



## Session 82 PD, Behavioral Analytics for Annuities

### **Moderator:**

Timothy S. Paris, FSA, MAAA

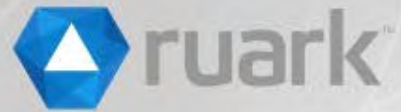
### **Presenters:**

Kendrick D. Lombardo, FSA, MAAA

Timothy S. Paris, FSA, MAAA

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# Behavioral Analytics for Annuities

2017 SOA Life and Annuity Symposium

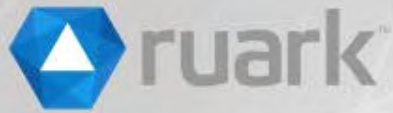
May 9, 2017

Session 82, 3:00-4:15pm

Timothy Paris, FSA, MAAA

Ruark Consulting LLC

# Overview of VA Industry Experience



## VA Participating Companies

AIG

Allianz

AXA

Commonwealth

Forethought

Genworth

Guardian

John Hancock

MassMutual

Met Life

Nationwide

New York Life

Ohio National

Pacific Life

Penn Mutual

Protective

Prudential

Security Benefit

Voya

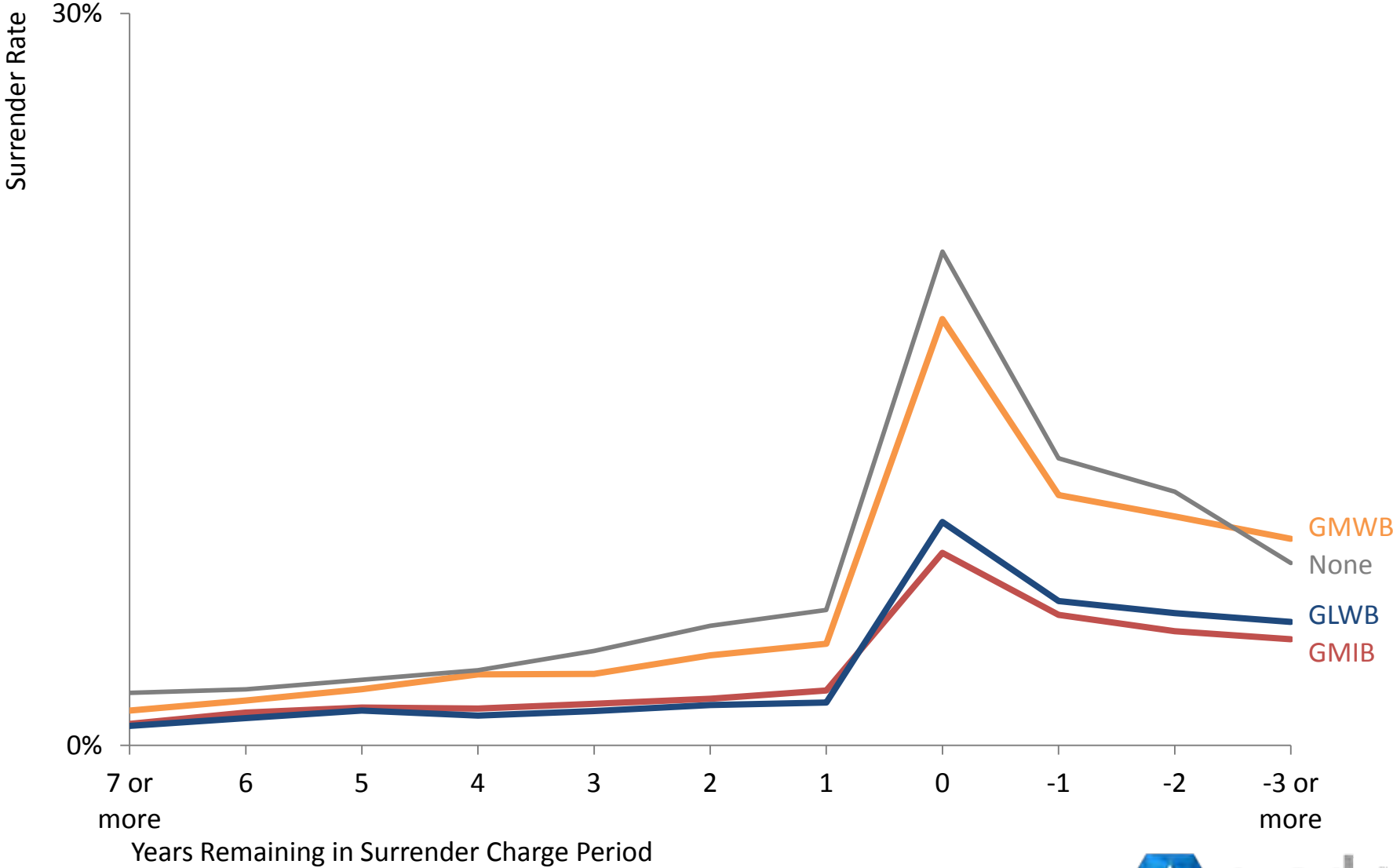


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## VA Industry Data

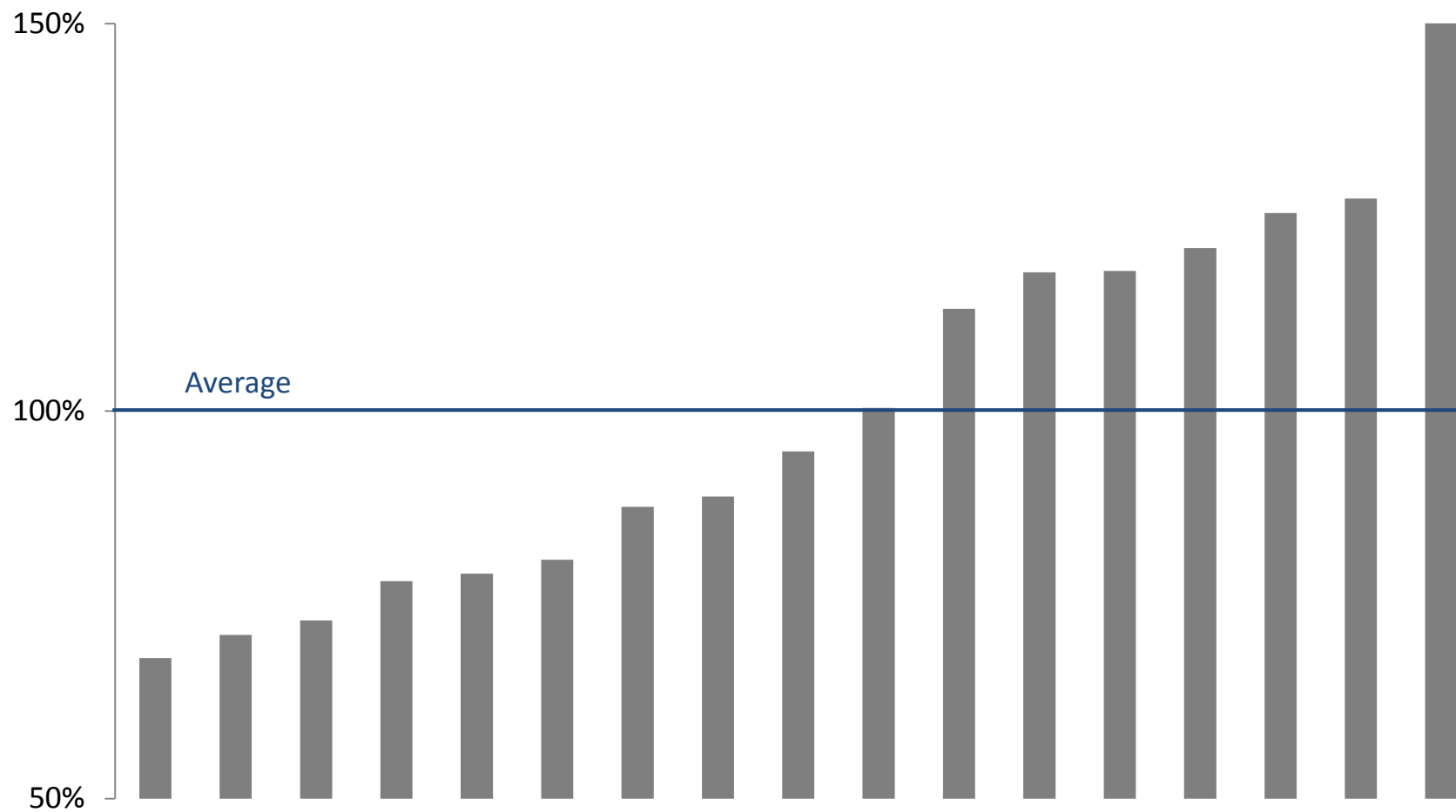
- 2008 to present
- 60 million contract years of exposure
- 3 million surrenders
- 6 million contract years with partial withdrawals
- 33,000 GMIB annuitizations
- 585,000 deaths

