



WPI

John Hancock

Indexed Universal Life

Hairan Li, Andrew St. Jean, Sergey Tsitlenko

Worcester Polytechnic Institute

Advisor: Jon Abraham

Sponsor: John Hancock

Background

- ▶ John Hancock Financial
- ▶ Manulife acquisition in 2004
- ▶ Products
 - 401(k), Mutual Funds, Annuities, College savings, Long Term Care, Life Insurance



Indexed Universal Life

- ▶ Offered by John Hancock since 2011
- ▶ Credits interest based on stock market performance
 - Offers protection from market downturns
- ▶ Flexible premiums



Project Goal



- ▶ John Hancock wants to accurately illustrate the policy to potential customers
 - The illustrated rate of return should not be too high or too low
- ▶ Our goal is to determine a rate of return that would accurately illustrate the product to a potential customer

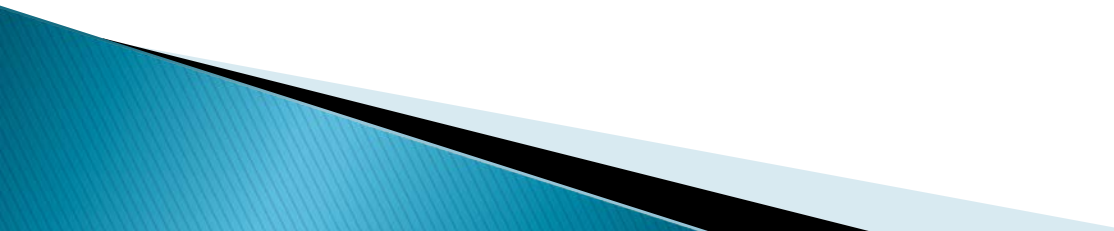
Random Walk Simulation

Historical S&P500 Data

	Mean monthly return	Standard Deviation
Poor (2000 - 2009)	-0.11%	4.62%
Average (1961 - 2010)	0.60%	4.34%
Great (1990 - 1999)	1.28%	3.83%

Year	Age	Time	Month	Monthly Return	Annual Return	Annual Return (Adjusted)
1	40	1	Jan	4.64%		
1	40	2	Feb	-0.79%		
1	40	3	Mar	-2.76%		
1	40	4	Apr	-1.98%		
1	40	5	May	-6.24%		
1	40	6	Jun	-0.88%		
1	40	7	Jul	2.75%		
1	40	8	Aug	-4.82%		
1	40	9	Sep	-4.35%		
1	40	10	Oct	-3.05%		
1	40	11	Nov	2.74%		
1	40	12	Dec	4.16%		
2	41	13	Jan	1.96%	-10.75%	0.00%
2	41	14	Feb	3.70%	-13.03%	0.00%
2	41	15	Mar	5.53%	-9.10%	0.00%
2	41	16	Apr	-3.24%	-1.35%	0.00%
2	41	17	May	5.46%	-2.62%	0.00%
2	41	18	Jun	-9.87%	9.54%	9.54%
2	41	19	Jul	-1.62%	-0.39%	0.00%
2	41	20	Aug	4.76%	-4.63%	0.00%
2	41	21	Sep	-1.72%	4.97%	4.97%
2	41	22	Oct	1.57%	7.85%	7.85%
2	41	23	Nov	8.96%	12.99%	12.99%
2	41	24	Dec	-1.66%	19.82%	13.00%
3	42	25	Jan	-3.18%	13.13%	13.00%
3	42	26	Feb	4.99%	7.43%	7.43%
3	42	27	Mar	-2.43%	8.77%	8.77%
3	42	28	Apr	-1.38%	0.56%	0.56%
3	42	29	May	-2.68%	2.49%	2.49%
3	42	30	Jun	-1.13%	-5.42%	0.00%
3	42	31	Jul	7.08%	3.76%	3.76%
3	42	32	Aug	11.77%	12.94%	12.94%
3	42	33	Sep	3.06%	20.49%	13.00%
3	42	34	Oct	-2.86%	26.36%	13.00%
3	42	35	Nov	1.41%	28.85%	15.00%
3	42	36	Dec	-2.69%	12.48%	12.48%

Analysis

- ▶ Simulated the policy under different scenarios
 - Monthly Premiums vs. Single Premium
 - Comparing different withdrawal patterns
 - Measuring the effect of the cap/floor
 - ▶ Ran 10,000 simulations for each scenario
 - ▶ Conducted probability analysis on the simulation outcomes
- 

