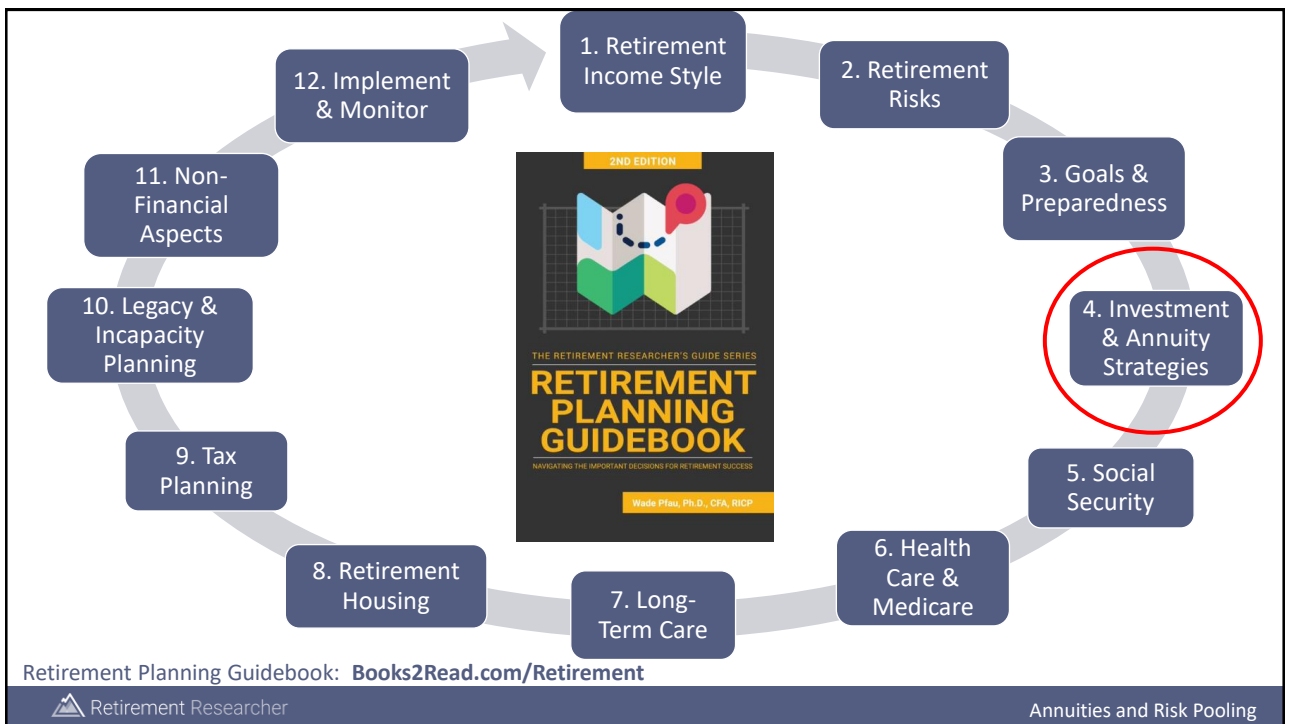


# Workshop Series: Annuities and Risk Pooling

Wade Pfau, PhD, CFA, RICP

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# What We're Going to Cover

- Overview of Annuity Types
- Income Annuities: SPIAs and DIAs
- Variable Annuities
- Fixed Index Annuities
- Registered Index-Linked Annuities
- Annuities as Accumulation Tools
- Fitting Annuities into a Retirement Plan

# Overview of Annuity Types

# Caveat

Assuming “Good” Annuities

i.e., Competitively Priced

# Annuity Vocabulary

Fixed vs. Variable

# Fixed Annuities

Principal protection  
Insurance company general account  
Growth can be variable, but not negative

