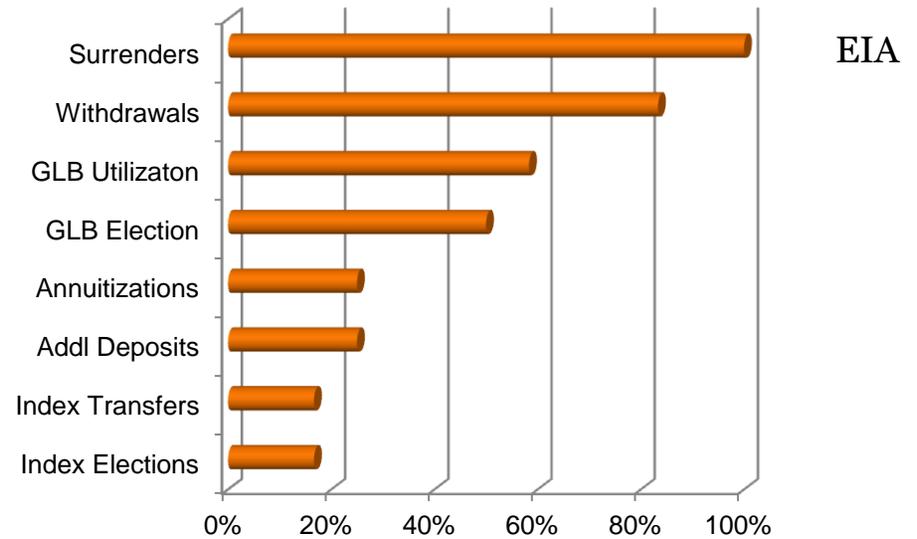
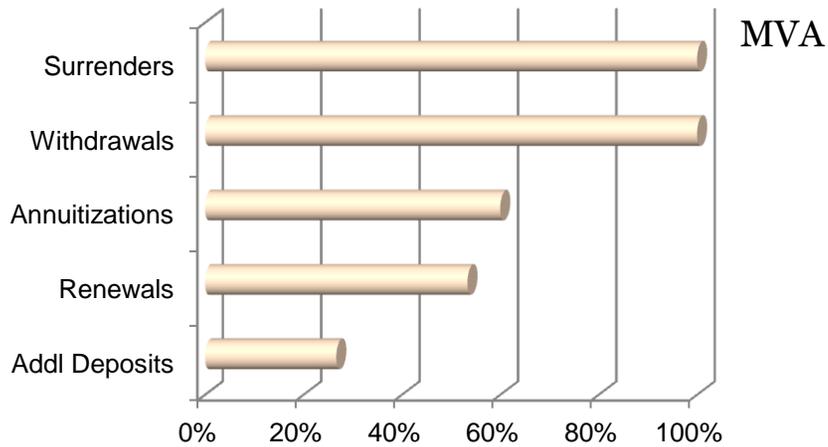


Assumptions Setting: Annuities

Policyholder Behavior Assumptions Modeled

Question B-2:

What PH behavior assumptions are currently included in the annuity actuarial modeling work?



Assumptions Setting: Annuities

Dynamic Assumptions

Question B-2:

Of those assumptions included in PH behavior modeling work, which are modeled dynamically?

Observations:

- More dynamic assumptions on annuity products than on life.
- Most common dynamics are surrenders, withdrawals, additional deposits, and GLB utilization.

Responses:

	MVA	Fixed Other	EIA	VA
Surrenders	67%	75%	67%	100%
Withdrawals	7%	22%	10%	50%
Addl Deposits	25%	24%	67%	17%
Annuitizations	0%	0%	0%	40%
Renewals	0%			
GLB Election			17%	0%
GLB Utilization			43%	67%
EIA Index Elections			0%	
EIA Index Transfers			0%	
SA Fund Elections				0%
SA Fund Transfers				33%
Fixed Acct Transfers				67%