# Surrenders vary by living benefit type

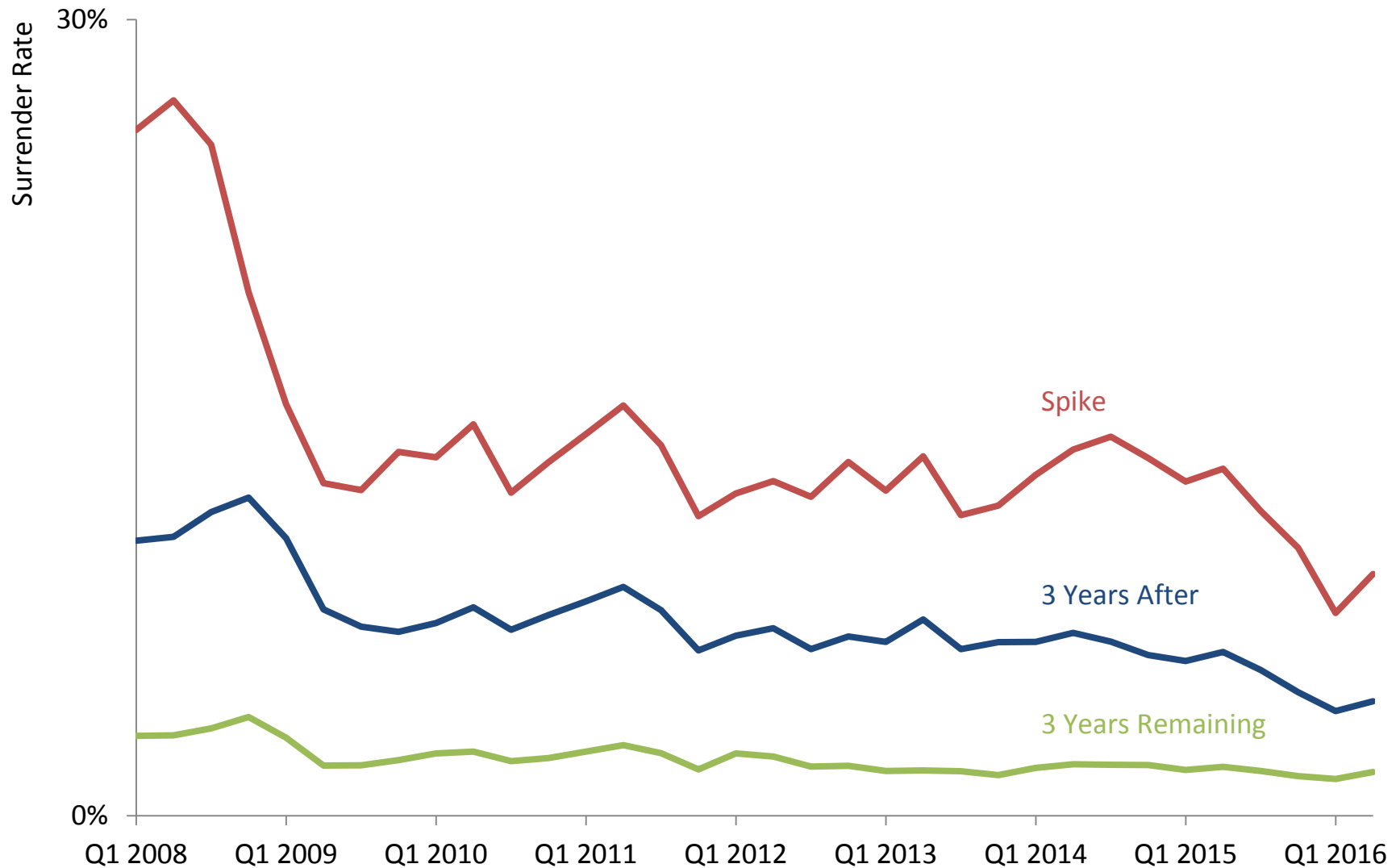


# Experience varies by company, but why?

GLWB, Normalized by Years Remaining in Surrender Charge Period

