

Financial and Actuarial Wealth Management



Dr. Moshe A. Milevsky
Finance Professor
York University
Toronto, Canada

My Agenda for Today



- Describe the recent development of a **wealth management** movement, in North American capital markets.
- Discuss the balance sheet, human capital and real options for **Me. Inc.**
- Use **actuarial mathematical** ideas and concepts to help individuals make better economic decisions.

Government Finance (1940 -1970)



Corporate Finance (1970 - 1990)



Personal Finance (1990 -)

Risk Shifting to Individuals



- Movement from Defined Benefit to Defined Contribution pension plans.
- Currencies, interest rates, stock markets and employment are more volatile.
- Greater standard of living that increases discretionary wealth.

Too Many Choices...



- You can select 20,000 individual securities traded on various exchanges, or from 10,000 different mutual funds.
- Asset classes are stocks, bonds, bills, real estate, hedge funds, precious metals, etc.
- 50 different life & health policies.
- Borrow money floating, fixed or capped for 1,3,5,10,25 years.
- Universe of retail derivative securities.

So...



- Individuals need help in making better financial and economic decisions.
- We can quantify the risks they face, and try to manage them in a more scientific, and less *ad hoc* manner.
- Merging the fields of economics, finance, insurance, mathematics and even psychology.

The Balance Sheet: Me Inc.

Traditional Approach



Assets

- Bank Accounts
- Housing
- Stocks & Bonds
- Car & Vehicles
- Small Business Equity
- PV of Pension

Debt + Liabilities

- Mortgages
- Consumer Loans
- Credit Cards
- Student Loans

Equity

- Net Worth of Me Inc.

Accounting for Me Inc.



- **Fact:** Corporate accounting is moving towards a system of valuing future cash-flows, e.g. brands and franchises.
- **Rule:** If you invested in the item, receive income from the item, and maintain the item, it should be treated as an asset.
- **My Claim:** The asset side of the household balance sheet is vastly understated.

Human vs. Financial Capital

- You have an implicit investment in both human and financial capital.
- Human capital is the embodiment of all future wages, salary, and earnings
- Over the life-cycle, human capital (HC) is converted to financial capital (FC).
- For most people in their 30s, 40s and even 50s, human capital is more valuable than financial capital.

The Balance Sheet: Me Inc.

Modern Approach



Assets

- Bank Accounts
- Housing
- Stocks & Bonds
- RRSPs
- Vehicles
- Small Business Equity
- PV of Pensions