Assumptions Setting: Data

Annuities – Primary Data Source for Assumption Setting

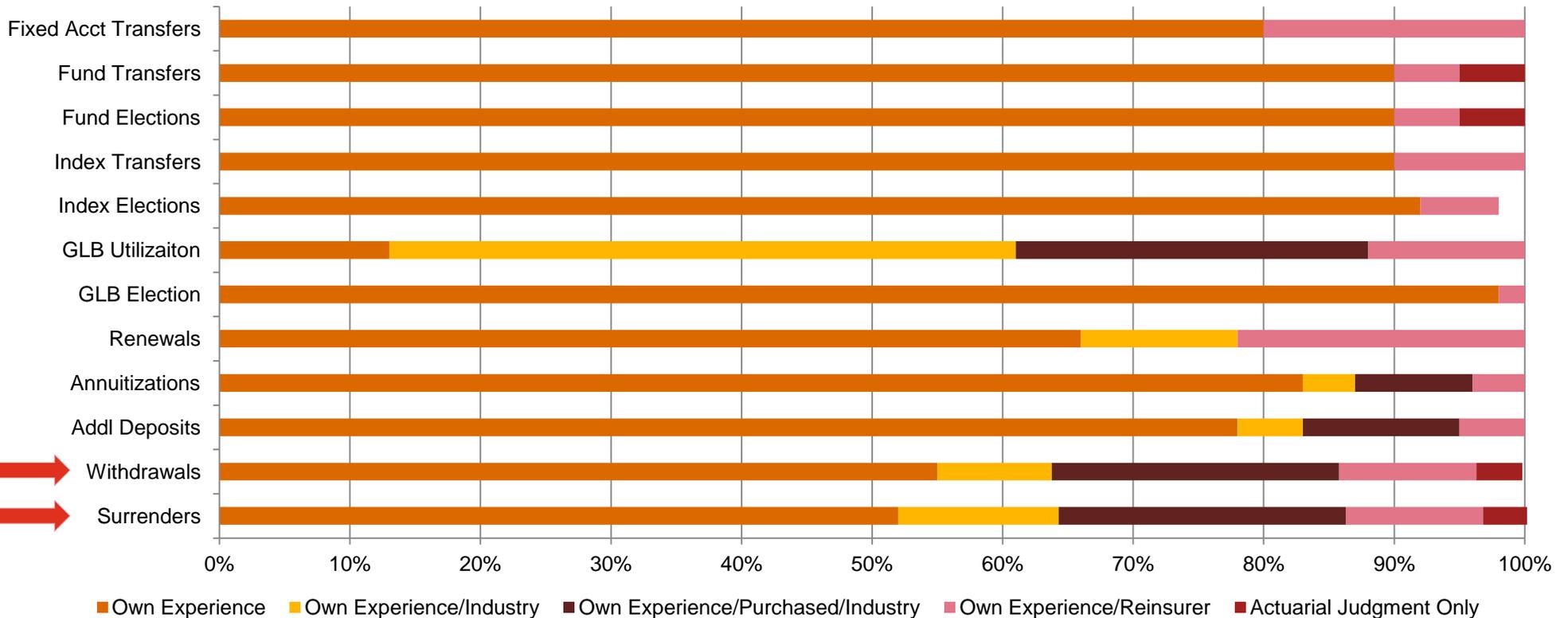
Question B-7:

For this product, what data sources does your company use to study policyholder behavior? Please think about both primary and secondary data sources for each. Please include all that apply.

Observations:

- More reliance on outside data sources for some traditional assumptions than life insurance products.
- This is due to lack of experience data for impact of newer GLB riders.

Responses:



Assumptions Setting: Data

Annuities – Credibility of Primary Data Source

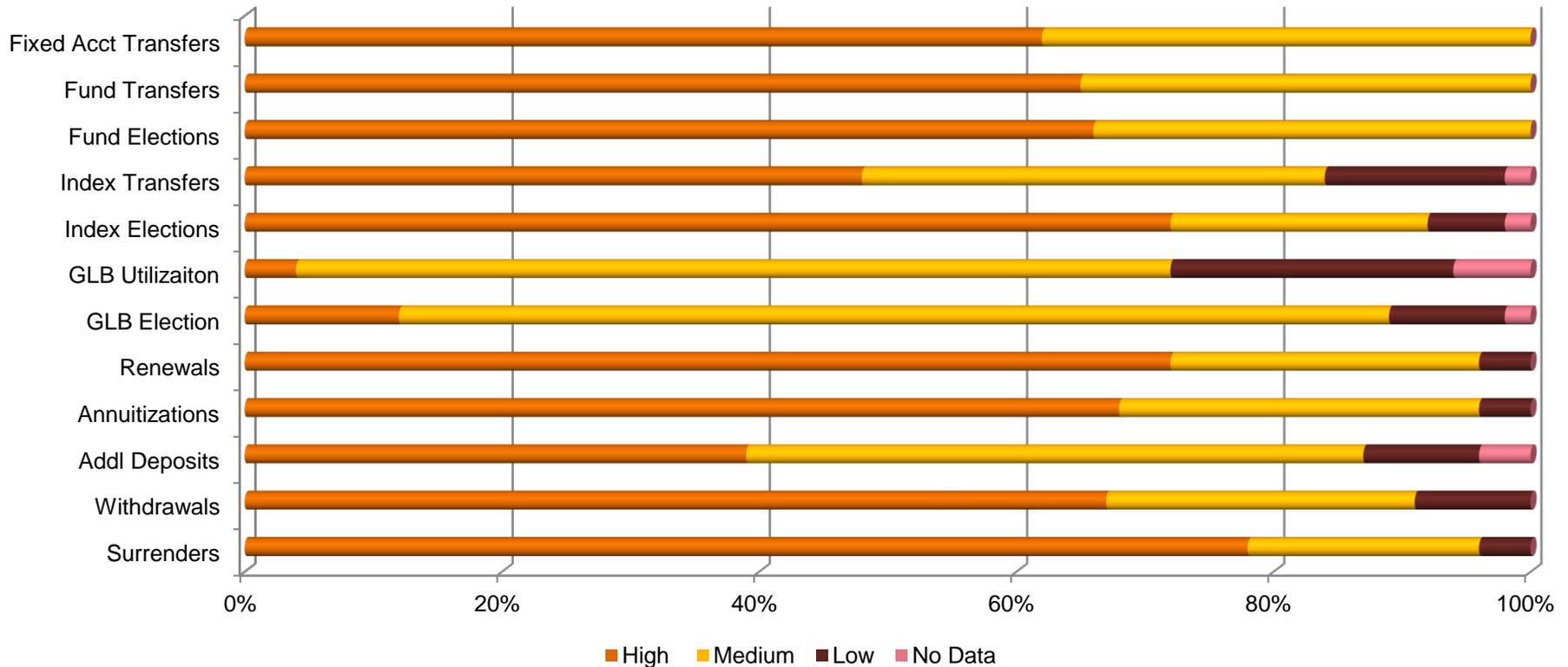
Question B-8:

How credible is the data that is used to study policyholder behavior for this product type?

Observations:

- Generally more confidence in credibility of data for annuities than life.
- This results from a combination of availability of secondary data sources and experience from mature inforce blocks.
- Like life insurance, few companies have formally developed a definition of credibility for policyholder behavior assumptions.

Responses:



Assumptions Setting

Question B-1b and B-1c:

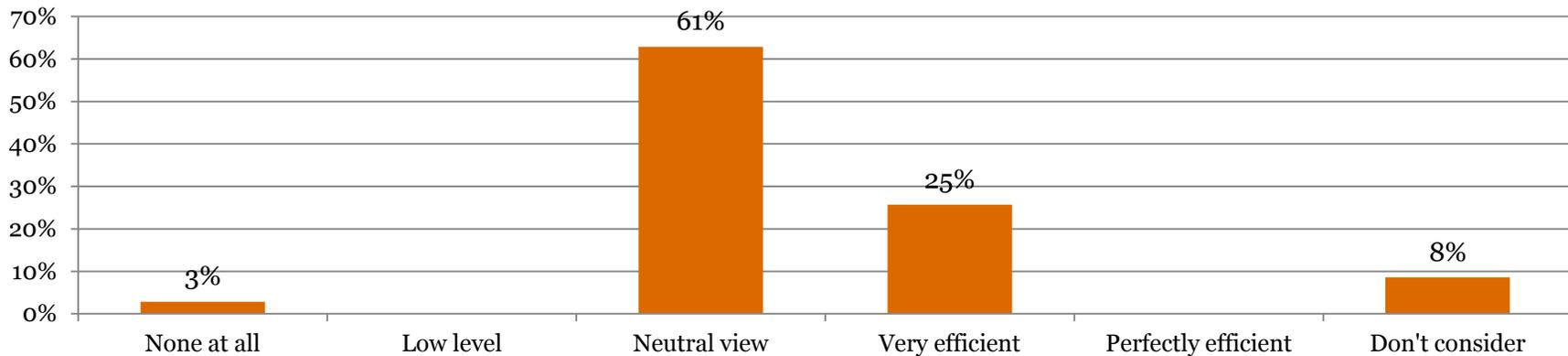
On a scale from 1 to 5, how “financially efficient” does your organization generally assume policyholders are in making decisions about product purchases and electing product benefits?