# Variable Annuities

Subject to losses  
Often, investment-styled subaccounts

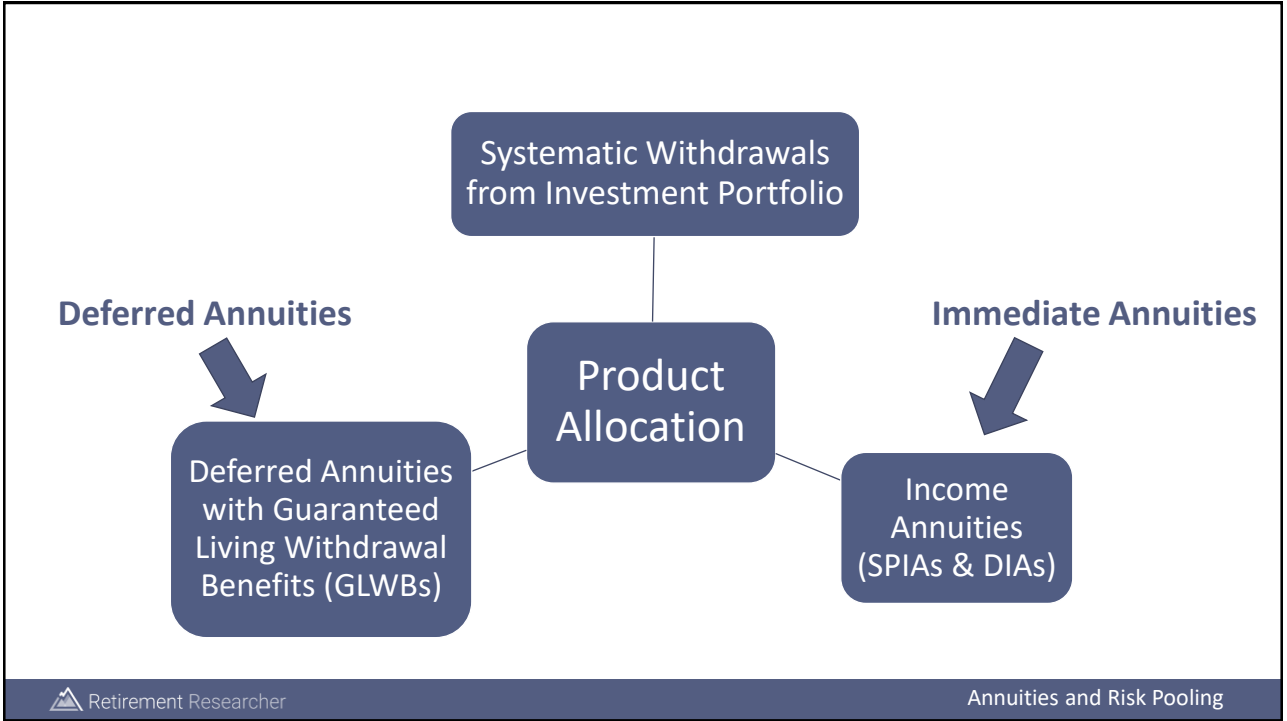
# Annuity Vocabulary

## Immediate vs. Deferred

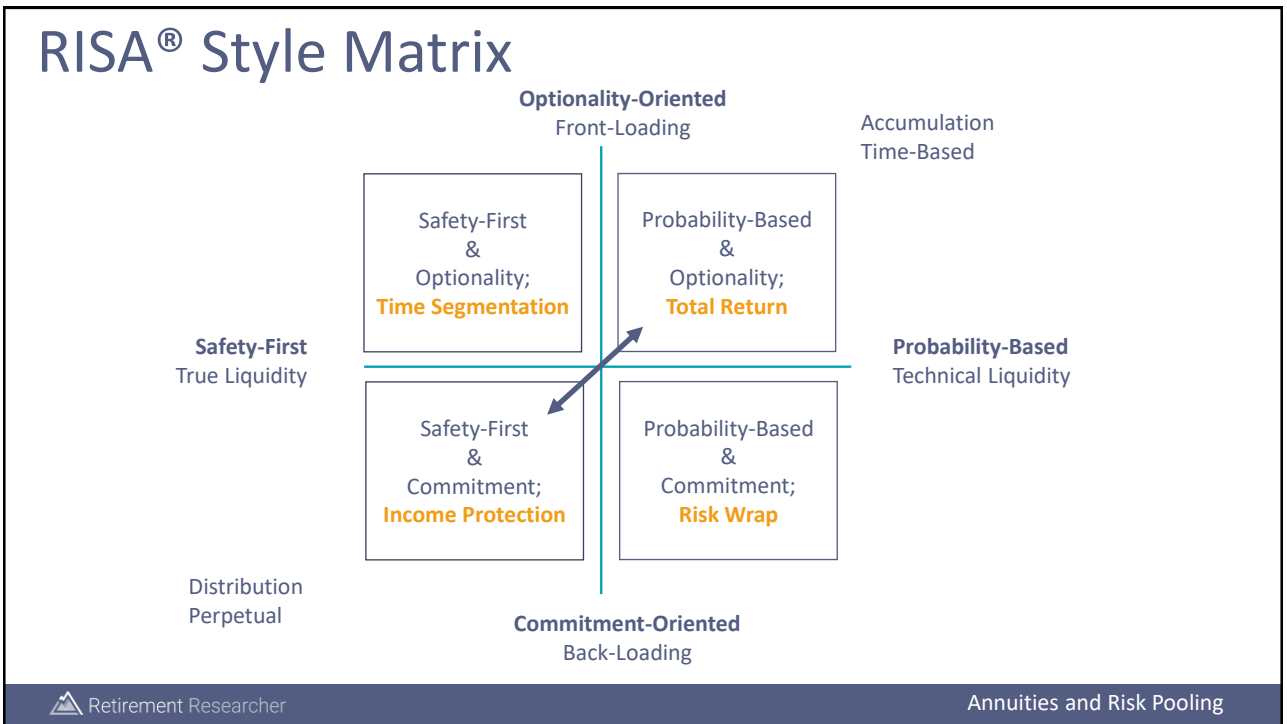
# Immediate vs. Deferred

When is contract annuitized?

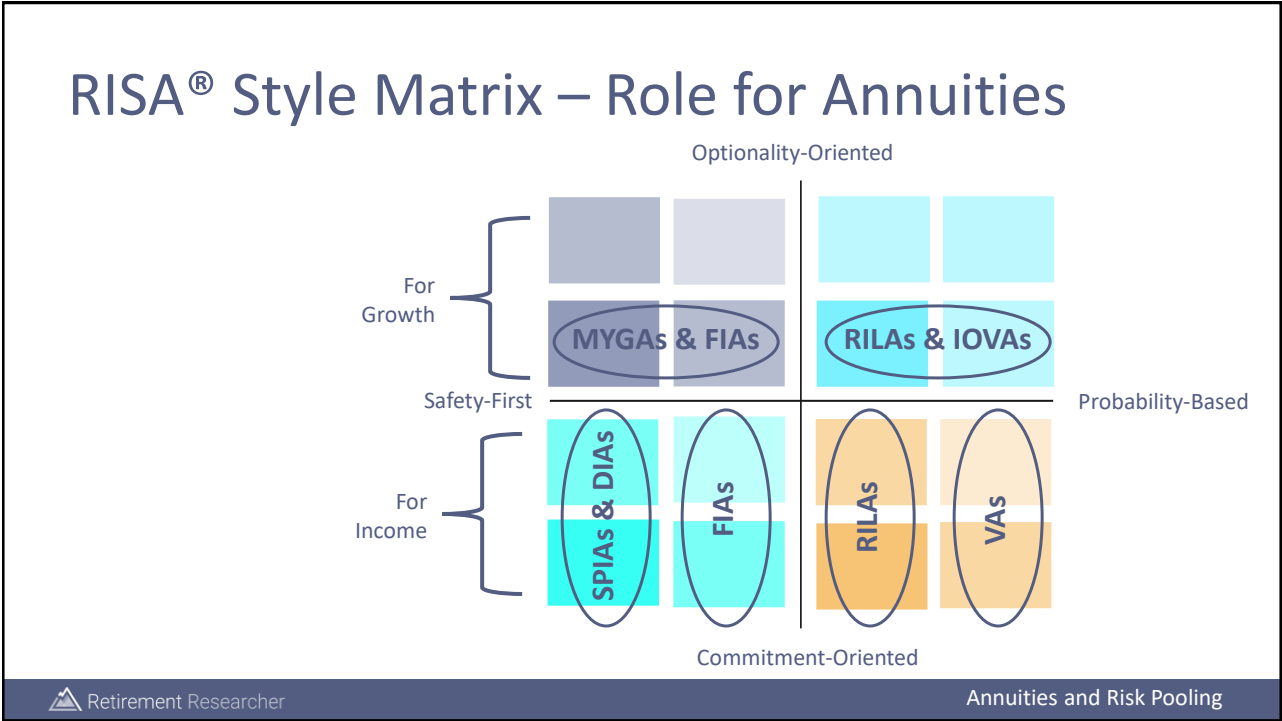
When do lifetime payments begin?



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## Income Annuities (SPIAs and DIAs)

- *Who is covered by an annuity?*  
owner, annuitant, beneficiary
- *When do income payments start?*  
immediate or deferred
- *Do income annuities cover one life or two?*
- *What are the different flavors of payouts?*  
Life only, life with period certain, life with cash refund, life with installment refund, period certain (not linked to mortality)
- *Are payments fixed or do they grow over time?*  
Level payments, cost-of-living adjustments, inflation-indexed (CPI)

## Pricing an Income Annuity

- 1) Mortality rates (which vary by age and gender) impact how long payments will be made.
- 2) Interest rates impact the returns the annuity provider can earn on the underlying annuitized assets.
- 3) Overhead costs relate to extra charges an annuity provider seeks to cover business expenses and to manage risks related to the accuracy of their future mortality and interest rate predictions.



## Pricing an Income Annuity – Life Only for 65-Year Old Female

Discount Rate:		3.00%			
Age	Income	Discount Factor	Discounted Value of Income	Survival Probabilities	Survival-Weighted Discounted Value
65	\$10,000	100.0%	\$10,000	100.0%	\$10,000
66	\$10,000	97.1%	\$9,709	99.4%	\$9,646
67	\$10,000	94.3%	\$9,426	98.7%	\$9,302
68	\$10,000	91.5%	\$9,151	98.0%	\$8,965
69	\$10,000	88.8%	\$8,885	97.2%	\$8,637
70	\$10,000	86.3%	\$8,626	96.4%	\$8,315
71	\$10,000	83.7%	\$8,375	95.5%	\$8,000
72	\$10,000	81.3%	\$8,131	94.6%	\$7,691
...	...	...	...	...	...
95	\$10,000	41.2%	\$4,120	30.2%	\$1,245
96	\$10,000	40.0%	\$4,000	25.7%	\$1,029
97	\$10,000	38.8%	\$3,883	21.5%	\$835
98	\$10,000	37.7%	\$3,770	17.5%	\$660
99	\$10,000	36.6%	\$3,660	14.0%	\$512
100	\$10,000	35.5%	\$3,554	10.8%	\$384
Cost of Bond Ladder (Through Age 100):			\$224,872		
Sustainable Withdrawal Rate:			4.45%		
Cost of Annuity (Survival-Weighted Present Discounted Value of the Income Stream Through 104):					\$172,915
Annuity Payout Rate:					5.78%
*Survival Probabilities are calculated from the Society of Actuaries 2012 Individual Annuitant Mortality Tables with improvements through 2019.					

For illustration purposes only. Does not represent any specific annuity.

## Pricing a Deferred Income Annuity – Life Only for 65-Year Old Female, Income Starts at 85

Discount Rate:		3.00%			
Age	Income	Discount Factor	Discounted Value of Income	Survival Probabilities	Survival-Weighted Discounted Value
65	\$0	100.0%	\$0	100.0%	\$0
66	\$0	97.1%	\$0	99.4%	\$0
67	\$0	94.3%	\$0	98.7%	\$0
...	...	...	...	...	...
83	\$0	58.7%	\$0	77.9%	\$0
84	\$0	57.0%	\$0	75.3%	\$0
85	\$10,000	55.4%	\$5,537	72.3%	\$4,003
86	\$10,000	53.8%	\$5,375	69.1%	\$3,714
87	\$10,000	52.2%	\$5,219	65.5%	\$3,421
88	\$10,000	50.7%	\$5,067	61.7%	\$3,125
89	\$10,000	49.2%	\$4,919	57.5%	\$2,828
90	\$10,000	47.8%	\$4,776	53.2%	\$2,540
...	...	...	...	...	...
100	\$10,000	35.5%	\$3,554	10.8%	\$384
101	\$10,000	34.5%	\$3,450	8.1%	\$280
102	\$10,000	33.5%	\$3,350	5.9%	\$199
103	\$10,000	32.5%	\$3,252	4.1%	\$135
104	\$10,000	31.6%	\$3,158	2.8%	\$89
Cost of Annuity (Sum of Survival-Weighted Discounted Values):					\$32,444
Annuity Payout Rate:					30.82%

For illustration purposes only. Does not represent any specific annuity.