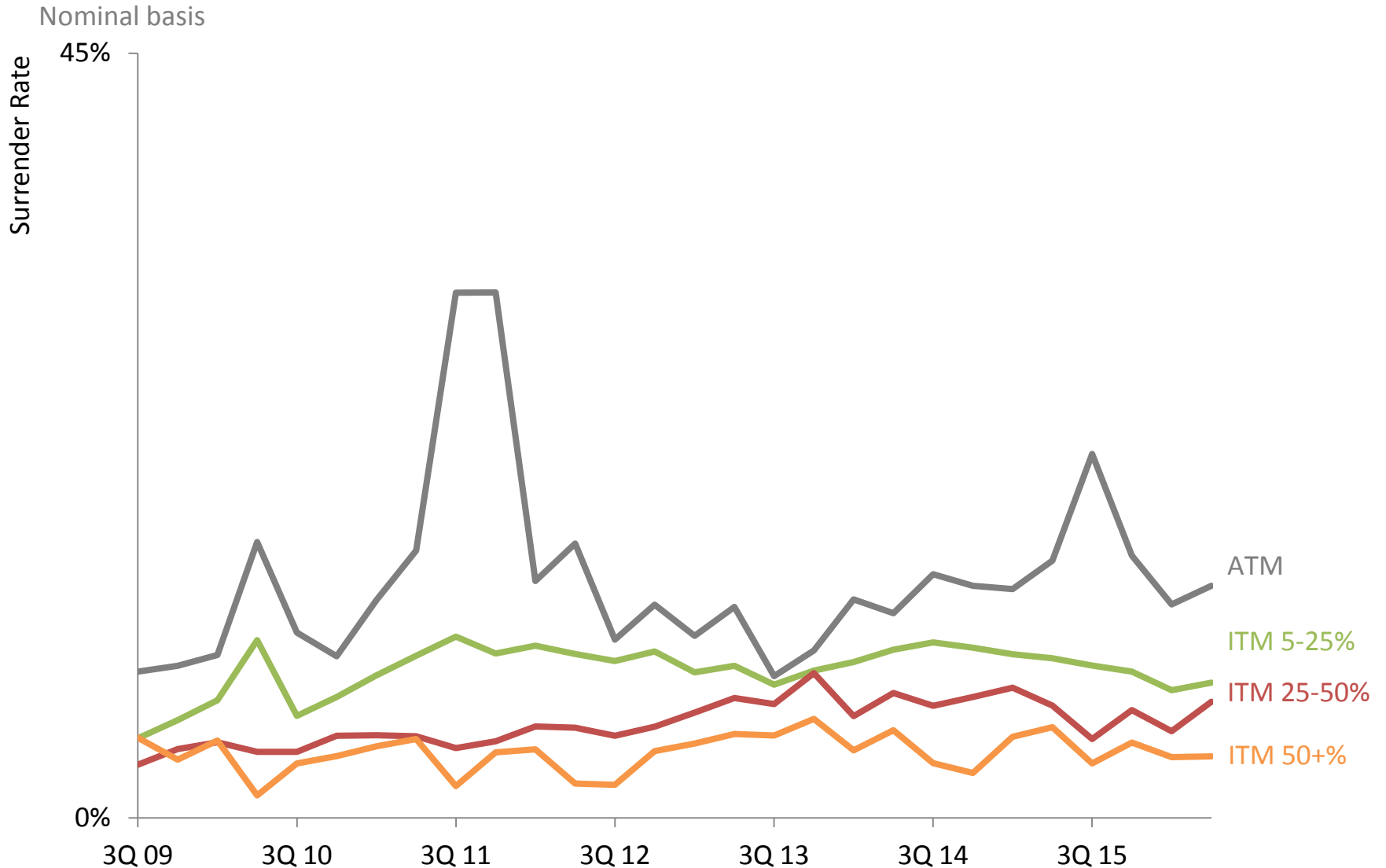


# Surrenders have decreased since the crisis

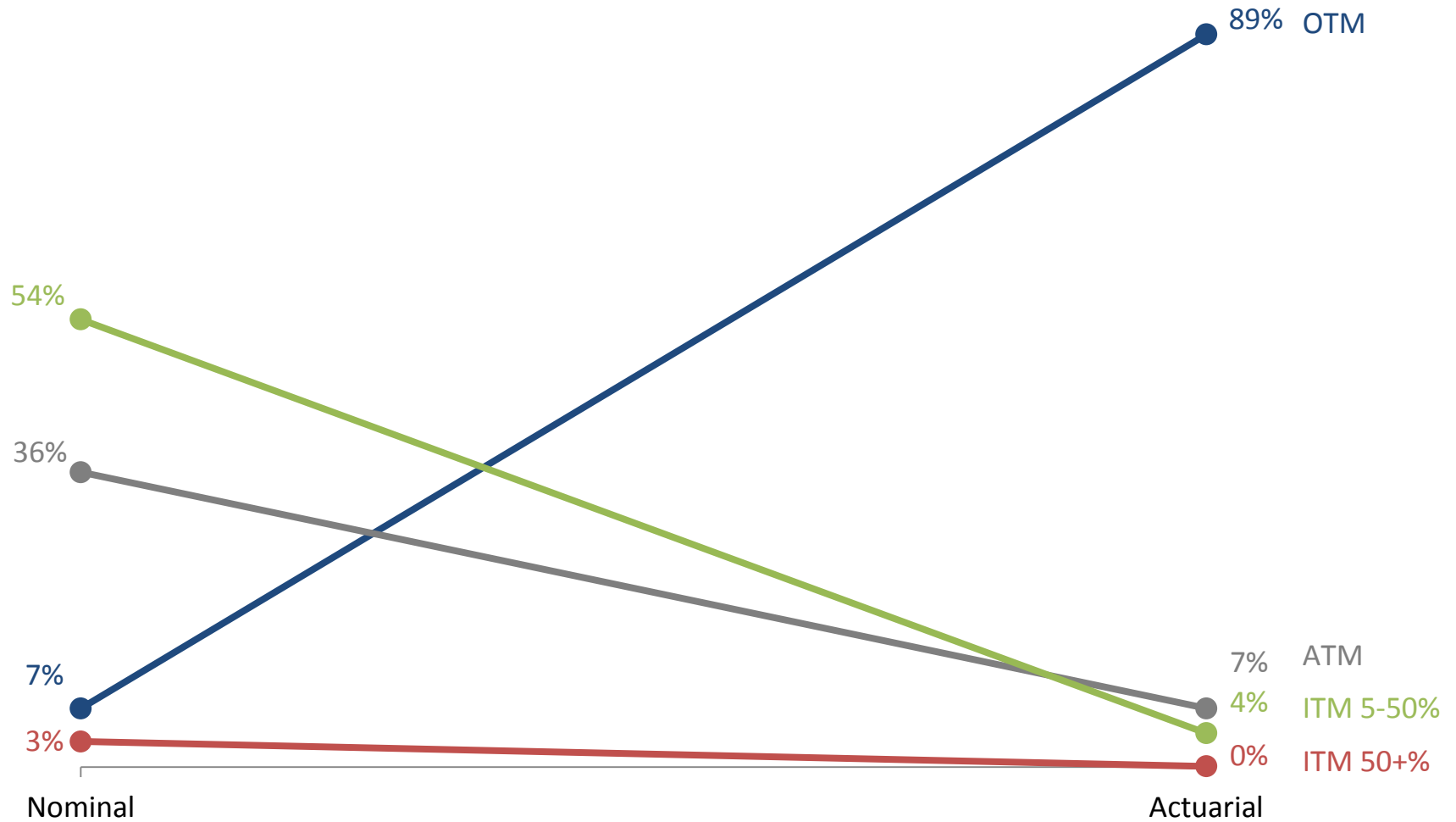




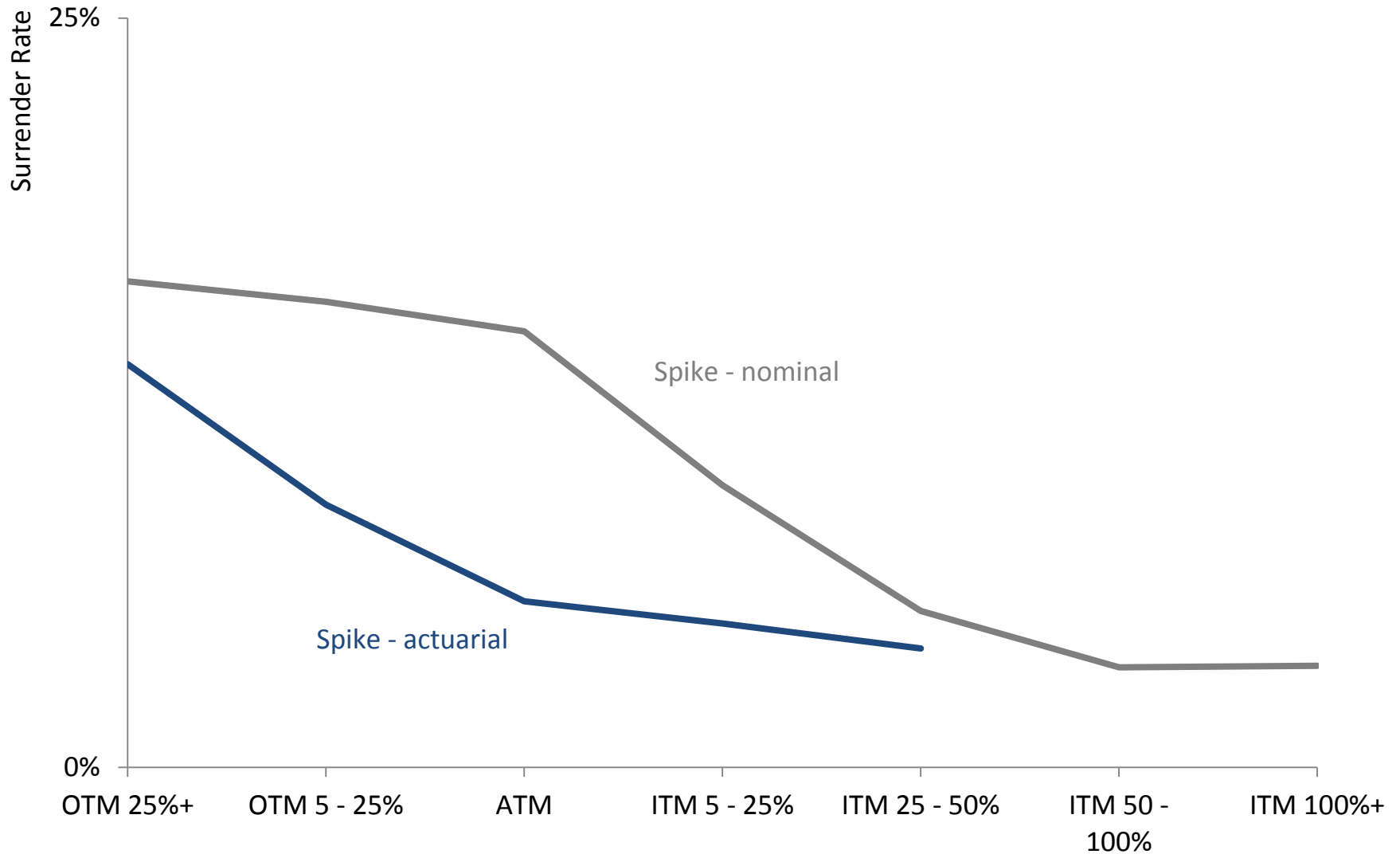
# However, a different trend for GLWB “spike”



