

## Market Development of Deferred Annuities

September 3<sup>rd</sup> Plenary Session  
Universidad Diego Portales



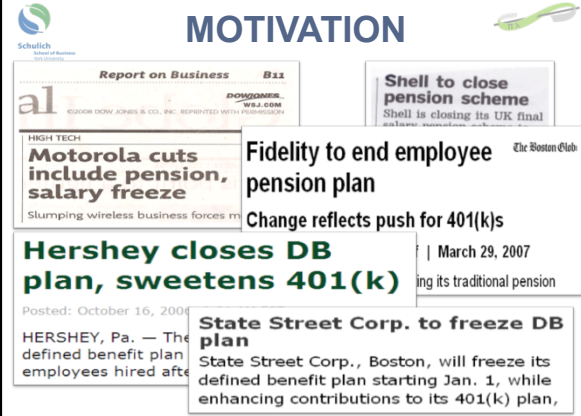
Prof. Moshe A. Milevsky  
Schulich School of Business, York University  
Π Longevity Extension Corp.  
Toronto, Ontario, CANADA

## OUTLINE

30 minutes

- 1 Mortality Motivation: Pensions are Dying
- 2 What is a Deferred Annuity (and what isn't)?
- 3 Who sells them and in what flavors?
- 4 How are they priced and what are they worth?
- 5 Optimal allocation within a portfolio
- 6 Provide some (key) academic references
- 7 Suggestions for better product design

## MOTIVATION



**Motorola cuts pension, salary freeze**  
Slumping wireless business forces m

**Fidelity to end employee pension plan**  
Change reflects push for 401(k)s

**Hershey closes DB plan, sweetens 401(k)**  
March 29, 2007  
ing its traditional pension

**State Street Corp. to freeze DB plan**  
State Street Corp., Boston, will freeze its defined benefit plan starting Jan. 1, while enhancing contributions to its 401(k) plan,

## MOTIVATION



**The Best Life**  
Success and happiness in older age.

**Longevity Annuities Growing in Popularity**  
Deferred income annuities offer a solution for guaranteed income in old age.

By Philip Moore | Sept. 9, 2013 | 3 Comments | SHARE


The risks of living longer in a problem of our times - stemming from significant longevity gains that could result in retirement lasting 20 years or even longer. Making sure you have enough money for those later years is challenging, especially since it's difficult to judge how long you'll live.

**WHAT IT IS...**


**A**      **L**      **D**      **A**  
Advanced      Life      Delayed      Annuities

a.k.a. Deferred Income Annuities (DIA)  
a.k.a. Longevity Insurance  
a.k.a. Qualified Longevity Annuity Contracts (QLAC)

Unless you're in Italy, where it's chocolate.

A photograph showing several bags of ALDA chocolate. The bags are white and gold, with the ALDA logo and a picture of a chocolate bar. One bag is prominently displayed in the foreground, showing the ALDA logo and the word 'ALDA' in gold letters.


**Advanced Life Delayed Annuity (ALDA)**

A diagram showing three treasure chests filled with gold coins. A large red 'X' is drawn over the chests, indicating that this traditional annuity structure is being rejected. Below the chests, a horizontal arrow points from 'Age ~50' to 'Death', representing the period of the annuity.

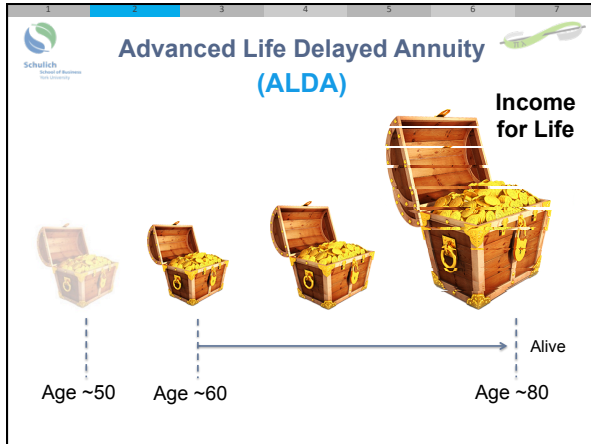
Age ~50      Death

**Advanced Life Delayed Annuity (ALDA)**

**Income for Life**

A diagram showing four treasure chests of increasing size, each filled with gold coins. The largest chest is labeled 'Income for Life'. Below the chests, a horizontal arrow points from 'Age ~50' to 'Age ~80', representing the period of the annuity.