## Other Income Annuity Pricing Dynamics

Reduced payment for:

- 1) Increased certainty of payments (period certain, cash refund)
- 2) Joint life instead of single life
- 3) Cost-of-living adjustments on payments

## Income Annuities & Investment Returns

Payout rate  $\neq$  Rate of return

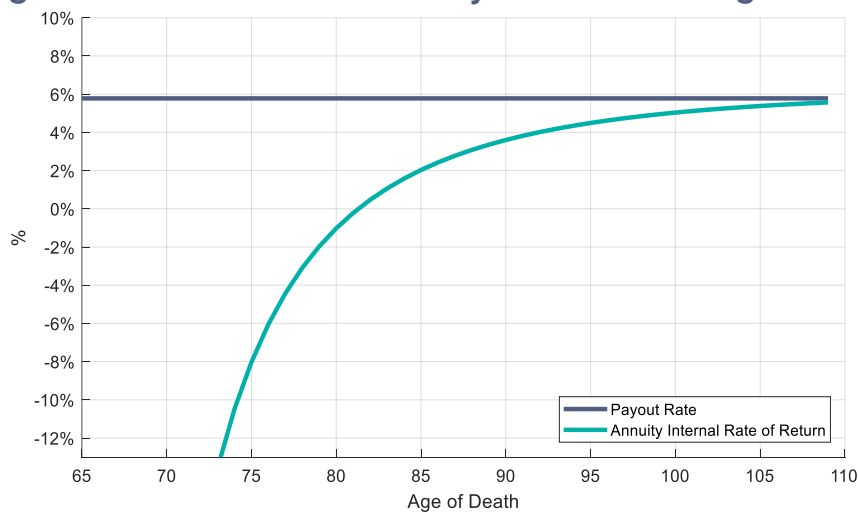
Includes return of principal  
Comparable to “4% rule” style withdrawal rates

## Income Annuities & Investment Returns

Payout rate includes an underlying return assumption linked to performance of insurance company's general account

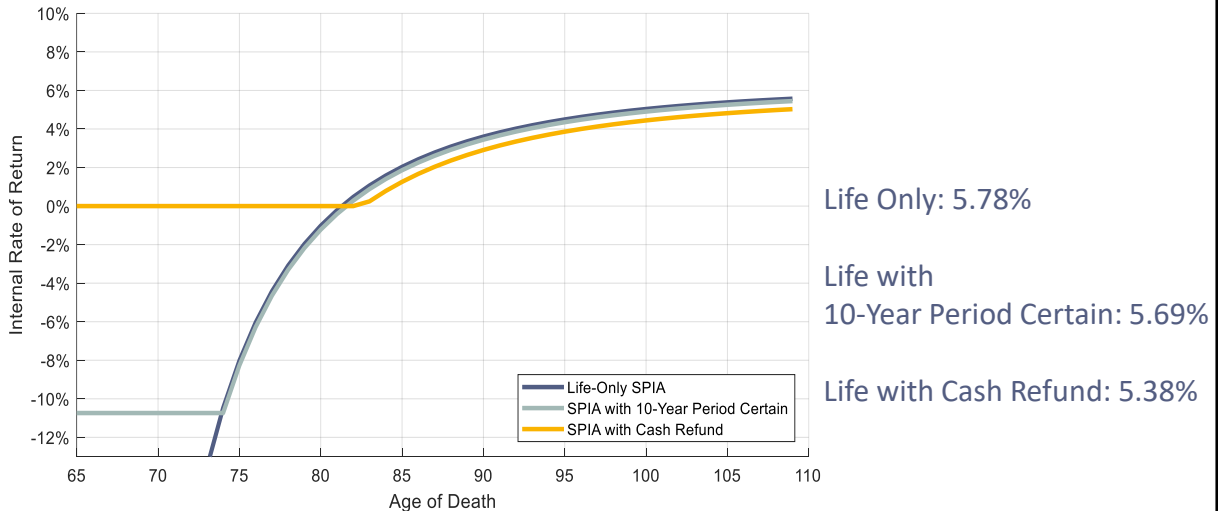
- ❖ Primarily fixed income
- ❖ Asset-liability matching
- ❖ Higher fixed income yields than households might earn – longer maturity, more diversified credit risk, less need for liquidity, institutional pricing on trades

### Mechanics of a Single-Premium Immediate Annuity Payout Rate and Internal Rate of Return by Age of Death for Purchase by a Female at Age 65



For illustration purposes only. Does not represent any specific annuity.

## Mechanics of a Single-Premium Immediate Annuity Payout Rate and Internal Rate of Return by Age of Death for Purchase by a Female at Age 65



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## How Much do Income Annuities Cost?

Spread products – like checking accounts  
Fees not observable

Reverse engineer: Money's Worth measure

## Fees vs. Money's Worth for Income Annuities

Discount Rate: 3.00%					
Age	Income	Discount Factor	Discounted Value of Income	Survival Probabilities	Survival-Weighted Discounted Value
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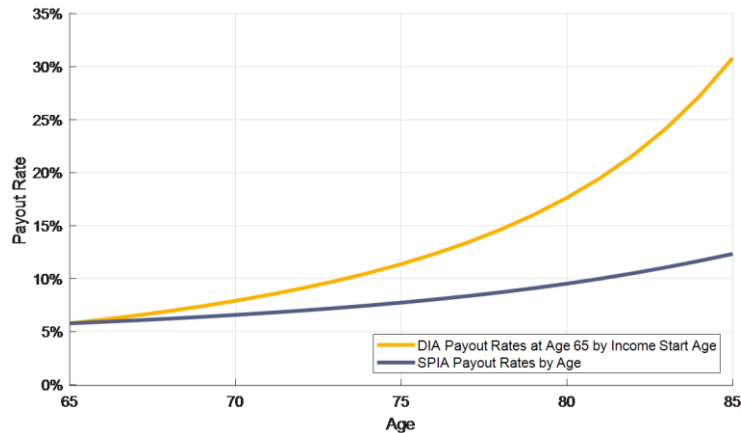
For illustration purposes only. Does not represent any specific annuity.

## Deferred Income Annuities

Including a deferral period for an income annuity increases the payout rate for two reasons:

- 1) Reduced probability of survival for receiving payments
- 2) Opportunity for investment growth on premiums in insurance company's general account

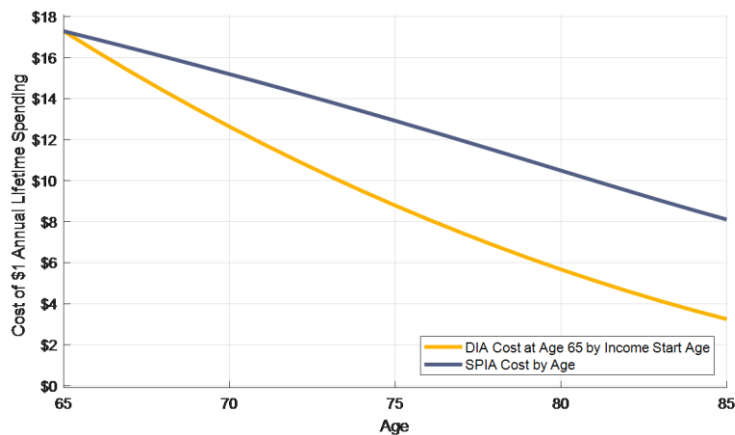
## Deferred Income Annuities – Payout Rates



For illustration purposes only.

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## Deferred Income Annuities & The Cost of Hedging Longevity Tail Risk



For illustration purposes only.

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## What Age to Buy an Annuity?