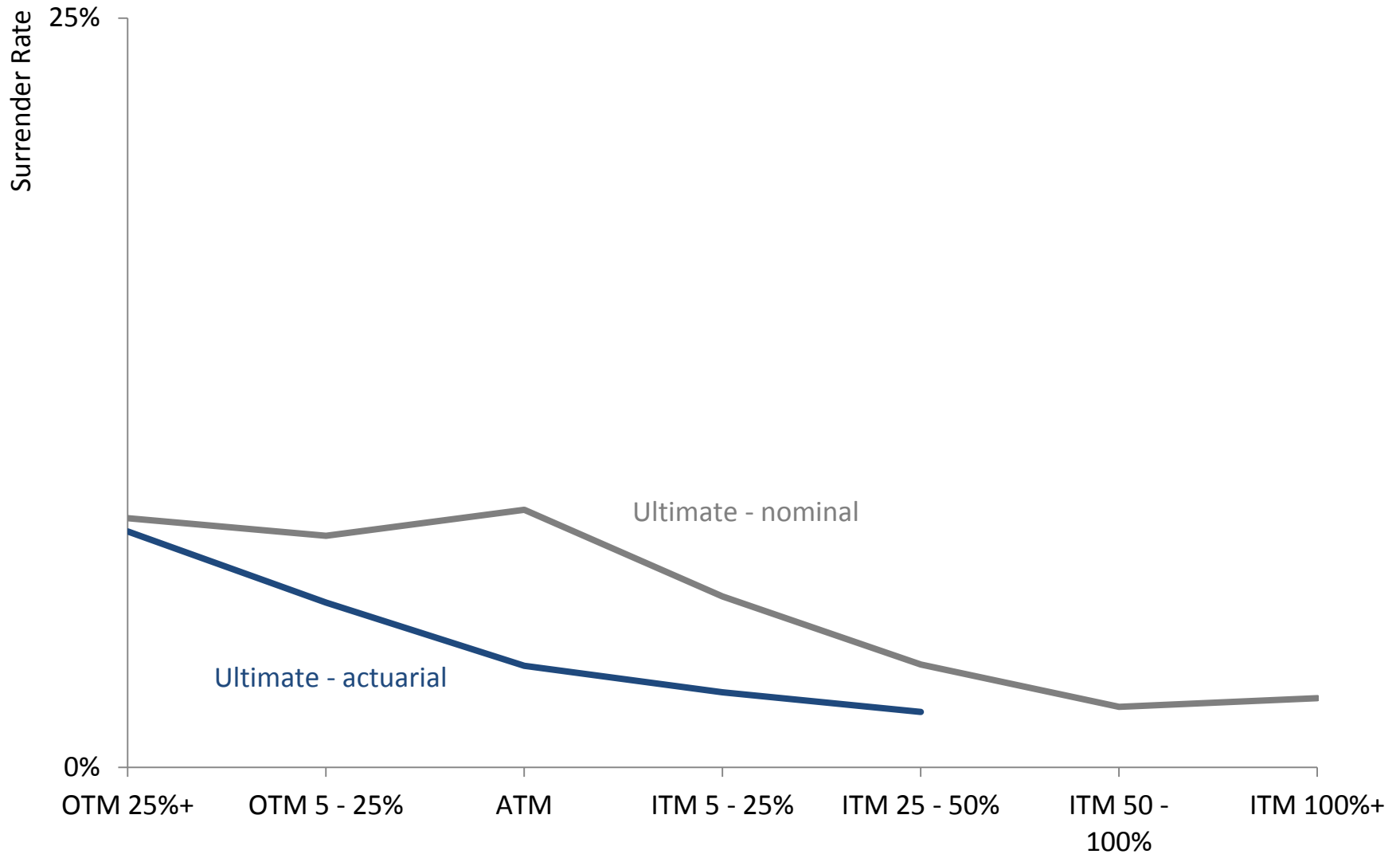
# Most GLWBs are actuarially out-of-the-money