Age ~50      Age ~80



### \$2.2 Billion USD Premiums in 2013: Sold by....

### WHAT ARE THE FLAVORS?

Source: Retirement Income Journal, 16 May 2014

Product	Minimum premium	Flexible or single premium	Death benefit option	Inflation protection options	Deferral period	Annual dividend	Accelerated payment option	Lifetime income options	Accelerated payments?
AI (A)	A	N/A	Single	No	No	No	No	No	N/A
First Investors Life Single Pay (Futures)	A	N/A	Single	No	No	No	No	6 months payments in lump sum	No
Guardian Future Inc	A	N/A	Single	No	No	No	No	6 months payments in lump sum	No
Lincoln DL Income St	A	N/A	Single	1x change, +/- 5 years	Yes	Yes	1%-4%	No	No
MassMutual Retiree Choice	A	N/A	Single	1x change, +/- 5 years	Yes	Yes	1%-4%	No	No
MetLife Guaranteed Income St	A	N/A	Single	2x change, +/- 5 years; 30 min. delay	Yes	Yes	2%-4%	No	No
New York Life Guaranteed Future Income Annuity St	A++	\$5,000	Flexible	1x change, +/- 5 years; not with life-only	Yes	Yes	1%-3%	No	No
Northwestern Mutual Select and Select Portfolio DLIA	A	N/A	Single	No	With vs single life only	Yes	No	Only with Portfolio	Use dividends as cash out or Portfolio
OneAmerica Secure Income Stream Annuity	A	N/A	Single	1x change, +/- 5 years; not with life-only	Yes	Yes	No	No	6 months payments in lump sum
Principal DIA	A	N/A	Single	1x change, +/- 5 years; not with life-only	Yes	Yes	No	No	N/A
Symetra Freedom Income Annuity	A	N/A	Single	No	Yes	Yes	No	No	N/A

\*Note: All prices control contracts to hold the assets and set up two different start dates. Hold mainly as an advanced life deferred annuity, with income beginning at age 65.  
\*\*Varying, qualified contracts must be purchased by age 67-69, depending on the contract, and begin paying out by age 70.


### Go to website [www.cannex.com](http://www.cannex.com) for pricing examples

Input



Income Annuity Survey Details	
Owner's State of Residence	Alabama
State of Issue	Alabama
Name	Client
Birth Date	June 25, 1948
Sex	Male
Annuity Type	Single Life
Fund Type	Non-qualified
Quarantee Type	Guaranteed
Premium	\$100,000.00
Cost Basis	\$100,000.00
Purchase Date	June 25, 2014
Payment Frequency	Monthly
Income Start Date	July 25, 2030
Contract Period	Life Only
Return of Premium before Income Start Date	No

Output

Financial Institution	Monthly Income	Monthly Flexible Portion	Guaranteed To End Of	Notes
New York Life Insurance & Annuity Corporation	\$3,866.50	\$2,681.12	JUL-08-2014	See below
MetLife Investors Insurance Company	\$3,518.20	\$2,352.20	JUL-08-2014	See below
American General Life Insurance Company	\$3,428.20	\$2,304.42	JUL-02-2014	See below
Massachusetts Mutual Life Insurance Company	\$3,202.79	\$2,075.40	JUL-09-2014	See below
Symetra Life Insurance Company	\$3,137.26	\$2,054.57	JUL-05-2014	See below
The Lincoln National Life Insurance Company	\$3,089.13	\$1,961.80	JUL-02-2014	See below
Guardian Insurance & Annuity Company	\$2,586.91	\$1,469.85	JUL-02-2014	See below
Principal Financial Group	\$2,087.15	\$1,401.74	JUL-04-2014	See below