Moshe Milevsky's Implied Longevity Yield:

Buy SPIA today vs.  
Take distributions for 5 years then buy

## What Age to Buy an Annuity? Implied Longevity Yield

Current Age	\$1,000 of Lifetime Income with SPIA today	\$1,000 of Lifetime Income with SPIA in 5 Years	Implied Longevity Yield
65	\$17,291	\$15,197	3.75%
70	\$15,197	\$12,920	4.09%
75	\$12,920	\$10,493	4.68%
80	\$10,493	\$8,105	6.08%
85	\$8,105	\$6,045	9.25%

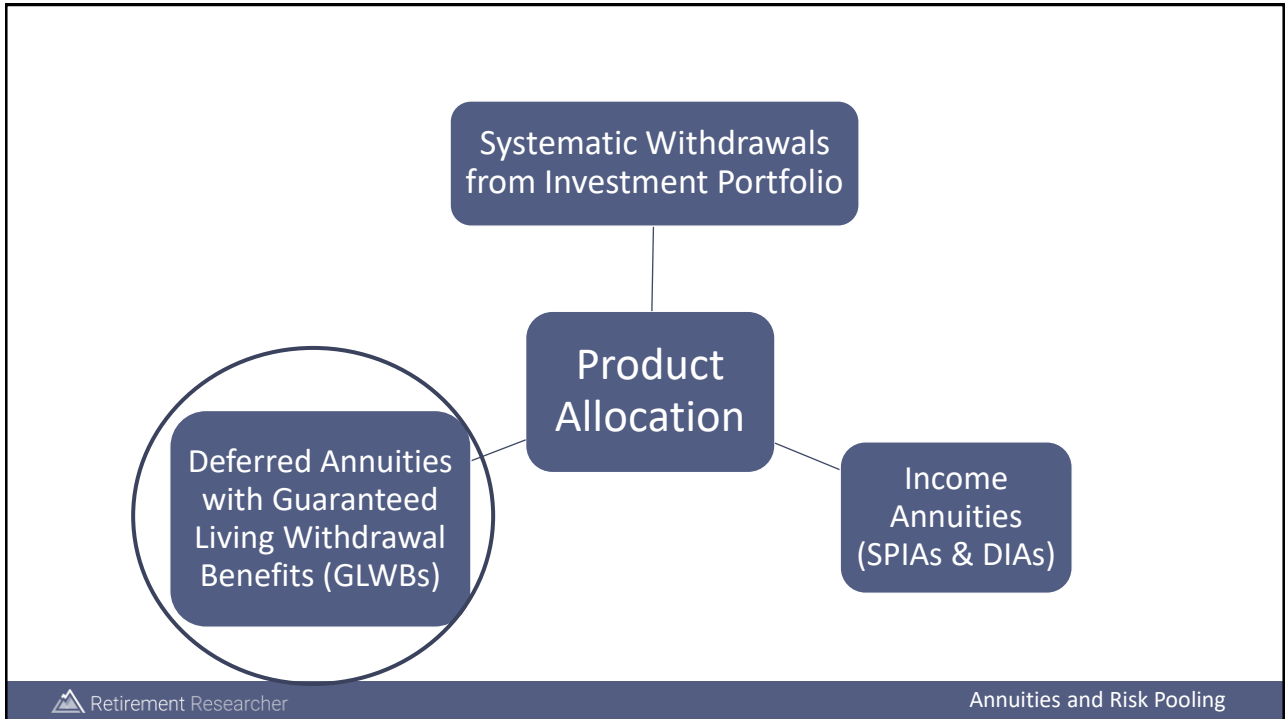
For illustration purposes only. Does not represent any specific annuity.

## Income Annuities

Income guaranteed amount	What is the minimum guaranteed amount of lifetime income?
Guaranteed withdrawal rates	What is the guaranteed payout rate? How does it vary by age and length of deferral period?
Other withdrawal features	Does the contract provide liquidity to take nonguaranteed withdrawals? (Answering yes is uncommon)
Death benefit	What are the death benefit provisions, such as cash refund, installment refund, or period certain payments?
Insurance company credit rating	What credit ratings has the insurance company earned from the major credit rating agencies?

## Variable Annuities





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## Deferred Variable Annuity – General Features

- Downside spending protection through optional guaranteed lifetime withdrawal benefit (GLWB)
- Upside potential through asset growth and income step-ups
- Liquidity – contract is not annuitized
- Tax deferral

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## Deferred Variable Annuity – Behavioral Aspects

- Obtain risk pooling without “sacrificing” asset
- Can still see assets on the balance sheet
- Guarantee supports aggressive investing
- Helps to stay the course with market volatility

## Variable Annuity Vocabulary

Guaranteed Lifetime Withdrawal Benefit  
Benefit Base  
Rollup Rate  
Contract Value  
Step-up opportunities  
Guaranteed Withdrawal Rate

## Key Issues

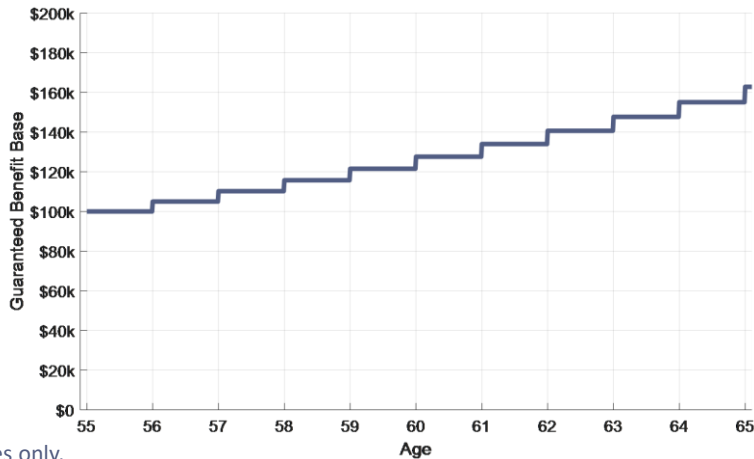
1. Living benefit: How do guarantees grow during the deferral period?
2. Living benefit: How are guaranteed withdrawals determined?
3. What is the death benefit?
4. How does the insurance company manage its risks?

## VA with \$100,000 premium, 10-year deferral

Roll-up Type	Benefit Base
5% Simple	\$150,000 -- $\$100,000 \times (1+0.05 \times 10)$
5% Compounded	\$162,890 -- $\$100,000 \times (1.05 ^ 10)$
6% Simple	\$160,000
6% Compounded	\$179,080

For illustration purposes only.

## Guaranteed Benefit Base for \$100k with 5% Annually Compounded Rollup Rate



For illustration purposes only.

## Rollup Rate

**NOT** a guaranteed rate of return!!!

Other compounding frequencies

When are rollups vested?

# Step-up Opportunities

New high watermarks

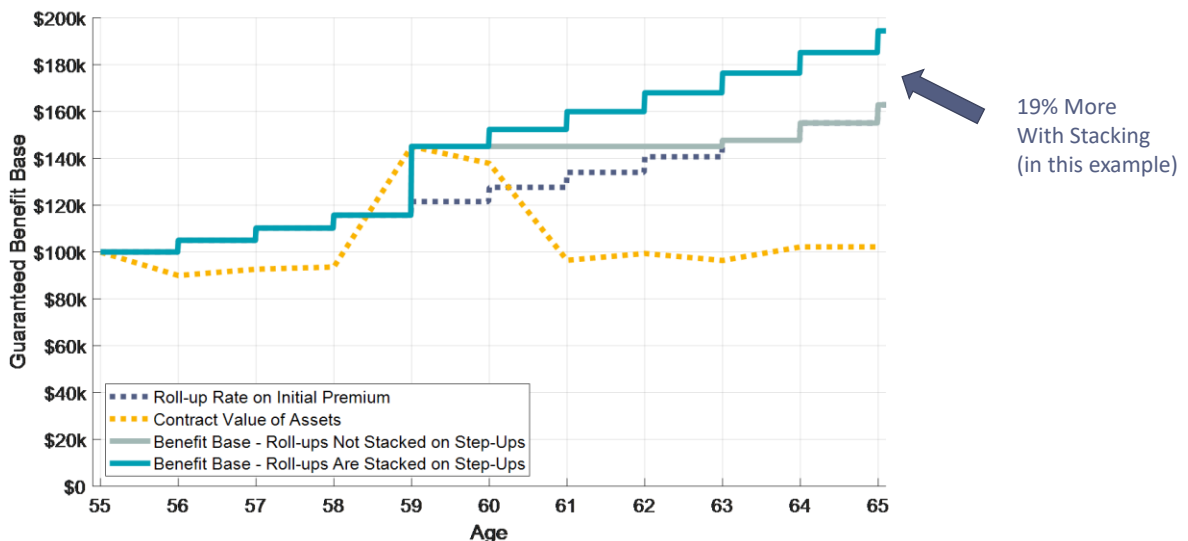
Frequency (daily, monthly, quarterly, annual)

Vesting

Do rollups stack on step-ups?