File Home Insert Page Layout Formulas Data Review View Load Test Acrobat Team

PivotTable Table Picture Clip Art Screenshot Illustrations

Column Pie Bar Other Charts Charts

Line Area Scatter Sparklines

Slicer Filter

Hyperlink Links

Text Box Header & Footer Object Text

WordArt Signature Line Object

Equation Symbol

I6 fx

1
2

A B C D E G H I J

Simulate

Mean	Volatility	Iterations	Interval Length	Expected
0.60%	4.34%	500	0.25%	

Issue Month	Initial Death Benefit	Premium Load	Issue Charge	
January	4,000,000.00	5.00%	10.00	

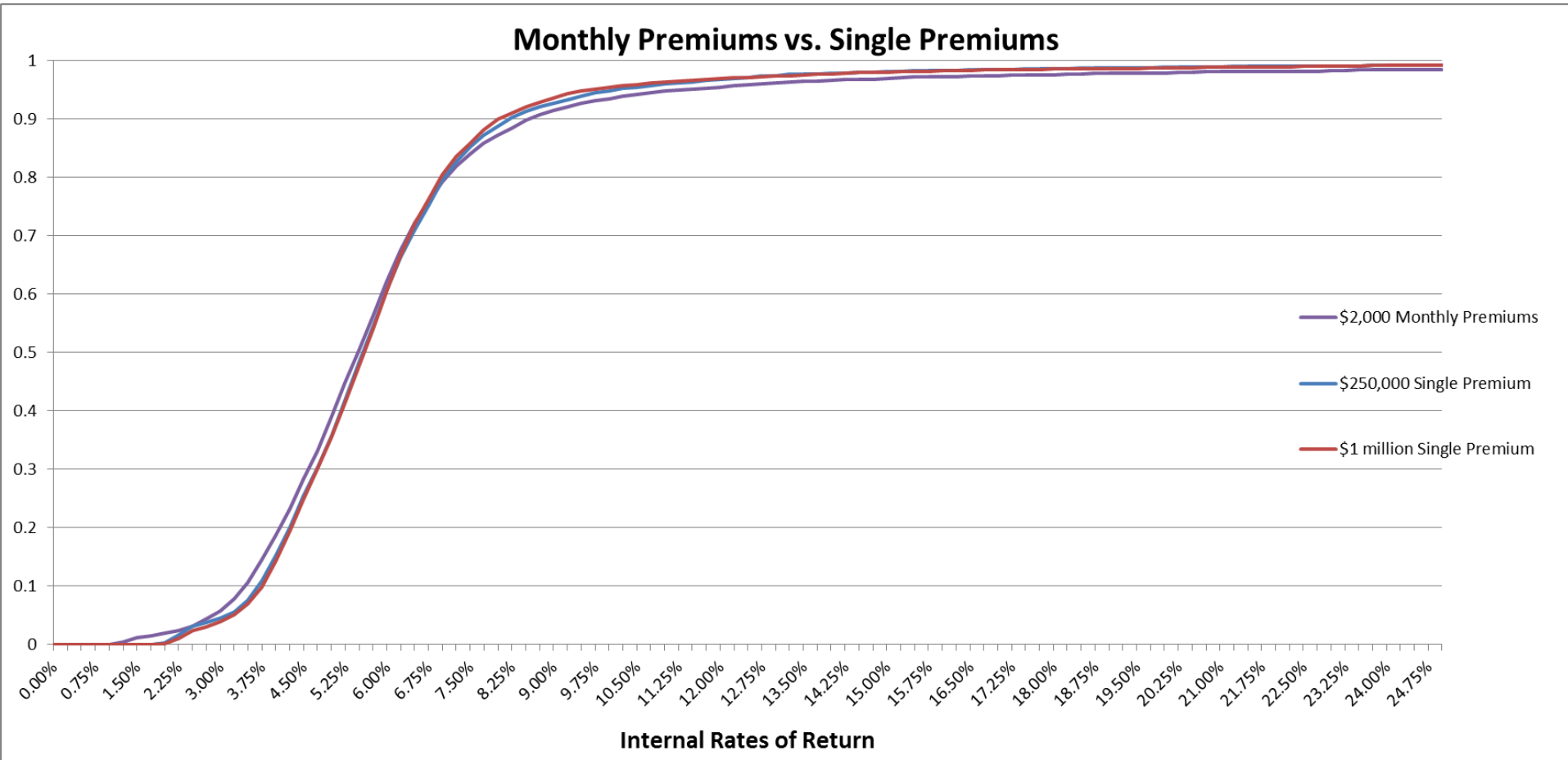
Smoking Preference	Floor	Cap	Mortality Table	
			01 CSO S&U ANB Male NS	