## Sample Monthly USD Payouts Delayed Annuity at Age 68

### Sample Monthly USD Payouts Delayed Annuity at Age 68

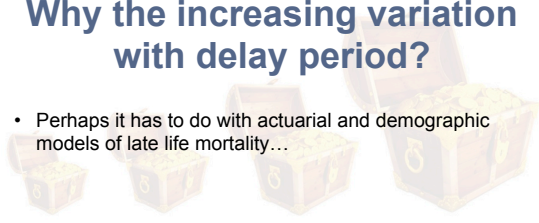


(Assumes \$100,000 Deposit from Non-Qualified Funds, No Inflation Adjustment)

Female Start	1st Best	2nd Best	3rd Best	4th Best	5th Best
68	\$580.50	\$579.83	\$577.42	\$575.63	\$569.18
70	\$668.66	\$664.69	\$650.17	\$633.66	\$625.42
72	\$788.89	\$787.70	\$768.94	\$743.85	\$724.38
74	\$956.24	\$946.01	\$920.86	\$886.20	\$882.53
76	\$1,154.22	\$1,149.84	\$1,113.40	\$1,080.35	\$1,043.25
78	\$1,418.22	\$1,413.66	\$1,371.23	\$1,328.18	\$1,290.86
80	\$1,775.75	\$1,761.64	\$1,705.12	\$1,653.92	\$1,616.93
82	\$2,270.93	\$2,241.53	\$2,165.99	\$2,101.45	\$2,064.67
84	\$2,970.64	\$2,923.90	\$2,823.30	\$2,744.46	\$2,727.20
86	\$3,984.90	\$3,680.19	\$3,468.53	\$2,986.80	
88	\$5,502.37	\$4,820.46	\$4,808.95	\$3,901.53	
90	\$7,878.13	\$6,964.04	\$6,911.37	\$5,361.52	
92	\$10,427.28	\$7,730.52			
94	\$16,169.53	\$11,832.89			





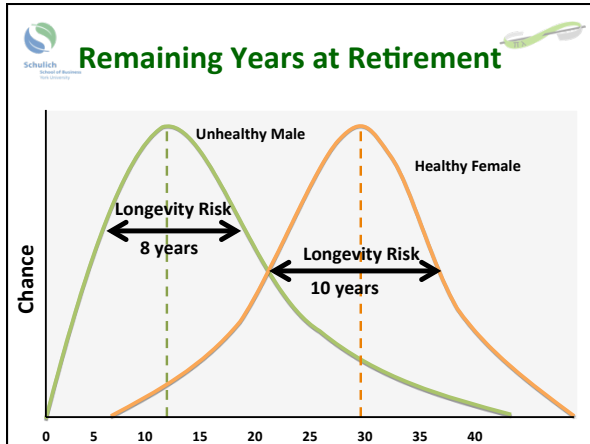
## Why the increasing variation with delay period?

- Perhaps it has to do with actuarial and demographic models of late life mortality...

## With ALDAs, late life mortality models are extremely important

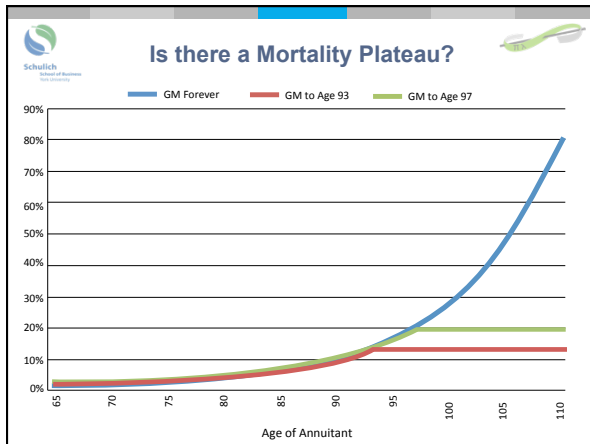




### Pricing Question

- Your expected age at death **80** (years) with a standard deviation of **10** (years.)
- Interest rates are **2%** (real) over the entire term structure.
- You are currently **55** years old.