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## Benefit Base: Stacking vs. No-Stacking for Step-ups



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# Guaranteed Withdrawal Amount

## GLWB

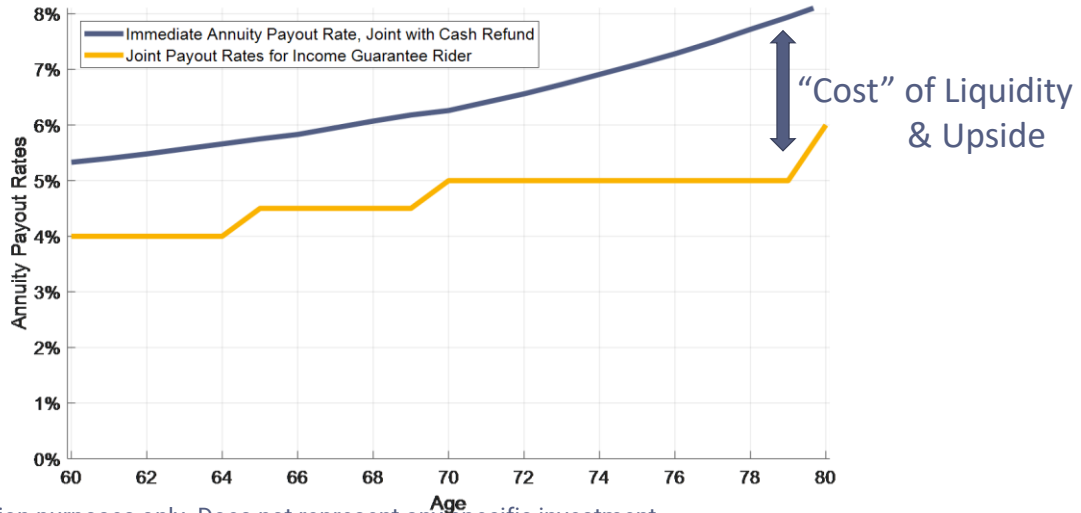
Age-based Withdrawal Rate  $\times$  Benefit Base

No more rollups  
Step-ups are still possible

## Types of Living Benefits

- **GLWB: supports lifetime income without annuitization**
- **Guaranteed Minimum Income Benefit:** requires annuitization, providing age-based guaranteed payout rates applied to benefit base. Lifetime income with annuitization.
- **Guaranteed Minimum Accumulation Benefit:** Protects contract value growth to a minimum value. No link to income.
- **Guaranteed Minimum Withdrawal Amount:** Guarantees certain amount (such as return of premium or value of benefit base). No lifetime income.

## Guaranteed Withdrawal Rates: VA/GLWB vs. SPIA



For illustration purposes only. Does not represent any specific investment.

## Guaranteed Income for a \$100,000 Premium After 10-Year Deferral Period

		Withdrawal Rate				
Rollup Rate		4.0%	4.5%	5.0%	5.5%	6.0%
Compounded	4.0%	\$5,921	\$6,661	\$7,401	\$8,141	\$8,881
	4.5%	\$6,212	\$6,988	\$7,765	\$8,541	\$9,318
	5.0%	\$6,516	\$7,330	\$8,144	\$8,959	\$9,773
	5.5%	\$6,833	\$7,687	\$8,541	\$9,395	\$10,249
	6.0%	\$7,163	\$8,059	\$8,954	\$9,850	\$10,745
	6.5%	\$7,509	\$8,447	\$9,386	\$10,324	\$11,263
	7.0%	\$7,869	\$8,852	\$9,836	\$10,819	\$11,803
Simple	5%	\$6,000	\$6,750	\$7,500	\$8,250	\$9,000
	6%	\$6,400	\$7,200	\$8,000	\$8,800	\$9,600
	7%	\$6,800	\$7,650	\$8,500	\$9,350	\$10,200
	10%	\$8,000	\$9,000	\$10,000	\$11,000	\$12,000

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Simple	5%	\$6,000	\$6,750	\$7,500	\$8,250	\$9,000
	6%	\$6,400	\$7,200	\$8,000	\$8,800	\$9,600
	7%	\$6,800	\$7,650	\$8,500	\$9,350	\$10,200
	10%	\$8,000	\$9,000	\$10,000	\$11,000	\$12,000

For illustration purposes only. Does not represent any specific investment.

## “In the Money”

Contract value  
is less than benefit base

Increases the value of the GLWB



# Death Benefits

Basic death benefit provisions

Optional death benefit riders  
may be incompatible with living  
benefit riders

# GLWB and Deferred Annuitization

Annuity owner is spending own money until  
contract value depletes

Insurance company is only on the hook  
for the guarantee after account depletion

## Managing Risks for the Income Guarantee

- Strong company culture for financial performance & risk management
- Adjust parameters to lower guaranteed amounts
- Choose high quality managers for investment subaccounts
- Limit the allowed volatility in subaccounts
  - Cap on allowed allocation to “risky” assets
  - Use volatility-controlled funds
  - Require cash positions
- Increase variable annuity fees

## Variable Annuity Fees

1. Underlying fund expenses
2. Mortality and expense charges
3. Surrender charges (for excess distributions in early contract years)
4. Charges for optional living benefits (i.e. the GLWB) or death benefits

New fee-only annuities:

do not pay commissions, which can reduce (2) and (3) dramatically

# Framing Variable Annuity Fees

Ongoing **fee drag**  
vs. **required assets** to meet goal

# Framing Variable Annuity Fees

Ongoing **fee drag**  
vs. **asset allocation** choice

## Deferral Period

Rollup rate	Is the rollup rate simple or compounded?
Other rollup features	How long will the rollup rate be applied?
Step-up frequency	How frequently are step-up opportunities provided?
Stacking	Do step-ups stack on top of rollups?
Vesting frequency	How frequently are step-ups and rollups vested into the benefit base?

## Distribution Period

Income guaranteed amount	What is the minimum guaranteed amount of lifetime income as determined by the interaction of rollup rates and withdrawal rates after an assumed deferral period?
Guaranteed withdrawal rates	What are the guaranteed withdrawal rates? Do they depend on the age at first guaranteed withdrawal? Or do they depend on age at contract issue and length of deferral period?
Adjustment for couples	Are withdrawal rates or fees adjusted for couples relative to singles?
Other withdrawal features	Does the contract provide liquidity to take nonguaranteed withdrawals?
Impact of nonlifetime withdrawals	How does the amount of guaranteed lifetime income adjust to nonguaranteed withdrawals (including excess withdrawals beyond the guaranteed amount)?

## Risk Management Approach (1)

Maximum allocation to risky assets	What is the maximum allowed allocation for risky assets?
Range of investment offerings	What are the fund choices for the subaccount investments?
Other restraints on investment allocation	Are there any other requirements about using volatility-controlled funds or holding cash positions?
Insurance company credit rating	What credit ratings has the insurance company earned from the major credit rating agencies?

## Risk Management Approach (2) - Fees

Variable annuity and subaccount fees	What are the ongoing mortality and expense charges? What fees are applied to the investment options in the subaccounts? Are these fees applied to the contract value, the benefit base, or some other metric for the annuity?
Additional fees for guarantee rider	What are the ongoing fees for optional guaranteed living and death benefits? Are these fees applied to the contract value, the benefit base, or some other metric for the annuity?
Fee adjustments	How much flexibility does the insurance company maintain to adjust fees? What are the maximums?
Surrender charges	What surrender charge schedule is applied to excess distributions in the early years of the contract?

# Fixed Index Annuities

## Fixed Index Annuity – General Features

- Principal protection for contract value
- Lifetime spending protection through optional guaranteed lifetime withdrawal benefit (GLWB)
- *Some* degree of upside potential
- Liquidity – contract is not annuitized
- Tax deferral

## Fixed Index Annuity – Behavioral Aspects

- Obtain risk pooling without “sacrificing” asset
- Can still see assets on the balance sheet
- Principal protection – not at risk of loss in market downturn -> more investing comfort elsewhere

## Fixed Index Annuity Vocabulary

Interest Crediting Method  
Guaranteed Lifetime Withdrawal Benefit  
Deferral Credits (vs Benefit Base & Rollup Rate)  
Contract Value  
Step-up opportunities  
Guaranteed Withdrawal Rate

## Key Issues

1. How is interest credited to the contract value?
2. Living benefit: How are guaranteed withdrawals determined?
3. What is the death benefit?
4. How does the insurance company manage its risks?