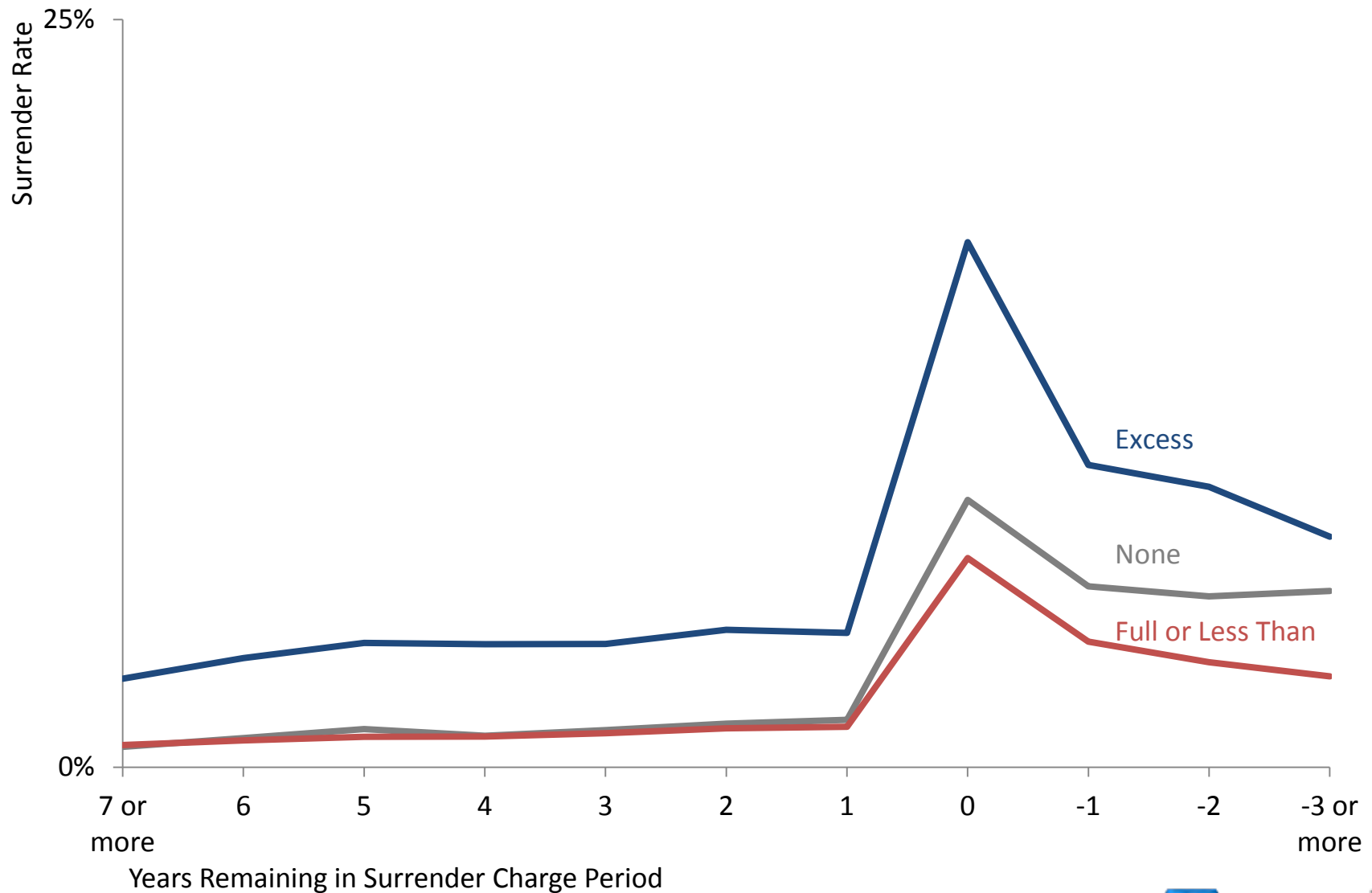
# GLWB moneyness basis matters



# GLWB moneyness basis matters

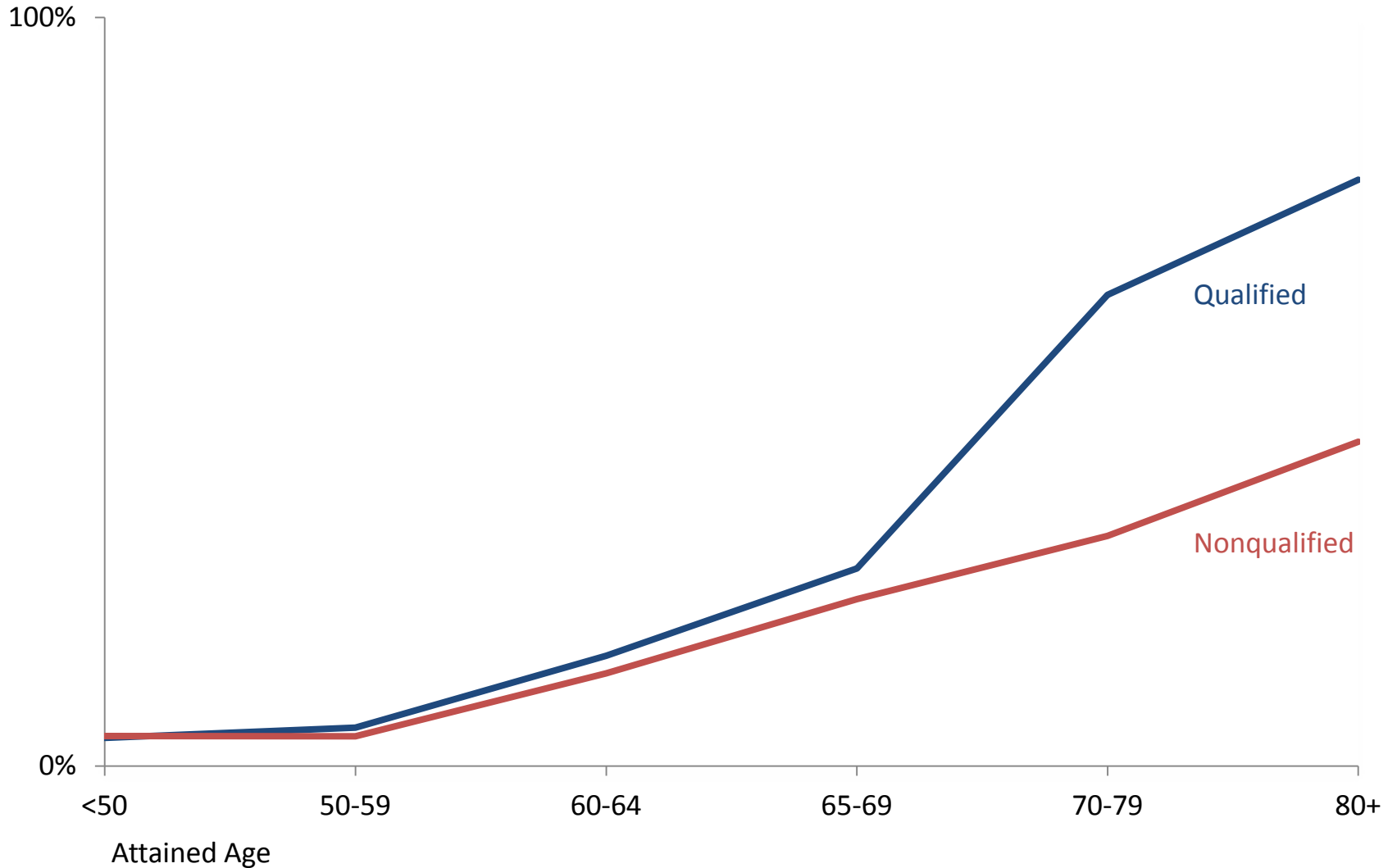


# GLWB income utilization affects surrenders



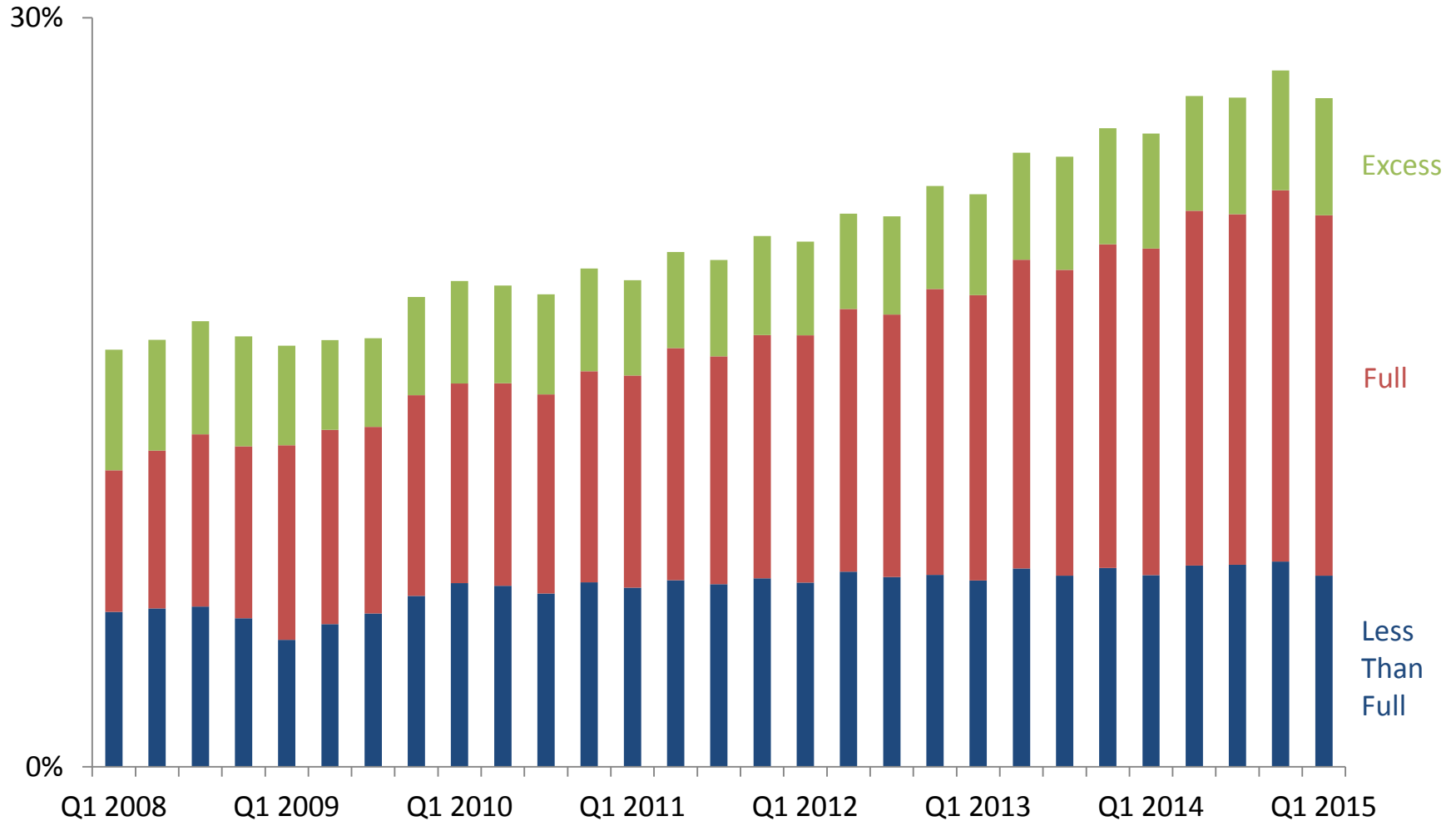
# Income utilization varies by age and tax status