Human Capital
& Real Options

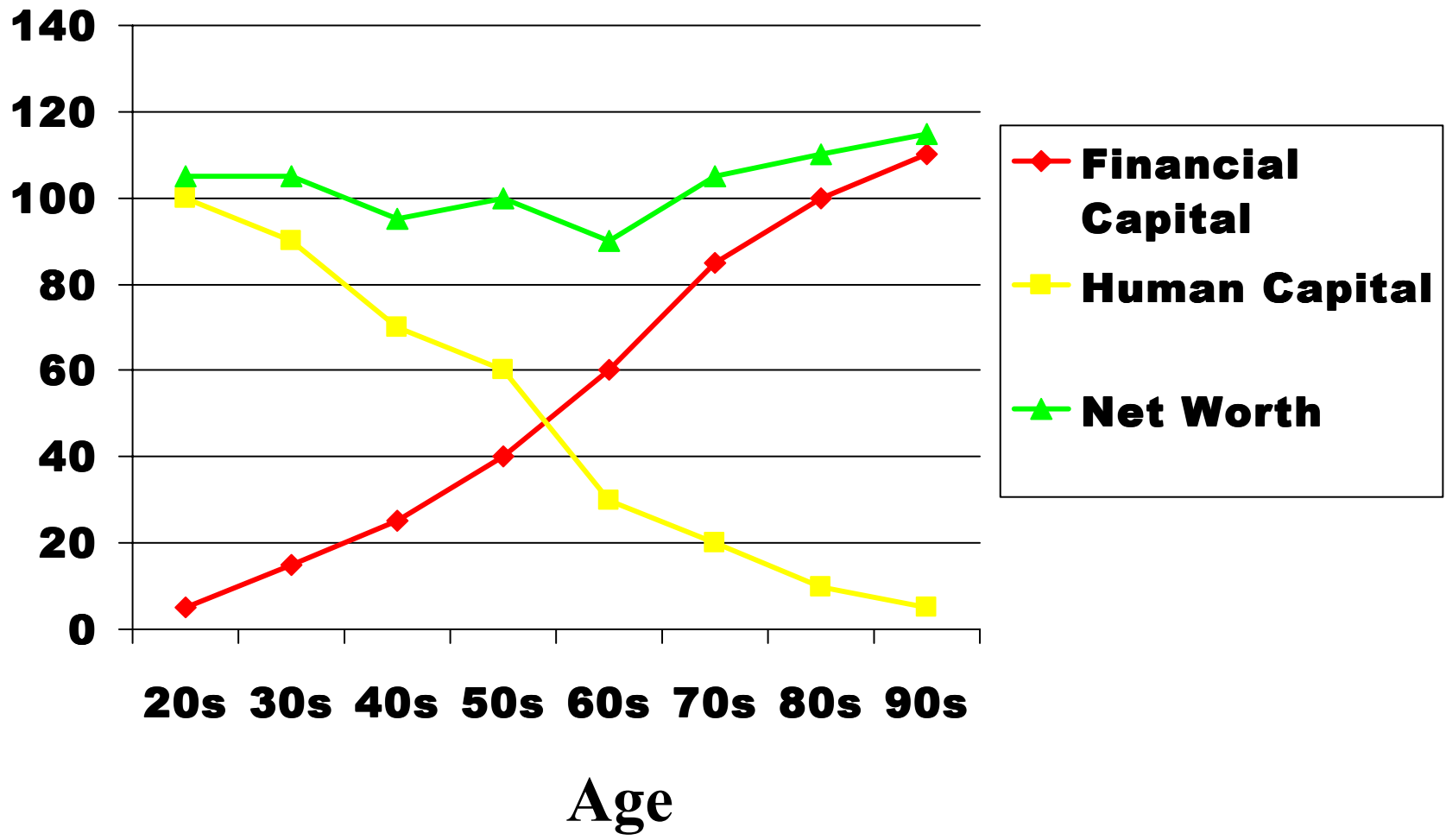
Debt + Liabilities

- Mortgages
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Equity

- Net Worth of Me Inc.

Expanded View of Net Worth



Human Capital Value: An Example



- Median Canadian economic family, age 30, earns \$40,500 after-tax, with a net-worth of \$47,500. (\$1 CDN = 0.73 EURO)
- Assume the family unit works for 30 more years, to age 60, and then retires.
- Human Capital valuation discounts after-tax salary at (1) risk-adjusted, (2) after-tax, (3) real rate of return.