## Crediting Method

FIA “returns” = **interest crediting**

Fixed interest or  
linked to external index performance

Ex. S&P 500, MSCI EAFE, Low-Volatility Index



# Linked Index

FIAs **do not** invest in the index

Interest is based index performance  
through **financial derivatives**

This means price returns **without** dividends!

# Principal Protection

FIAs are fixed annuities

Contract value does **not** decrease  
when index experiences losses

## Fixed Index Annuity Fees

1. ~~Underlying fund expenses~~
  2. ~~Mortality and expense charges~~
  3. Surrender charges (for excess distributions in early contract years)
  4. Charges for optional living benefits (i.e. the GLWB) or death benefits
  5. Unobserved internal spread  
(like a single-premium immediate annuity)
- } “no fees”

New fee-only annuities:

do not pay commissions, which can reduce (3) and (5)

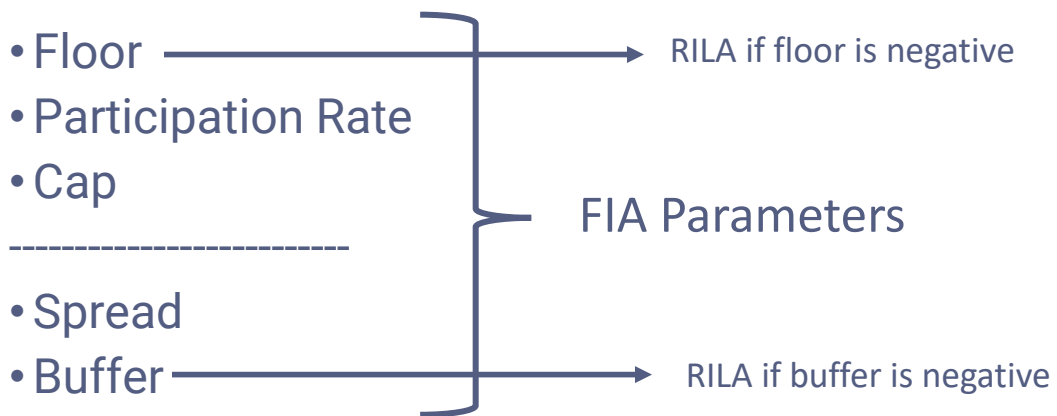
## One-year Term Point-to-Point Crediting Method with Annual Reset

- Most common method (more competition on pricing)
- One-year: length of term; could be longer
- Point-to-point: compare value of market index at the start and end of year/term
- Credit interest for the year based on index price return (excluding dividends)
- Annual reset: Comparisons start fresh for each term – no need for cumulative gains to make up for previous losses

## Basic idea – FIA Interest Crediting

1. Buy enough bonds to protect principal after interest is received
2. From remainder, keep enough to cover company expenses (i.e. internal fees)
3. Use remaining funds to purchase financial derivatives (call options) providing upside exposure to linked index

## Crediting Interest -- Translating Price Return into FIA "Return"



# FIA Parameters Depend on...

Level of **interest rates**

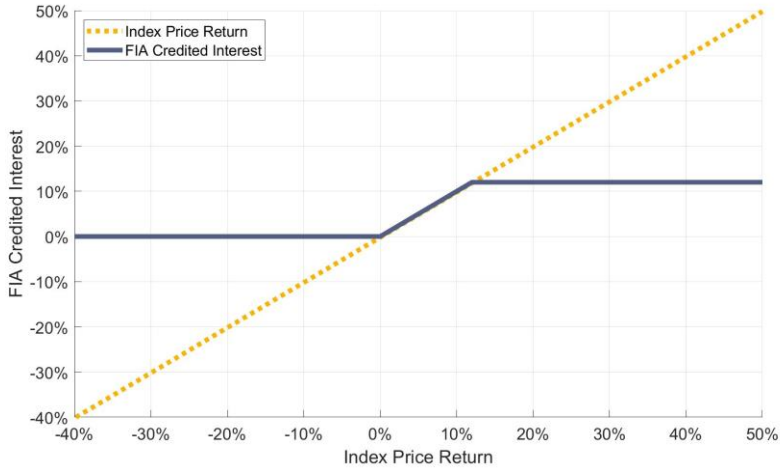
How much is needed for principal protection?  
What is the options budget?

Cost of **financial derivatives**

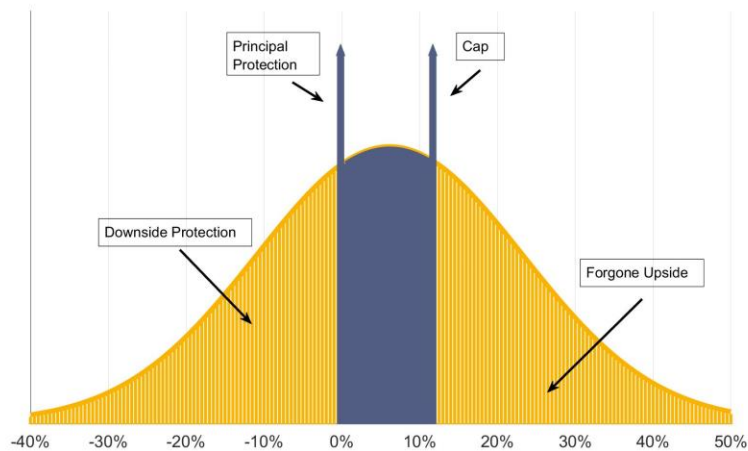
## Factors for Options Pricing

Factor	Impact of Increase on Call Option Price
Implied Volatility	Increased volatility = more expensive option; most important factor
Current Index Price & Option Strike Price	Increased Strike Price = less payoff potential = cheaper option
Risk-Free Interest Rate	Increased interest rate = slight increase in price (But more than offset by larger options budget)
Term to Maturity	Increased term = more expensive option (but not linear)

## Fixed Index Annuity Credited Interest, based on Index Price Return and 12% Cap



## Annual Return Distribution for a Fixed Index Annuity with a 1-Year Term & 12% Cap



## Parameter Renewals for Each Term

Same process each term for insurance company

Buy bonds to protect principal  
and buy derivatives for upside

Degree of upside depends on interest rates and  
option pricing factors – conditions change

## Parameter Renewals for Each Term

Insurance companies must maintain the right to  
change parameters each term

Good companies will not take advantage of this  
(recommendation: examine renewal history)

Especially during the surrender charge period

## What is the best crediting method?

Once index returns are known, one method will perform best

But with competitive pricing,  
the choice of crediting method should not matter  
(can't predict market returns)

Most important: how has the company treated its customers?

## Longer Term Length

(+) Current parameters locked in for longer

(+) More upside from financial derivatives

(-) No interest credited until term end

# Step-up Opportunities

New high watermarks

Could be less common for FIAs  
(Especially if cap rate is less than rollup or distribution rate)

Thus, focus on guaranteed income

# Guaranteed Withdrawal Amount

**GLWB**

Withdrawal Rate  $\times$  Benefit Base

Age at contract issue + deferral credit  $\times$  length of deferral

Ex. 4.5% payout at issue; increases by 0.3% for each deferral year  
(i.e. 7.5% after 10 years)

Provides an alternative to using rollup rate  
Step-ups are still possible (they may not be likely)



# Guaranteed Withdrawal Amount

FIA with GLWBs  
can be **competitive** with SPIAs

## Managing Risks for the Income Guarantee

- With principal protection, longevity risk must be managed; not market risk
- Adjust guaranteed payout rate
- Adjust parameters to keep more reserves and provide less upside exposure
- Adjust parameters at each new term to reflect market conditions
- Increase optional living benefit rider fees

## Deferral Period

Linked index	What financial market index is used for crediting interest?
Downside protection	Is principal protection provided? What is the worst-case interest to be credited? What is the guaranteed minimum surrender value?
Crediting method	What crediting method is used to determine upside participation?
Rollup rate	Is there a rollup rate? Is it simple or compounded?
Other rollup features	How long will the rollup rate be applied?
Step-up frequency	How frequently are step-up opportunities provided?
Possibility for step-ups	Given the crediting method, how likely are step-up opportunities?
Stacking	Do step-ups stack on top of rollups?
Vesting frequency	How frequently are step-ups and rollups vested into the benefit base?