Observations:

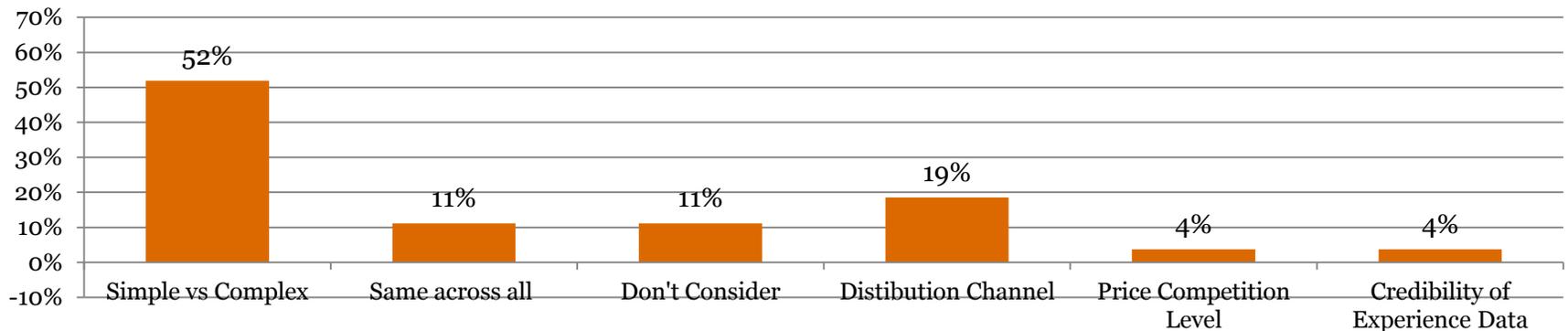
- Nearly 2/3 of companies assume that the policyholder is neither financially inefficient nor fully efficient in making decisions.
- Nearly half of companies assume more efficiency with more complex products.

Responses:

Policyholder Assumed Level of Financial Efficiency



Differences in View by Product or Assumption



Policyholder Behavior Modeling

Governance – Life and Annuity Combined

Length of Time Formal Assumption Setting Process in Place

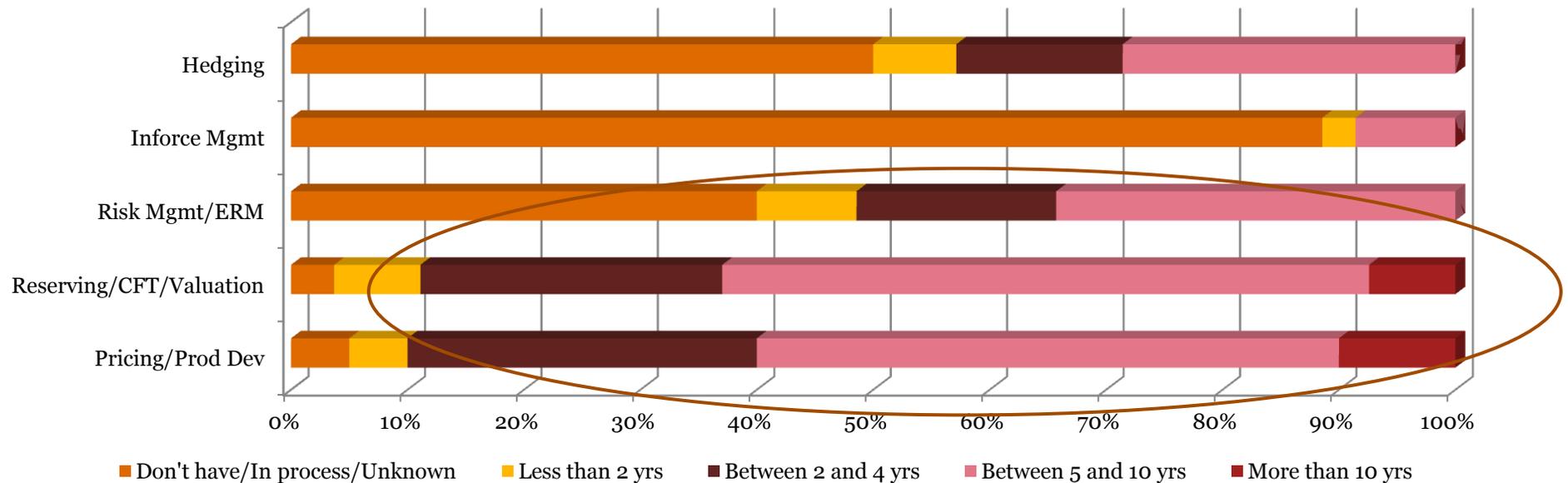
Question C-1:

For the following functions, how long has your organization had a formal assumption setting process in place that considers all aspects of policyholder behavior in making decisions about assumption setting and modeling dynamic policyholder behavior?

Observations:

- Hedging and inforce management are latest functions to be brought into the formal assumption setting process.

Responses:



Policyholder Behavior Modeling

Governance – Life and Annuity Combined

Question C-2:

Please explain how your modeling of policyholder behavior has changed over time?

Responses:

	% responses*
More sophisticated process with increased amount of experience data/increased factors included in dynamic or static formula	55%
More sophisticated process due to new technologies	21%
More formalized process for model updates	21%
Development and modeling includes predictive modeling component	9%
Little or no change	6%
Reduced number of dynamic assumptions	3%

*Multiple responses allowed.

Policyholder Behavior Model Validation

Question C-7a:

What steps are used to verify and validate the policyholder behavior assumptions modeled dynamically?

Observations:

- Traditional actual to expected analysis and dynamic validation lead the list of validation methodologies
- Inclusion of predictive modeling as part of the experience review and assumption setting process is growing

Primary Responses:

Traditional Actual to Expected Analysis

Review Projections for Reasonability with Recent Historical Results (Dynamic Validation)

Backtesting under Predictive Modeling Regime

Stress Test/Scenario Testing

Third Party Review

Policyholder Behavior Model Validation

Question C-8:

For each assumption modeled dynamically, what were the results of the most recent validation process?

Observations:

- Some insurers are more advanced in considerations where they make adjustments to incorporate drivers that are not observed in actual data
- Some have benefited from using dynamic assumptions which they noted provide better fit than static policyholder assumptions
- A rigorous process is required to set and validate dynamic assumptions

Responses:

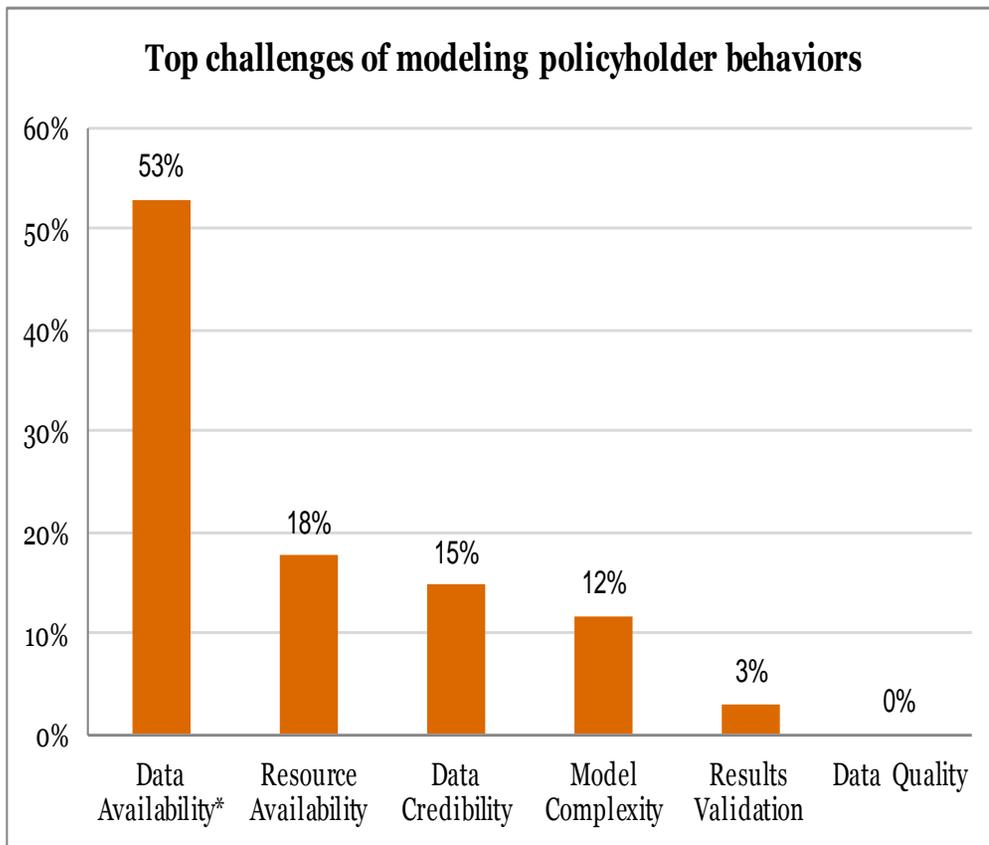
A range of results across respondents:

- *Generally in line with actual*
- *Dynamic assumptions provide better fit*
- *Good fit with historic data, made adjustments to capture behaviors that are not observed in actual data*
- *Assumptions and actual in line, but dynamic assumptions can be over-dynamic or under-dynamic*
- *Lapse lower than modeled due to low interest rate environment*
- *Surrender lower than actual, used stress testing*
- *Premiums on high guaranteed interest rate products higher than modeled*

Policyholder Behavior Modeling - Challenges

Question C-9b:

If you have more than one challenge in C-9a, describe which of these challenges you consider the greatest.



Observations:

- **Data availability/credibility tops the list of challenges that insurers are facing**
 - New product designs
 - Little experience data for some assumptions
 - Tail events or under different economic conditions (e.g., rising interest rate environment)
- **Resources are another challenge to some companies**
 - Research and Development projects are lower priority and do not receive adequate source s (e.g., actuarial staff, IT)
 - Data development requires significant time from actuarial and other areas (e.g., IT), posing a challenge
- **Model complexity presents challenges**
 - Running large seriatim files under various economic scenarios is time consuming
 - Policyholder behavior assumptions and modeling require model complexity, yet standard actuarial modeling packages can have various limitations

