



# 2021 UCLA Case Competition

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# 01 Data Exploration

# Data Quality

- Issue 1: Policy duplicates.

SPIA00272	AC	2015	11	25	1943
SPIA00272	AC	2015	11	25	1943

- Adjustment: removed the duplicates.

- Issue 2: Birth year being later than issue year.

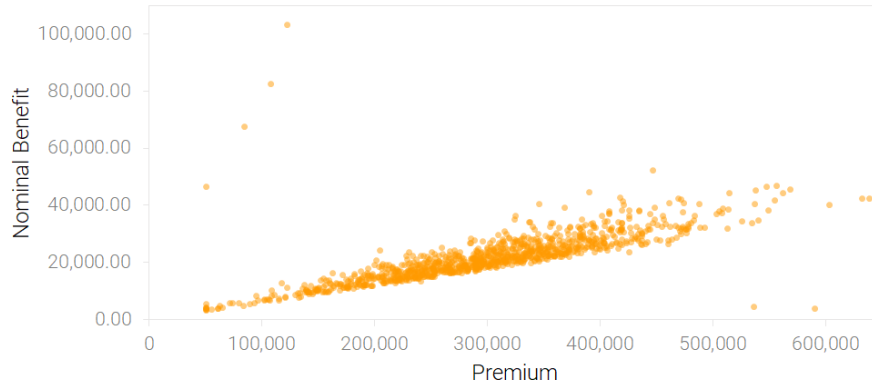
Iss_Yr	Iss_Mo	Iss_Day	Birth_Yr	Birth_Mo	Birth_Day	Sex	Iss_Age	Att_Age
2016	1	26	2055	11	22	F	60	65
2016	6	7	2055	2	20	M	61	65

- Adjustment: recalculated the birth year according to the given attained age.

# Data Quality (Cont.)

- Issue 3: Inconsistencies with benefit amounts and single premium.
  - Adjustment: removed the outliers.

## Nominal Benefit vs Premium



<i>Regression Statistics</i>	
Multiple R	0.746
R Square	0.557
Adjusted R Square	0.556
Standard Error	5633.645
Observations	1000.000

Before adjustment

<i>Regression Statistics</i>	
Multiple R	0.917
R Square	0.841
Adjusted R Square	0.841
Standard Error	3024.334
Observations	993.000

After adjustment

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## 02 Sensitivity Analysis

# Sensitivity Expectations



## Sensitivity Factors

- Two factors: mortality rate and interest rate
- Decreasing mortality (increasing mortality improvement) = increasing PV
- Increasing interest rate = decreasing PV

## Time Expectation

- Sensitivity increases with later projection dates
- More time for money to accumulate, greater mortality improvement

## Assumptions About Mortality

- Lee-Carter model for non-constant mortality improvement is unnecessary

# Sensitivity Results

PV of total benefits

Scenario	Best Est	Mort Shock	MI Shock	Rates Up	Rates Down	Rates 0%
Proj Year						
2020	332m	343m	334m	299m	372m	399m
2030	159m	168m	160m	133m	189m	212m
2040	51m	57m	52m	40m	65m	76m
2050	7.4m	9.2m	7.7m	5.4m	10.3m	12.6m
2060	251k	404k	263k	166k	380k	488k
2070	1.5k	4.0k	1.5k	0.9k	2.4k	3.3k

$$\% \Delta PV = \frac{PV^* - PV_{BE}}{PV_{BE}}$$

Mort	MI	RU	RD	0%
0.031	0.005	-0.099	0.119	0.201

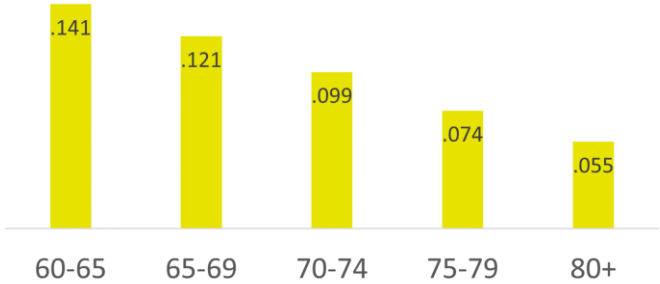


# Sensitivity Results

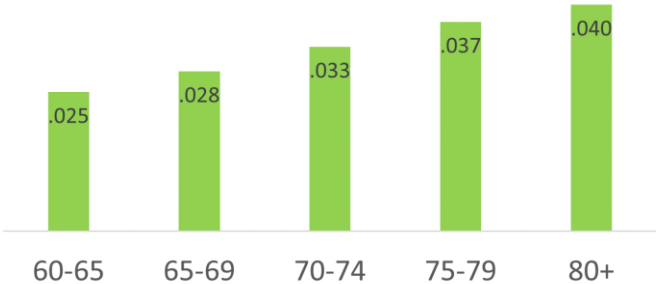


- For a given projection date, older policyholders' benefits are less sensitive to interest rate
- Yet they are more sensitive to mortality rate

Interest Sensitivity



Mortality Sensitivity



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# 03 Asset Portfolio

# Comments on Asset Sensitivities

## Assumptions

- To estimate the sensitivities, we assumed the future cash flows were fixed, and discounted back by the different yield rates to get PV
- Term structure of interest unknown
- 0% interest rate unlikely
- Sensitivities of liabilities should drive assets!

## Credit Rating Factor

- Using data from S&P Global, we ran SLR to model default probability versus year, for each credit rating
- For BBB rated bonds, probability of default increases by 0.31% each year

Default Factor	
AA	.08%
A	0.13%
BBB	0.31%

# 0% Shock Results



<b>Portfolio</b>	<b>Baseline PV</b>	<b>0% PV</b>	<b>0% Rating Adj PV</b>
CURRENT	343m	453m	445m
ALTERNATIVE 1	343m	436m	422m
ALTERNATIVE 2	343m	400m	396m

# Review of Each Portfolio

- CURRENT: Duration of 10.1, high-grade bonds (2% loss)
- ALTERNATIVE 1: Duration of 8.9, medium-grade bonds (3% loss)
- ALTERNATIVE 2: Duration of 7.5, high-grade bonds (1% loss)

SPIA Duration



## Problem

Only fixed-income securities to back SPIA

## Solution

Purchase longevity bonds

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# 04 Enterprise View & Key Risks

# Term Life Insurance



Liquidity Risk:

- Risk of not having sufficient cash to pay out claims

Possible Solution:

- Implement liquidity risk control
- Monitor liquidity risk profile

# Index Universal Life Insurance

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Asset Liability Management Risk:

- Make sure investment income is more than total liabilities

Possible Solution:

- Reinsurance



# Variable Annuity (VA)



Market Risk:

- Equity Market Risk
- Interest Rate Risk

Possible Solution:

- Diversified portfolio (futures, bonds, options)

# Single Premium Immediate Annuity (SPIA)



Longevity Risk:

- Mortality assumptions are not as expected
- Policyholders live longer than expected

Possible Solution:

- Design products with age restrictions on both receiving guaranteed benefits and on income commencement
- Risk pooling and product diversification

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**Thank You for Listening !**