GLWB Partial Withdrawal Frequency



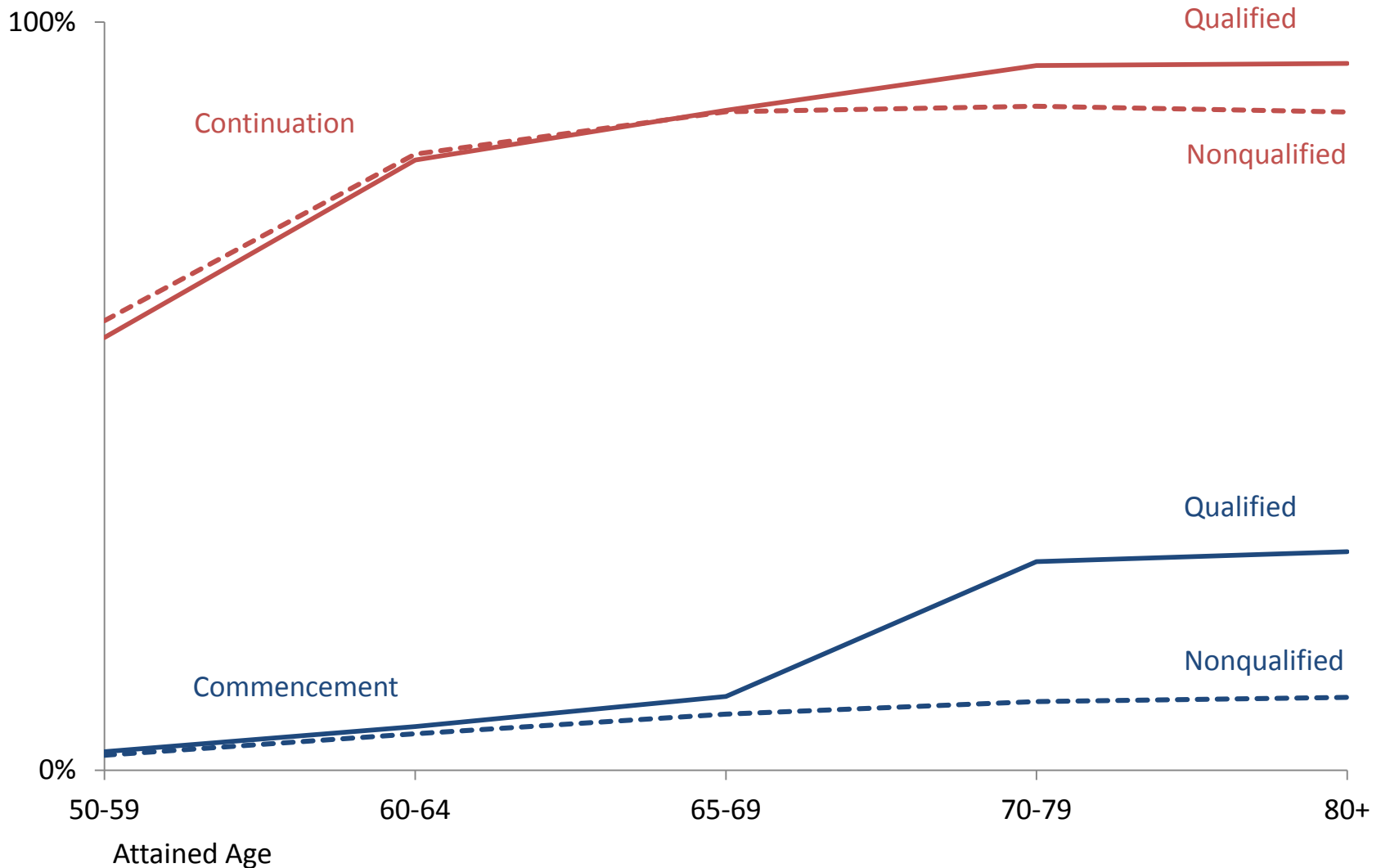
# Income utilization efficiency has increased