## Distribution Period

Income guaranteed amount	What is the minimum guaranteed amount of lifetime income as determined by the interaction of rollup rates and withdrawal rates after an assumed deferral period?
Guaranteed withdrawal rates	What are the guaranteed withdrawal rates? Do they depend on the age at first guaranteed withdrawal? Or do they depend on age at contract issue and length of deferral period?
Adjustment for couples	Are withdrawal rates or fees adjusted for couples relative to singles?
Other withdrawal features	Does the contract provide liquidity to take nonguaranteed withdrawals?
Impact of nonlifetime withdrawals	How does the amount of guaranteed lifetime income adjust to nonguaranteed withdrawals (including excess withdrawals beyond the guaranteed amount)?

## Risk Management Approach

Changes to crediting method	How much flexibility does the insurance company maintain to adjust parameters with the crediting method at each new term?
History of crediting method	Has the insurance company demonstrated the ability to not adjust crediting method parameters in an adverse direction at least during the surrender period?
Additional fees for guarantee rider	What are the ongoing fees for option guaranteed living and death benefits? Are these fees applied to the contract value, the benefit base, or some other metric for the annuity?
Fee adjustments	How much flexibility does the insurance company maintain to adjust rider fees? What are the maximums?
Surrender charges	What surrender charge schedule is applied to excess distributions in the early years of the contract?
Insurance company credit rating	What credit ratings has the insurance company earned from the major credit rating agencies?

## Registered Index-Linked Annuities

RILAs work the same way as FIAs, except their parameters allow for **principal loss**, classifying them variable annuities

RILAs are also known as variable index annuities, structured annuities, or buffered annuities

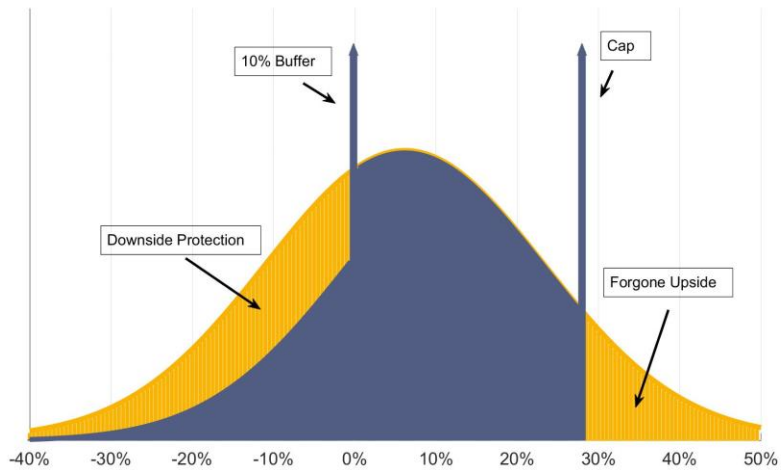
## Two main RILA types:

### Floors & Buffers

## Return for RILA with 10% Buffer & 28% Cap, based on Index Price Return



## Annual Return Distribution for a RILA with 10% Buffer, 28% Cap, & 1-Year Term



## Annuities as Accumulation Tools

## Accumulation without income protections

- Multi-year Guaranteed Annuities (MYGAs) / Deferred Fixed Annuities (DFAs)
- Fixed Index Annuities (FIAs)
- Registered Index-Linked Annuities (RILAs)
- Variable Annuity with guaranteed minimum accumulation benefit
- Investment-only Variable Annuities (IOVAs)

## MYGAs or DFAs as an “Asset Class”

- Principal is protected from investment volatility
- Assets grow at a higher yield than Treasuries
- Diversified asset base with less credit risk
- Tax deferral
- Potential early withdrawal penalties

## **FIA as an “Asset Class”**

FIA for accumulation without living benefits:

Principal protection

Competitive with bonds net of taxes

Not a stock replacement

## **RILA as an “Asset Class”**

RILA for accumulation without living benefits:

Limits on upside potential

Buffers create more risk than Floors

More upside exposure than FIAs

May draw from stocks & bonds



## Case Study: Adding an FIA to a Portfolio

- Capital Market Expectations:

	Arithmetic Means	Compounded Returns	Standard Deviations
U.S. Large Cap Equity	9.3%	7.8%	17.3%
U.S. Aggregate Bonds	3.8%	3.7%	5.1%

Source: BlackRock Investment Institute, February 2023. Data as of December 31, 2022. Return expectations over thirty years for gross total nominal returns.

- Assumed dividend yield: 1.7%; Investments held in tax-deferred account.
- Fixed Index Annuity: 0% Floor, 12% Cap, 1-Year Terms, Credited Interest Linked to U.S. Large Cap Equity Price Returns

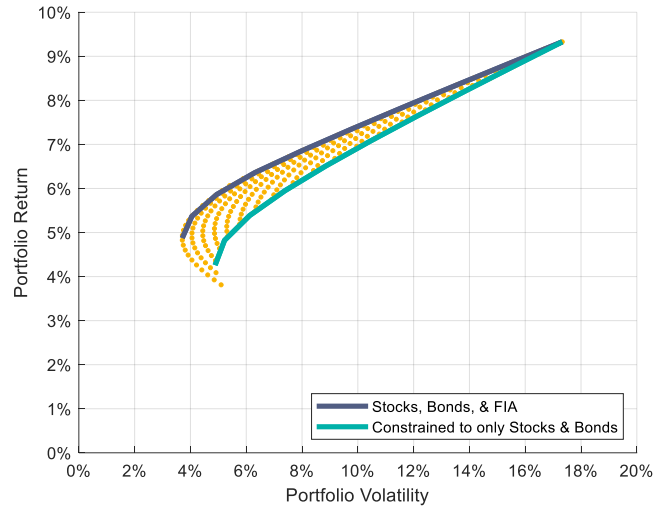
## Case Study: Adding an FIA to a Portfolio

- Return Statistics for Investments & Structured Annuity Segments, 1-Year Segment Duration

	Arithmetic Mean	Compounded Return	Standard Deviation	Correlation with Stocks	Probability (Return < 0%)
Stocks	9.3%	8.0%	17.3%	1.00	31.3%
Bonds	3.8%	3.7%	5.1%	-0.01	23.2%
Fixed Index Annuity	6.1%	5.9%	5.4%	0.86	0.0%

Source: Own Calculations Based on 100,000 Monte Carlo Simulations using Capital Market Expectations from BlackRock Investment Institute, February 2023. Note that the stock and bond returns are gross returns. Advisory and investment fees have not been deducted, which gives them an advantage over the FIA whose cap rate is estimated as net of internal costs.