Best Practices

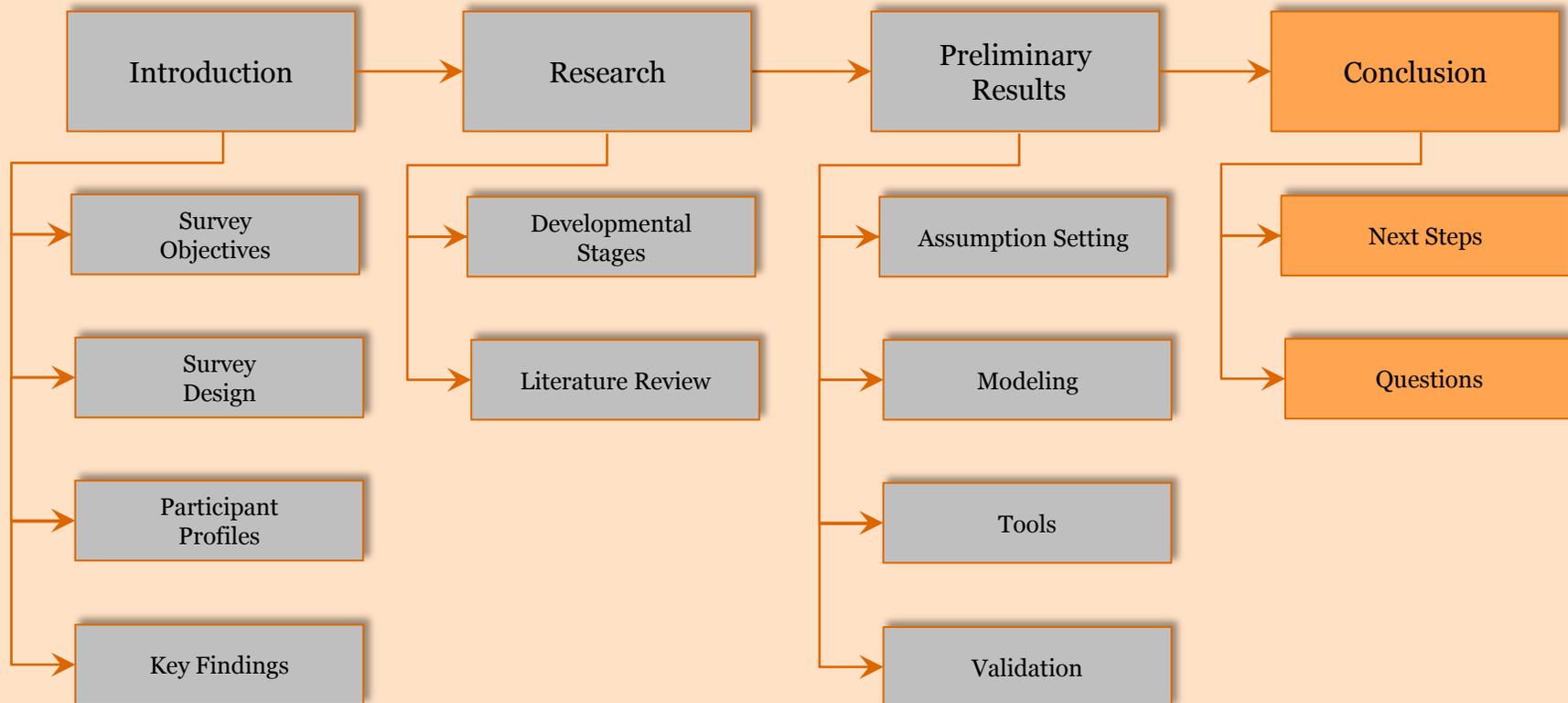
- **Data collection and sourcing**
 - Consideration of experience on inforce blocks with similar characteristics
 - Consideration of external data sources including industry data, reinsurer data as well as public sources of data
 - Consideration of potential results under extreme/tail scenarios
 - Use of predictive modeling and other statistical analysis techniques to identify the strongest influences on policyholder behavior
- **Centralization of data sources**
 - Investment in creating a centralized source of policyholder data including valuation, administration, underwriting, sales, and other data sources
- **Modeling**
 - Balancing the value versus added complexity of modeling various assumptions (static vs dynamic)
- **Validation**
 - Establishing a formal validation process that includes both high level and more detailed analysis of model results
 - “Model Sheriff” concept
- **Governance**
 - Formal process for data updates, review of assumptions in light of recent experience, and agreement regarding changes.
 - Cross functional discussions and agreement regarding appropriateness of inconsistencies

Best Practices

The most advanced companies have:

- Created a centralized data source for propriety in-house sources
- Begun to collect data from customer service and other web-based sources of customer interaction data (historical and real time)
- Established a cross functional data analytics area (not just across actuarial functions but across organizational functions)
- Begun to establish a basis for employing behavioral economics and advanced statistical techniques to better understand policyholder and potential buyer behavior for a variety of purposes including marketing, underwriting, actuarial and customer service

Conclusion



Next Steps

- A report will be posted on the Society Of Actuaries Website some time in December.
- A 90 minute Webinar sponsored by the Society of Actuaries will be held on December 17, 2013.
- Participants will receive individualized reports as well as the full report to be posted on the SOA website.

Questions?