How much would you have to pay, today, for an ALDA that pays \$1 for life if-and-when you reach age 80?



### INSTANTANEOUS FORCE OF MORTALITY

$$\lambda_x = \begin{cases} \lambda + \frac{1}{b} e^{(x-m)/b} & \text{when } x < z \\ \lambda + \frac{1}{b} e^{(z-m)/b} & \text{when } x \geq z \end{cases}$$

### SURVIVAL PROBABILITY

$$({}_{y-x}P_x) = e^{-\int_x^y \lambda_s ds} = e^{-\lambda(y-x) + b(\lambda_x - \lambda)(1 - e^{-(y-x)/b})}$$

### ANNUITY FACTOR

$$\bar{a}_x(y, z) = \int_{y-x}^{z-x} e^{-(r_s)s} ({}_sP_x) ds + ({}_{z-x}P_x) e^{\lambda_z(z-x)} \int_{z-x}^{\omega-x} e^{-(\lambda_z+r_s)s} ds$$

### How Much More Expensive is the Life Annuity Factor at Age 68?

Gompertz Makeham Forever vs Convergence to Mortality Plateau

Income Starting Age	Plateau at Age 93		Plateau at Age 97	
	@ r=3%	@ r=6%	@ r=3%	@ r=6%
68 (SPIA)	2.14%	0.93%	0.57%	<b>0.24%</b>
78	4.81%	2.61%	1.28%	0.68%
88	<b>16.91%</b>	11.53%	4.51%	2.99%

Assumes (GM law, female) m=91.68, b=9.174  
Source: Chigodavev, Milevsky and Salisbury (2014)

## I'm collecting data on ALDA prices and trying to imply market's mortality model...

### Mortality Plateaus and the Pricing of Longevity Insurance

MOSHE A. MILEVSKY

Abstract: This paper examines the pricing of long-term annuities in the presence of mortality plateaus. It shows that the pricing of long-term annuities is sensitive to the mortality plateau, and that the pricing of long-term annuities is sensitive to the mortality plateau. The paper also discusses the implications of mortality plateaus for the pricing of long-term annuities.

**OPTIMAL ALLOCATION**

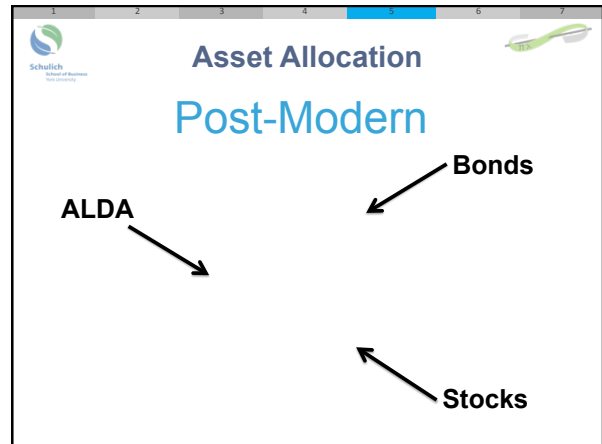
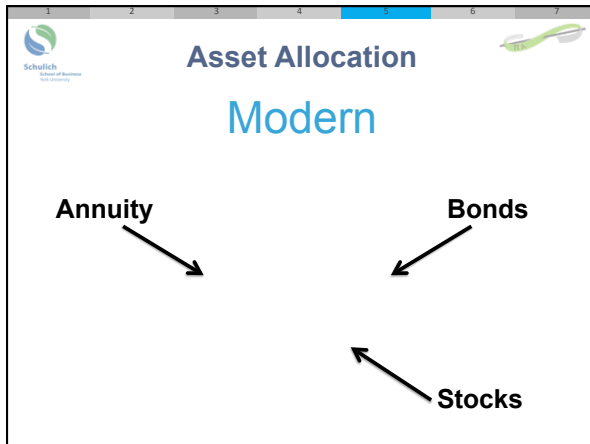
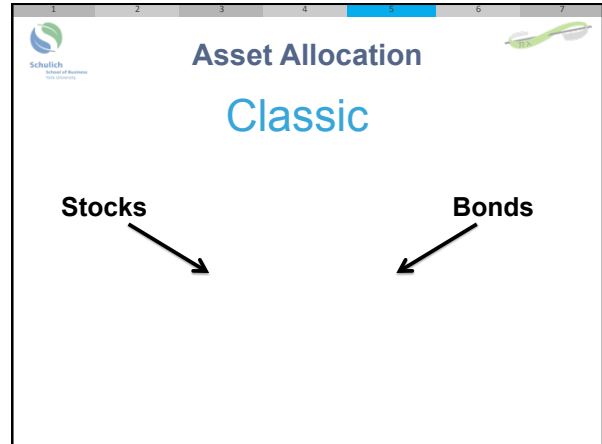
The New York Times | <http://nyl.ms/TLME8R>