## Modern Portfolio Theory's Efficient Frontier

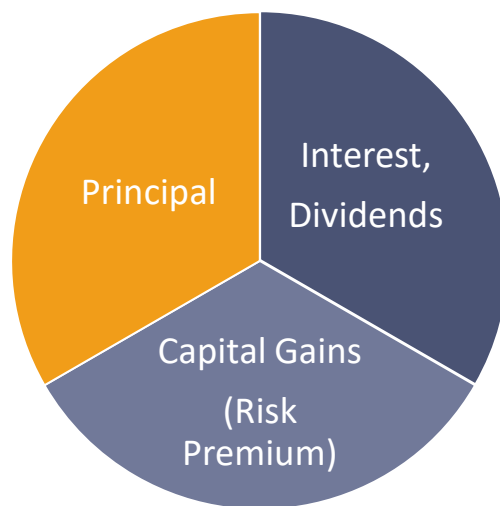


## A Selection of Outcomes from the Efficient Frontier

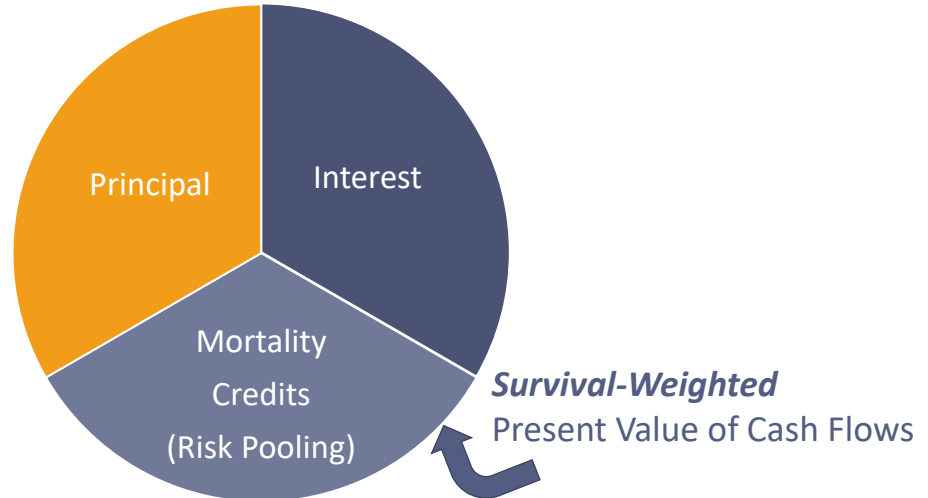
Portfolio Return	Portfolio Standard Deviation	Asset Weights		
		Stocks	Bonds	Fixed Index Annuities
9.3%	17.3%	100%	0%	0%
8.8%	15.4%	85%	0%	15%
8.3%	13.5%	70%	0%	30%
7.8%	11.6%	54%	0%	46%
7.4%	9.8%	39%	0%	61%
6.9%	8.0%	24%	0%	76%
6.4%	6.3%	9%	0%	91%
5.9%	4.9%	0%	9%	91%
5.4%	4.1%	0%	31%	69%
4.9%	3.7%	0%	53%	47%

## Fitting Annuities into a Retirement Plan

## Sources of Investment Spending



## Sources of Annuity Payments



## Case Study: Adding an FIA for Lifetime Income

- Capital Market Expectations:

	Arithmetic Means	Compounded Returns	Standard Deviations
U.S. Large Cap Equity	9.3%	7.8%	17.3%
U.S. Aggregate Bonds	3.8%	3.7%	5.1%

Source: BlackRock Investment Institute, February 2023. Data as of December 31, 2022. Return expectations over thirty years for gross total nominal returns.

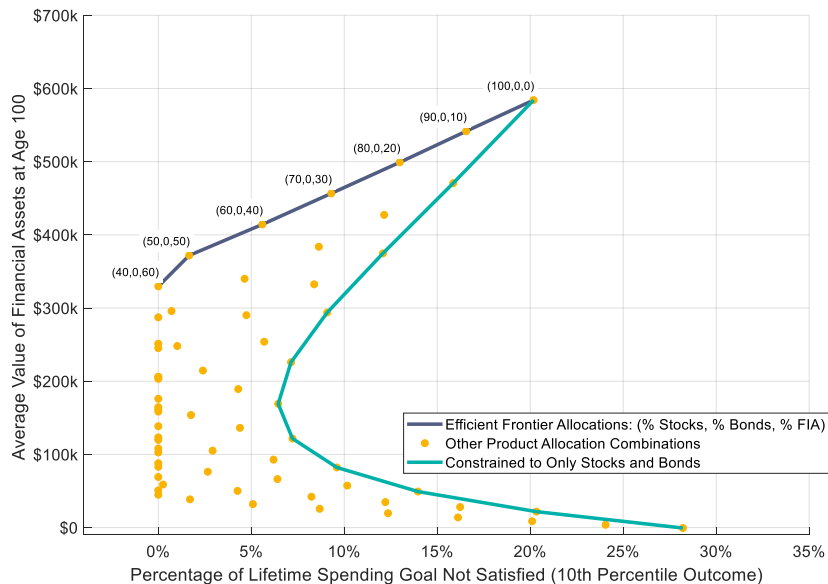
- Assumed dividend yield: 1.7%
- Fixed Index Annuity: 0% Floor, 12% Cap, 1-Year Terms, Credited Interest Linked to U.S. Large Cap Equity Price Returns
- Optional GLWB for FIA: 5.5% Payout Rate; Rider fee: annual 1.1% of benefit base

## The Efficient Frontier for Retirement Income

- 65-year old positions \$100,000 to fund \$4,000 spending goal with 2% annual COLAs through age 100
- Product Allocation Choices: Stocks, Bonds, & FIA with GLWB
- Risk Measure: Unable to meet spending goal with high success rate [percentage of lifetime spending goal through age 100 not met in 10<sup>th</sup> percentile of distribution – bad market outcome]
- Reward Measure: Preserve financial assets for liquidity and legacy [average value of remaining financial assets at age 100]

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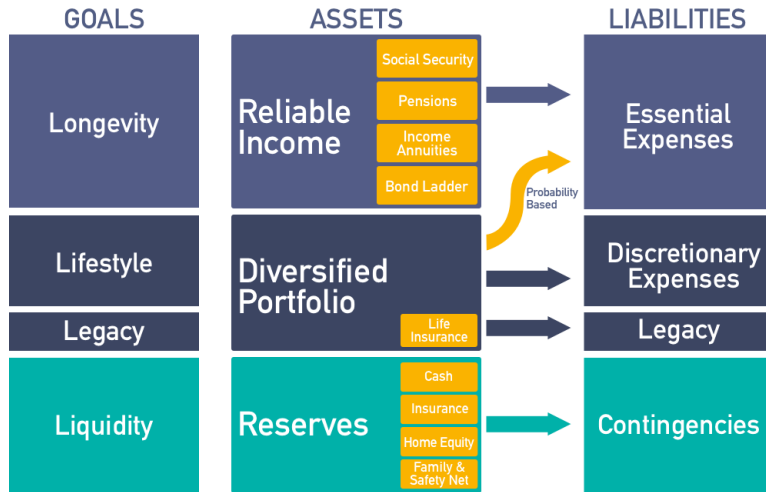
## The Efficient Frontier for Retirement Income



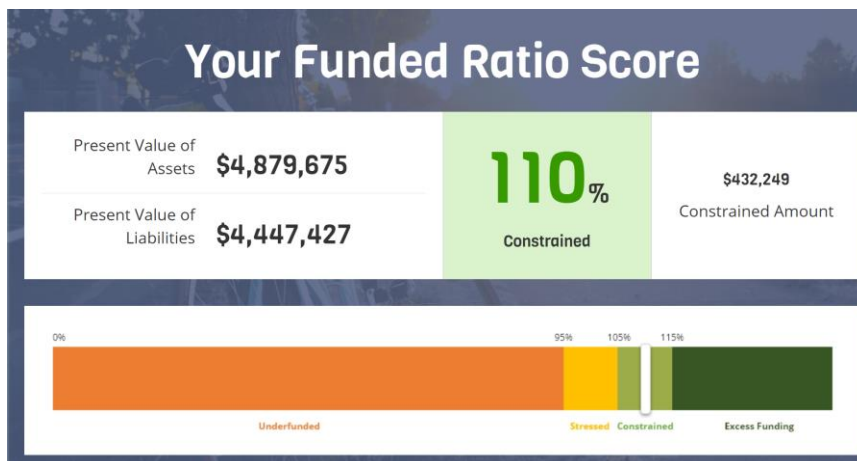
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# How much to put into the Annuity?

## Retirement Optimization Plan



# Funded Ratio



Note: This is a purely hypothetical example.

## The Funded Ratio & RIO Map Subcomponents

- We can consider the funded status both from the perspective of the overall RIO-Map and for different subcomponents of the map.
- Even when the full plan is funded, there may be gaps in some categories, such as whether there is sufficient reliable income to cover longevity expenses or sufficient reserves for contingencies.

## Funded Ratio & RIO-Map Components

Reliable Income for Essential Expenses		
Present Value of Reliable Income:	\$2,030,278	69%
Present Value of Essential Expenses:	\$2,955,639	
		\$925,361 Deficit
Investment Portfolio for Discretionary Expenses & Legacy		
Investment Portfolio Value:	\$2,414,190	250%
Present Value of Discretionary & Legacy Expenses:	\$963,788	
		\$1,450,402 Surplus
Reserves for Contingencies		
Value of Reserve Assets:	\$435,207	82%
Potential Contingency Expenses:	\$528,000	
		\$92,793 Deficit

Note: This is a purely hypothetical example.

- Total Return: combining Reliable Income and Diversified portfolio provides **113%** funded status. There are sufficient assets here for essential, discretionary, & legacy. No change needed
- Other styles: allocate some of diversified portfolio surplus to reliable income to better fund essential expenses (~ \$925,361)
- For either style, some diversified portfolio can be reclassified as reserves (~ \$92,793)

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# THANK YOU! ANY QUESTIONS?

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