Processing... 38%

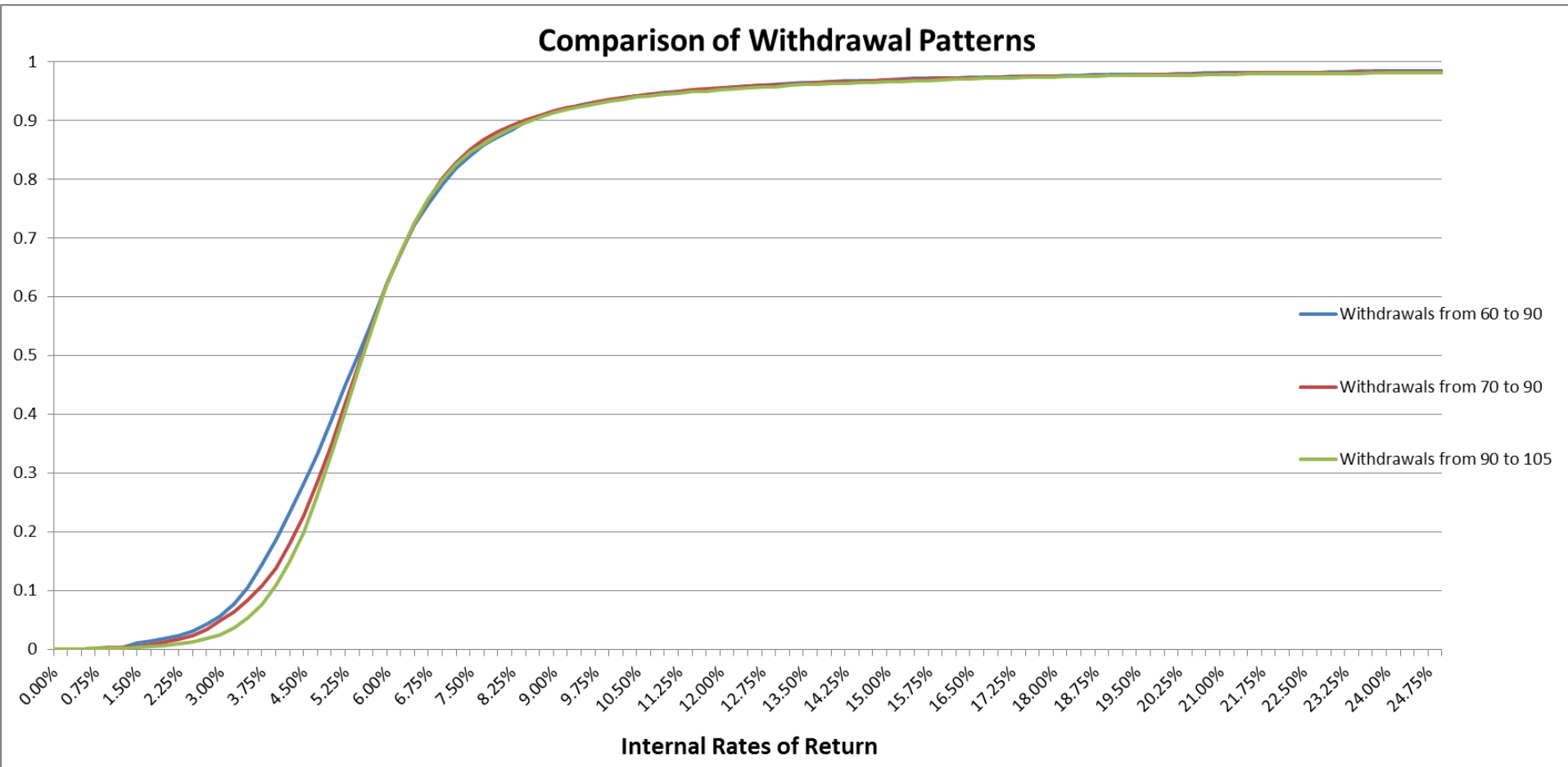
Year Age Time Month

28		1	40	1	Jan						
29		1	40	2	Feb						
30		1	40	3	Mar						
31		1	40	4	Apr						
32		1	40	5	May						
33		1	40	6	Jun						
34		1	40	7	Jul						
35		1	40	8	Aug						
36		1	40	9	Sep						
37		1	40	10	Oct						
38		1	40	11	Nov						
39		1	40	12	Dec						
40		2	41	13	Jan	0.46%		5.00%	47,283.18		
41		2	41	14	Feb	8.39%		5.00%	-		
42		2	41	15	Mar	13.09%		5.00%	-		
43		2	41	16	Apr	15.75%		5.00%	-		
44		2	41	17	May	18.90%		5.00%	-		
45		2	41	18	Jun	28.14%		5.00%	-		