**Longevity Insurance Joins the Menu of Retirement Plan Options**

By TARA REGEL BERNARD JULY 1, 2014

**New tax rules will make it possible for workers to buy a type of annuity often called longevity insurance inside their retirement plans.** The annuity aims to protect people from exhausting their savings in their later years. Longevity insurance is actually a deferred-income annuity, in which a person pays a lump sum premium to an insurer in exchange for a guaranteed lifetime income stream that begins several years later. ... perhaps well into the person's 70s or 80s. Until now, these annuities could not be widely used in 401(k) retirement plans and individual retirement accounts because those plans require account holders to begin withdrawals — known as required minimum distributions — at age 70½. But on Tuesday the Treasury Department announced that workers can now satisfy those rules if they use a portion of their retirement money to buy the annuities and begin collecting the income by age 85. The move is part of the Obama administration's broader effort to develop ways to provide Americans with more security in retirement.

"As boomers approach retirement and life expectancies increase, longevity income annuities can be an important option to help American plan for retirement and ensure they have a regular stream of income for as long as they can live," said J. Mark Ivers, the Treasury's deputy assistant secretary for retirement and health policy. The new rules take effect immediately.






## KEY REFERENCES


J.B. Stephenson, 1978, *Journal of Risk and Insurance*, Vol. 45(4)  
**The High Protection Annuity**

- "...Annuity contracts as currently written apparently involve substantial investment elements and minor protection..."
- "...Life annuities with certain payment options offer less of a protection element than most other insurance contracts..."
- "...High protection annuity contracts, such as deferred life annuities with payments commencing 12 to 15 years following retirement can be used to supplement fixed retirement benefits from other sources..."
- "...One would expect that deferred annuities have unrealized market potential for meeting these needs..."



## Selected References

- Gong, Guan, and Anthony Webb. "Evaluating the Advanced Life Deferred Annuity—An annuity people might actually buy." *Insurance: Mathematics and Economics* 46.1 (2010): 210-221.
- Horneff, Wolfram, Raimond Maurer, and Ralph Rogalla. "Dynamic portfolio choice with deferred annuities." *Journal of Banking & Finance* 34.11 (2010): 2652-2664.
- Scott, Jason S. "The longevity annuity: An annuity for everyone?." *Financial Analysts Journal* (2008): 40-48.
- Creighton, Adam, Henry Hongbo Jin, John Piggott, and Emiliano A. Valdez. "Longevity insurance: a missing market." *The Singapore Economic Review* 50, no. spec01 (2005): 417-435.
- Brown, Jeffrey R. Rational and behavioral perspectives on the role of annuities in retirement planning. No. w13537. *National Bureau of Economic Research*, 2007.
- Maurer, Raimond, Olivia S. Mitchell, Ralph Rogalla, and Vasily Kartashov. "Lifecycle Portfolio Choice With Systematic Longevity Risk and Variable Investment—Linked Deferred Annuities." *Journal of Risk and Insurance* 80, no. 3 (2013): 649-676.