GLWB Partial Withdrawal Frequency and Amounts



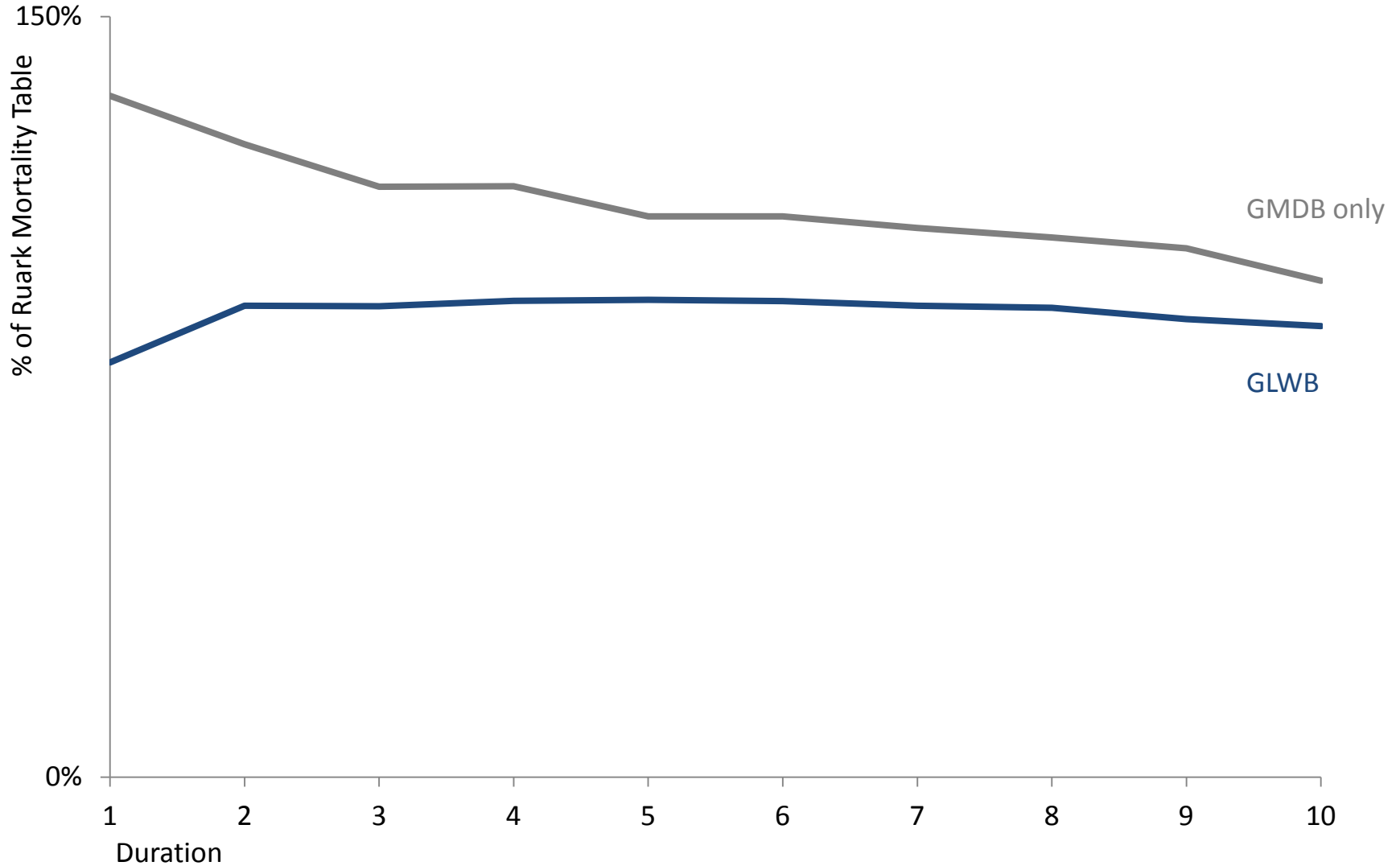
# Income commencement is the key question