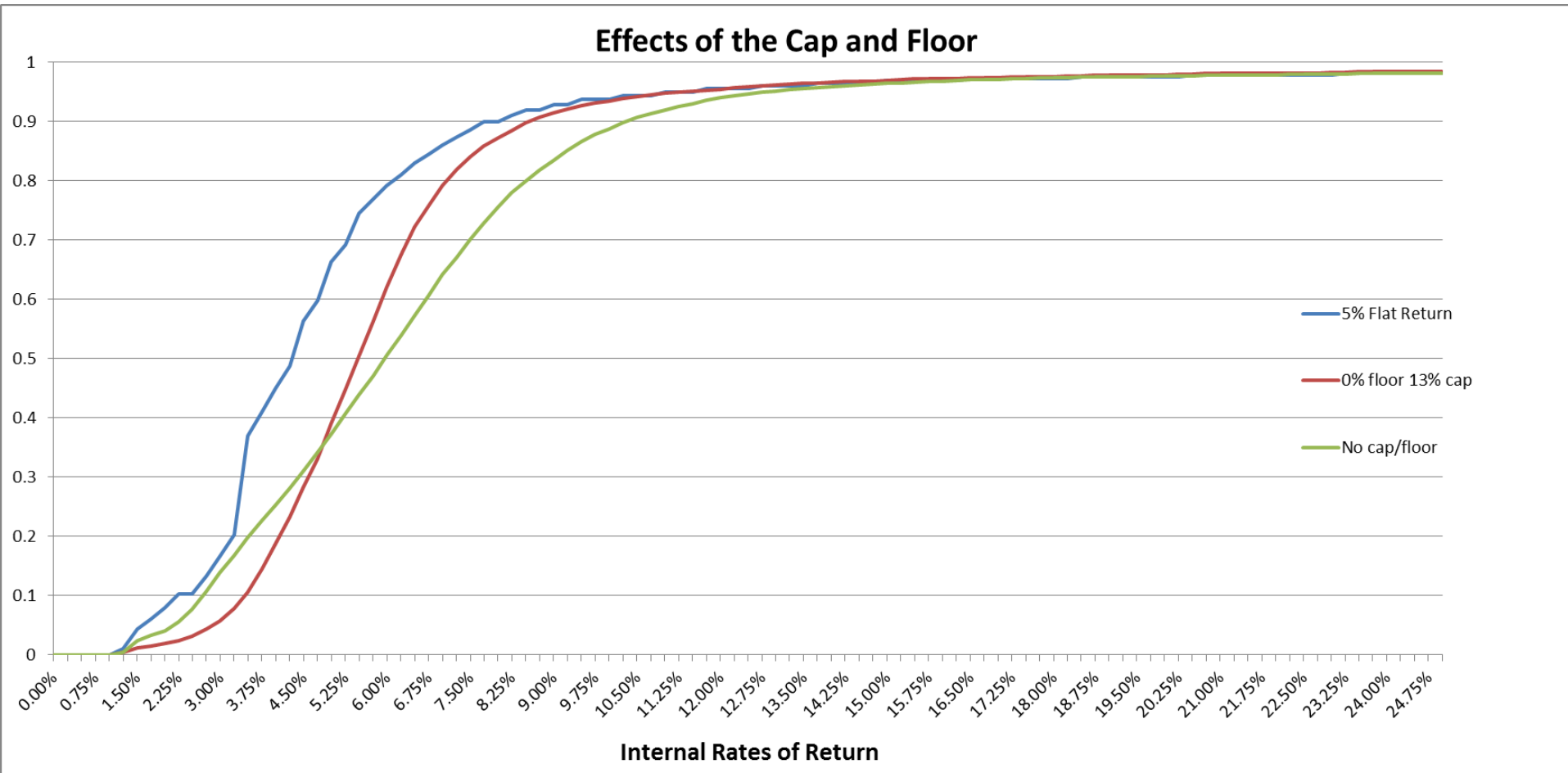
Analysis of Premium Options



Analysis of Withdrawal Patterns

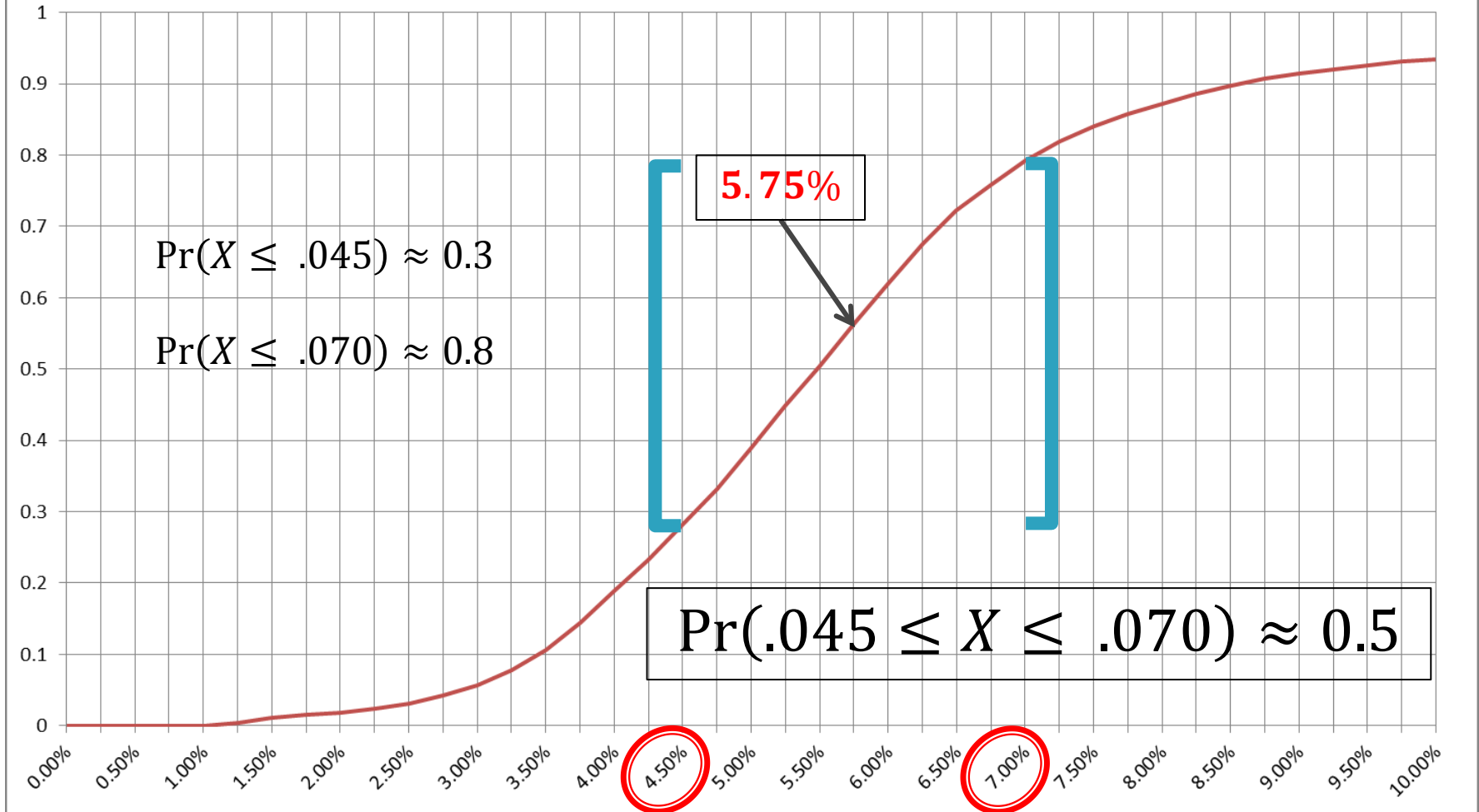


Analysis of Cap/Floor effects



Conclusions and Recommendations

60/30 Withdrawals, 0% floor/13% cap, \$2,000 Monthly Premiums





WPI

John Hancock

Indexed Universal Life

Hairan Li, Andrew St. Jean, Sergey Tsitlenko
Worcester Polytechnic Institute
Advisor: Jon Abraham
Sponsor: John Hancock