## It has even been patented!

[Fulltext](#)  
[View Cart](#) [Add to Cart](#)  
[Images](#)

(3 of 1)

**United States Patent** 8,234,132  
 Kreitzer, et al. July 31, 2013


Methods and systems for providing longevity insurance with or without an asset based premium

**Abstract**

The present invention provides methods and systems for providing longevity insurance by obtaining information useful for issuing a longevity insurance contract for an individual, and determining a premium or an income payment for the individual that are computed based at least in part on an individual's age as a predetermined date that income payments are deferred to. The longevity insurance contract generally provides deferred income payments for a period of time, such as for the life of the individual, beginning as a predetermined date that is after an individual's anticipated retirement, or as a predetermined date that is after the individual's life expectancy, or on or after a specified birthday of the individual.

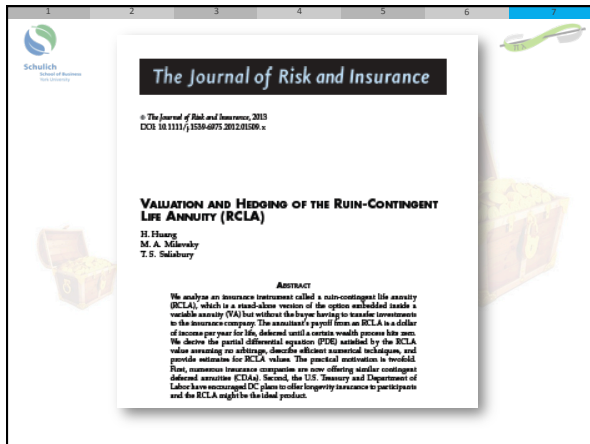
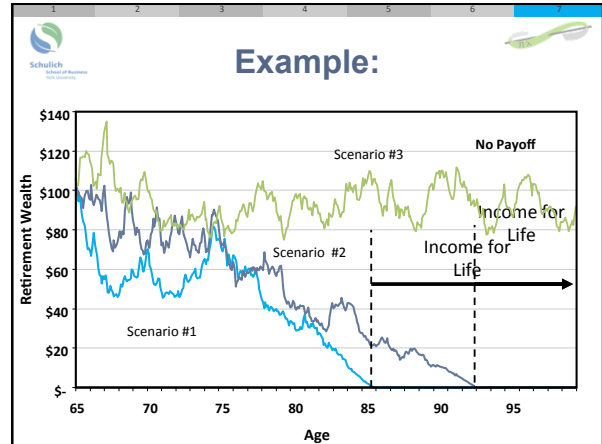
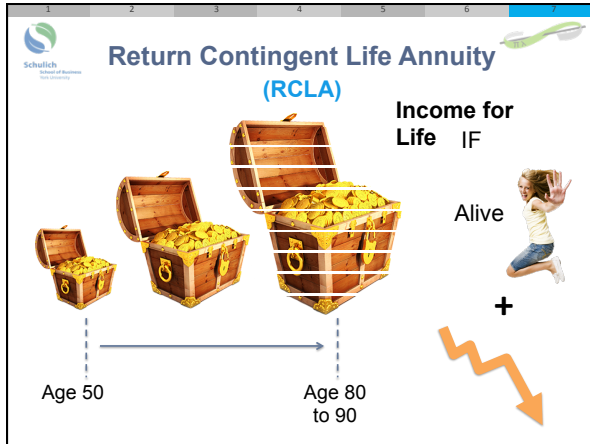
**Inventors:** Kreitzer, Joel L. (New York, NY); Meyer, John W. (States Island, NY); Gordon, Michael J. (New York, NY)  
**Assignee:** New York Life Insurance Company (New York, NY)  
**Family ID:** 3919796  
**Appl. No.:** 13784232  
**Filed:** May 6, 2007

"...A method for determining a premium ... based on the age of the individual and date the income payments are deferred to..."



## INNOVATIONS & IMPROVEMENTS

- My two cents worth on how to do this better...



- 
- 3 CONCLUSIONS**
- This issue is important
  - The market will grow
  - We need good data