GLWB Partial Withdrawal Frequency

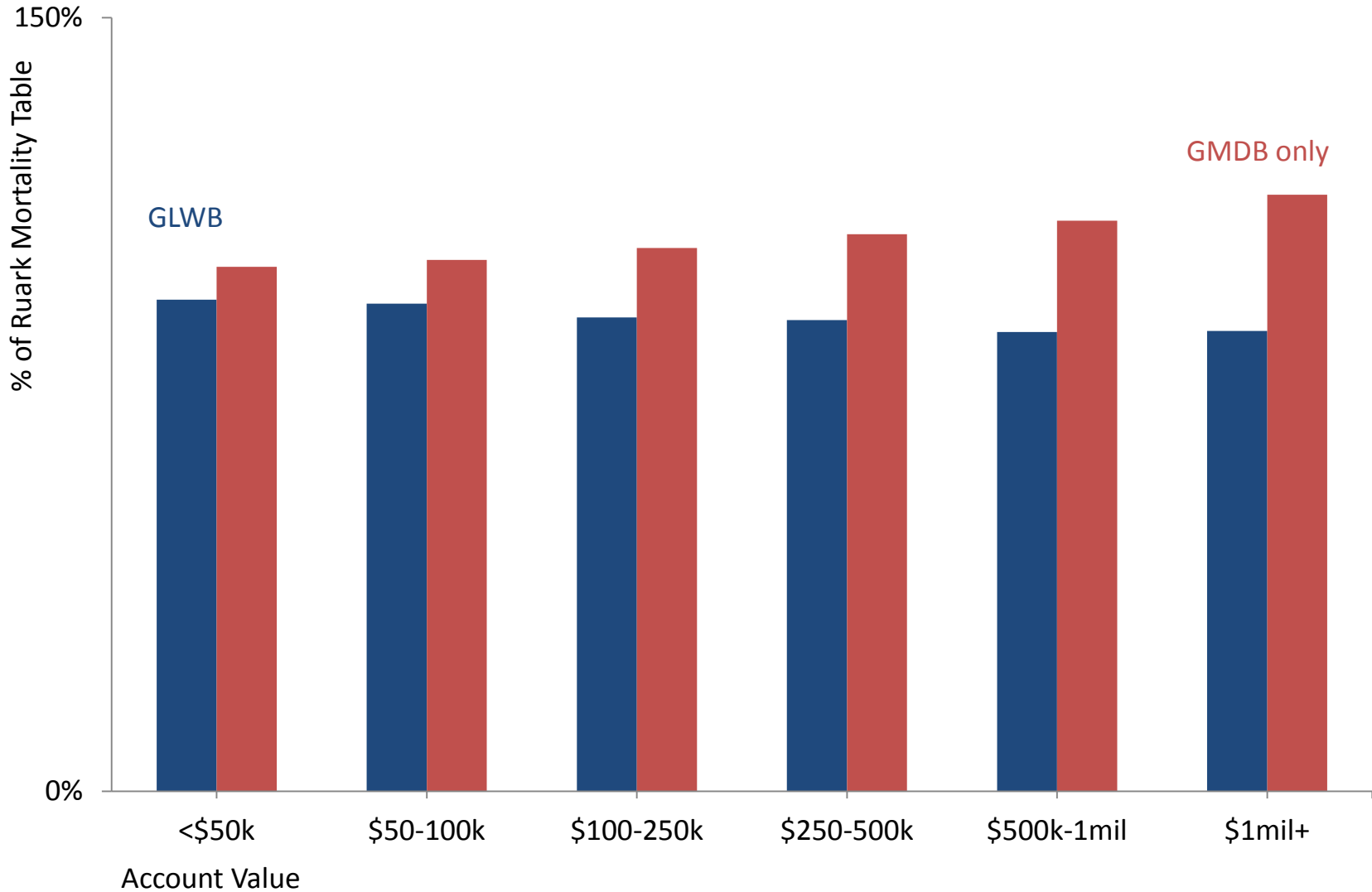




# Guarantees affect mortality too



# Mortality effects are amplified by policy size



# Overview of FIA Industry Experience

AIG

American Equity

Athene

EquiTrust

Forethought

Genworth

Midland National

Nationwide

Pacific Life

Phoenix

Protective

Security Benefit

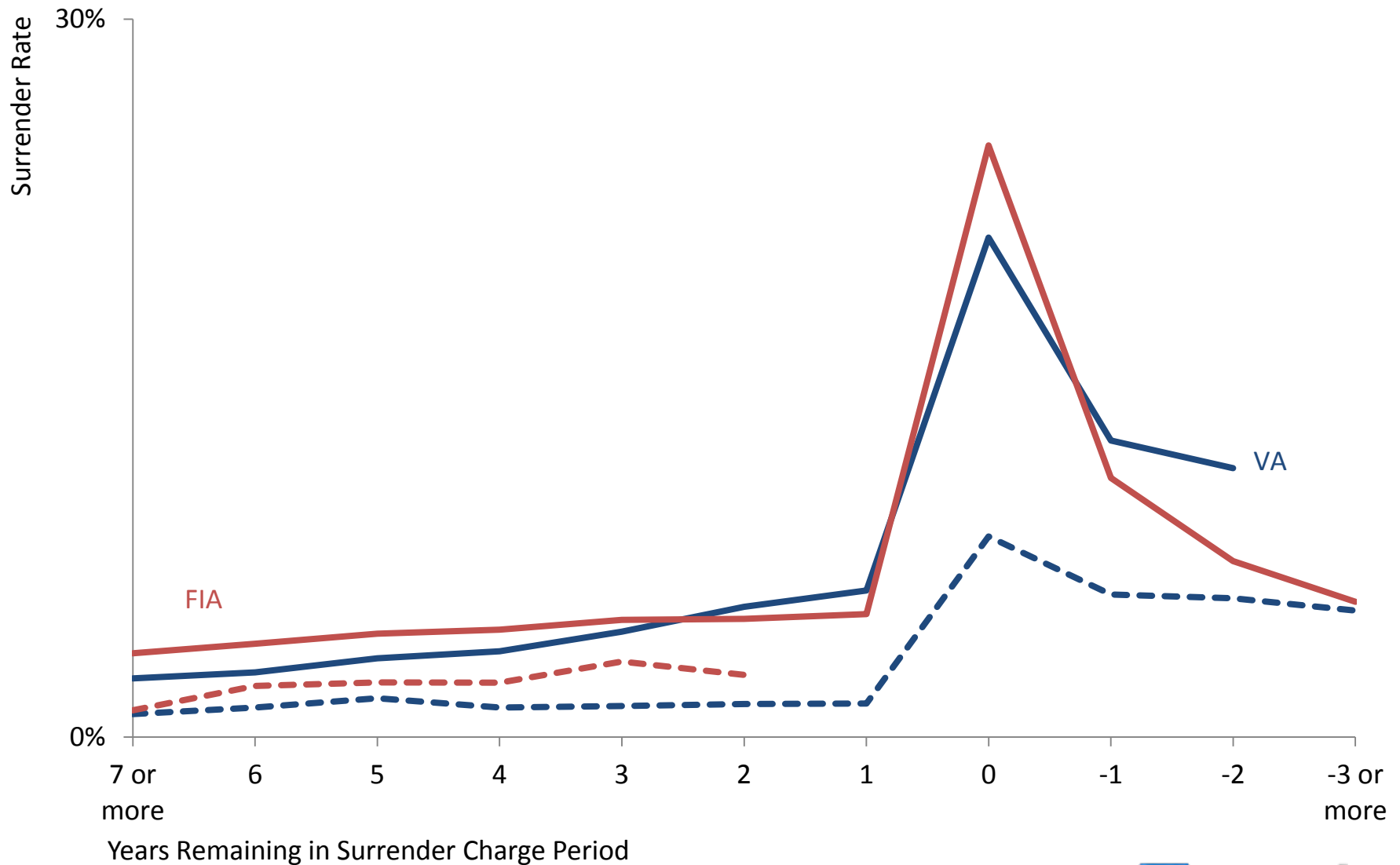


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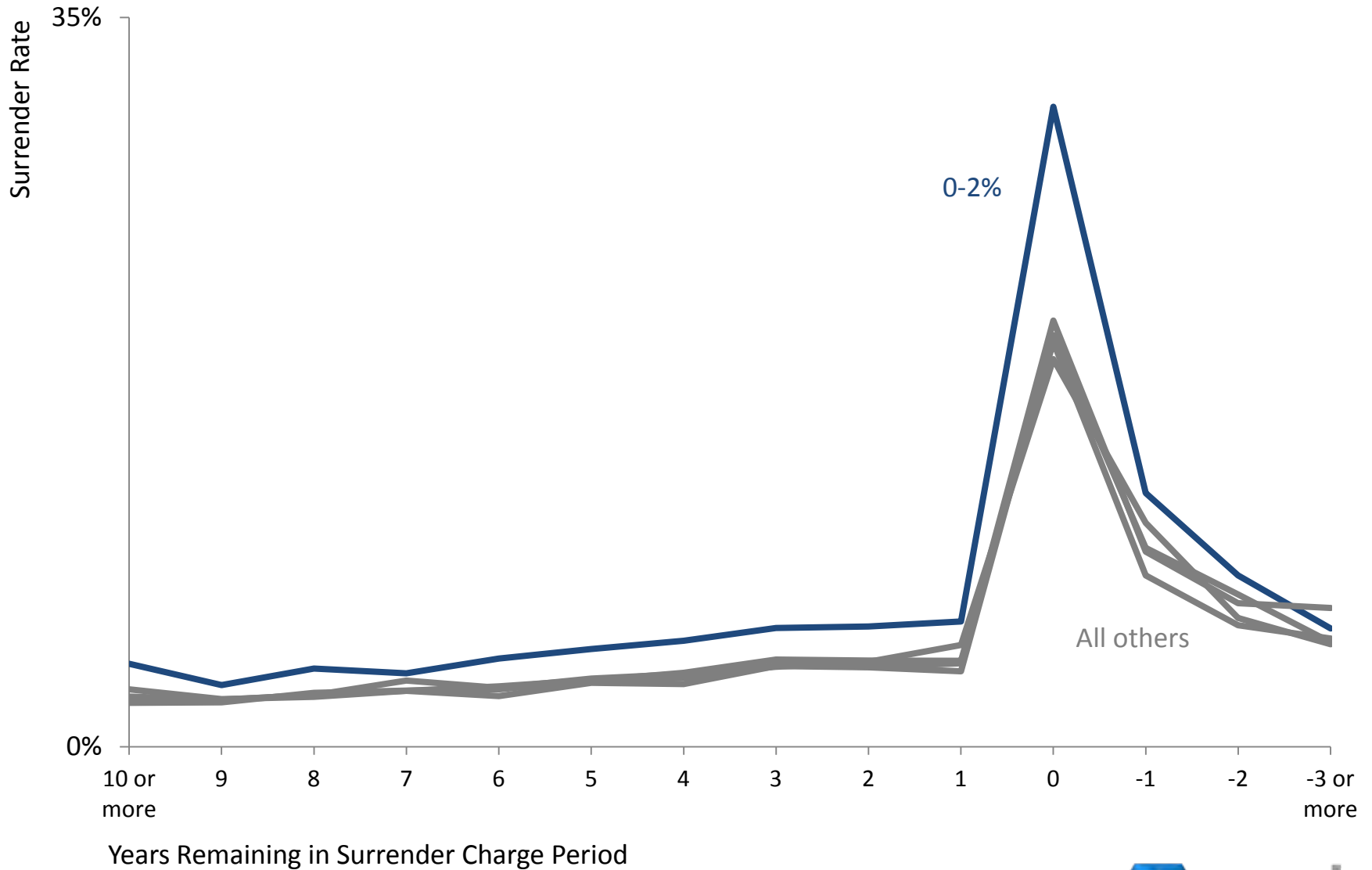
## FIA Industry Data

- 2007 to present
- 10 million contract years of exposure
- 350,000 surrenders
- 2.6 million contract years with partial withdrawals
- 165,000 deaths

# VA and FIA surrenders are lower with GLWB



# FIA surrenders vary based on interest credited



# Behavioral Analytics Framework





Industry  
Data

Traditional Analysis

Statistical  
Techniques

Expert  
Judgment

- Start with maximum data set (industry)
- Extract relevant subset for a company
- Develop a model on this basis
- Do likewise using only company's data
- Customize model to reflect both, so that most important factors are included, with stable coefficients, balancing goodness-of-fit and predictive power
- You can go far with Generalized Linear Models (GLM)

# Bayesian Information Criterion

- Rewards goodness-of-fit to historical data, but penalizes for additional factors used in your model
- One of many metrics to help guide your model selection process

- “Predictive Power” in the new vernacular
- Develop E using train data, compare to A from test data
- Out-of-sample, out-of-time, and k-fold cross-validations
- Examine in aggregate, by cohorts, and over time
- Look at range of outcomes and tails

# Expert Judgment is Vital

- Business context, sensibility, materiality, parsimony
- Let the data speak
- More data usually beats more complex models
- Build simple models for complex data, and complex models for simple data

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