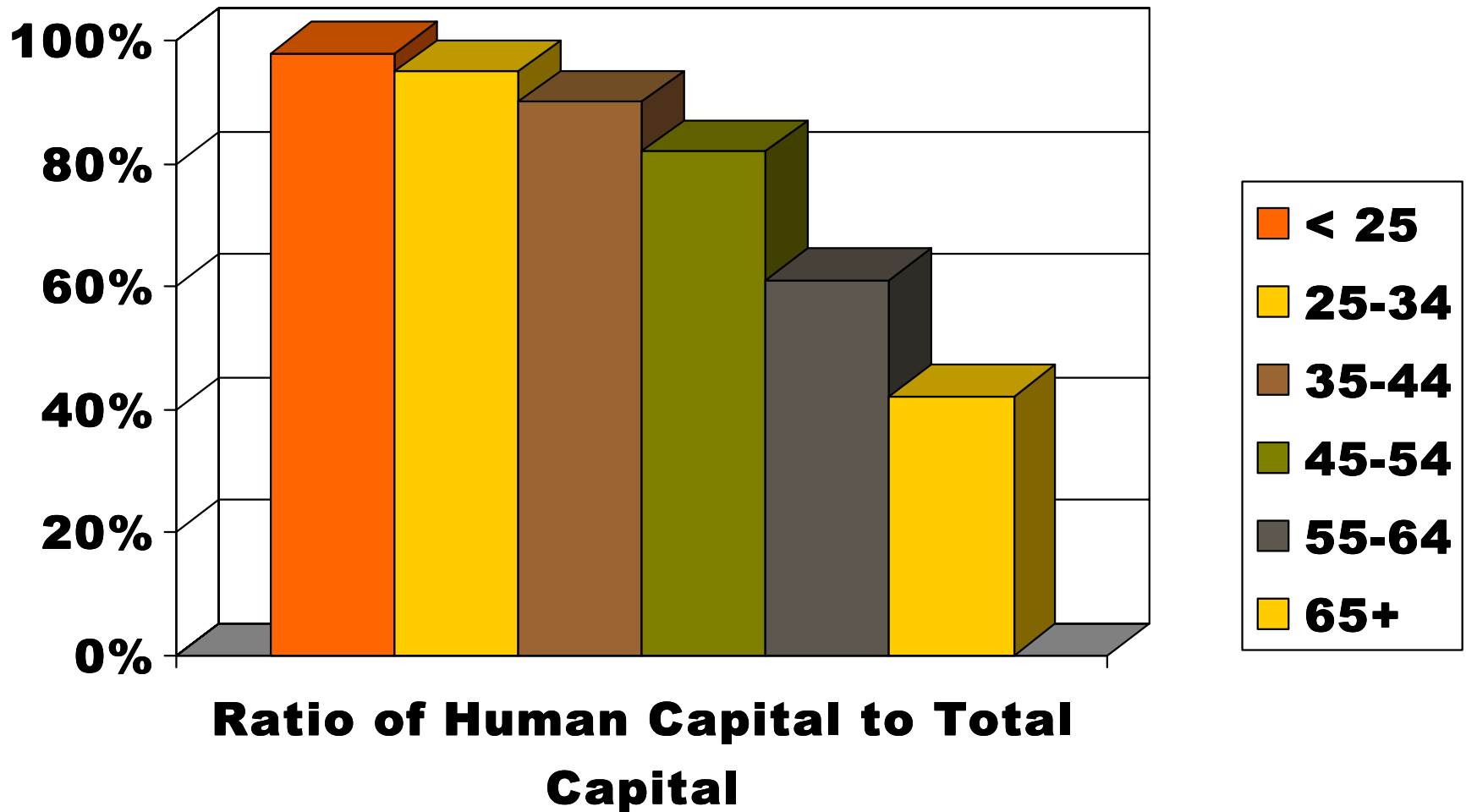
What is the Value of Human Capital?

Age 30, Salary of \$40,500 after-tax for 30 years

Discount Rate	\$ P.V. of H.C.	% of T.C.
3.5%	744,900	94%
5.0%	622,600	93%
7.5%	478,300	91%

Source: Milevsky calculations.

The Ratio Of Human Capital to Total Capital For Different Age Groups



Source: Statistics Canada (1999) Report: 13-595-XIE and Author Calculations

Human Capital: Total Asset Allocation



- Is it equity (stocks) or is it debt (bonds)?
- Entrepreneur vs. government employee.
- Human capital as a shadow asset class.
- Standard diversification rules apply.
- Insurance used to protect H.C. and F.C.
- Study co-variation with financial portfolio
- **Do not** invest in what you know!

Total Asset Allocation: The Main Questions



- Is my future income and salary flow **correlated** with my financial portfolio?
- If my financial capital declines, will it adversely **impact** my human capital?
- Do my human capital and financial capital share the same **risk factors**?
- If the answer to any of these question is yes, then you are not properly **diversified**.

Remember ENRON...



- Human Capital was invested in Enron.
- Financial Capital, pensions, stock options and mutual funds were invested in Enron.
- Local real estate will be affected as well.
- Very poor total diversification strategy.

Half of the Story....



- I have argued that human capital is quite valuable, and important asset class and belongs on the **balance sheet**.
- I now move on to **real options**, which are another form of wealth that should be managed.
- What are **real options**?

Real vs. Financial Options

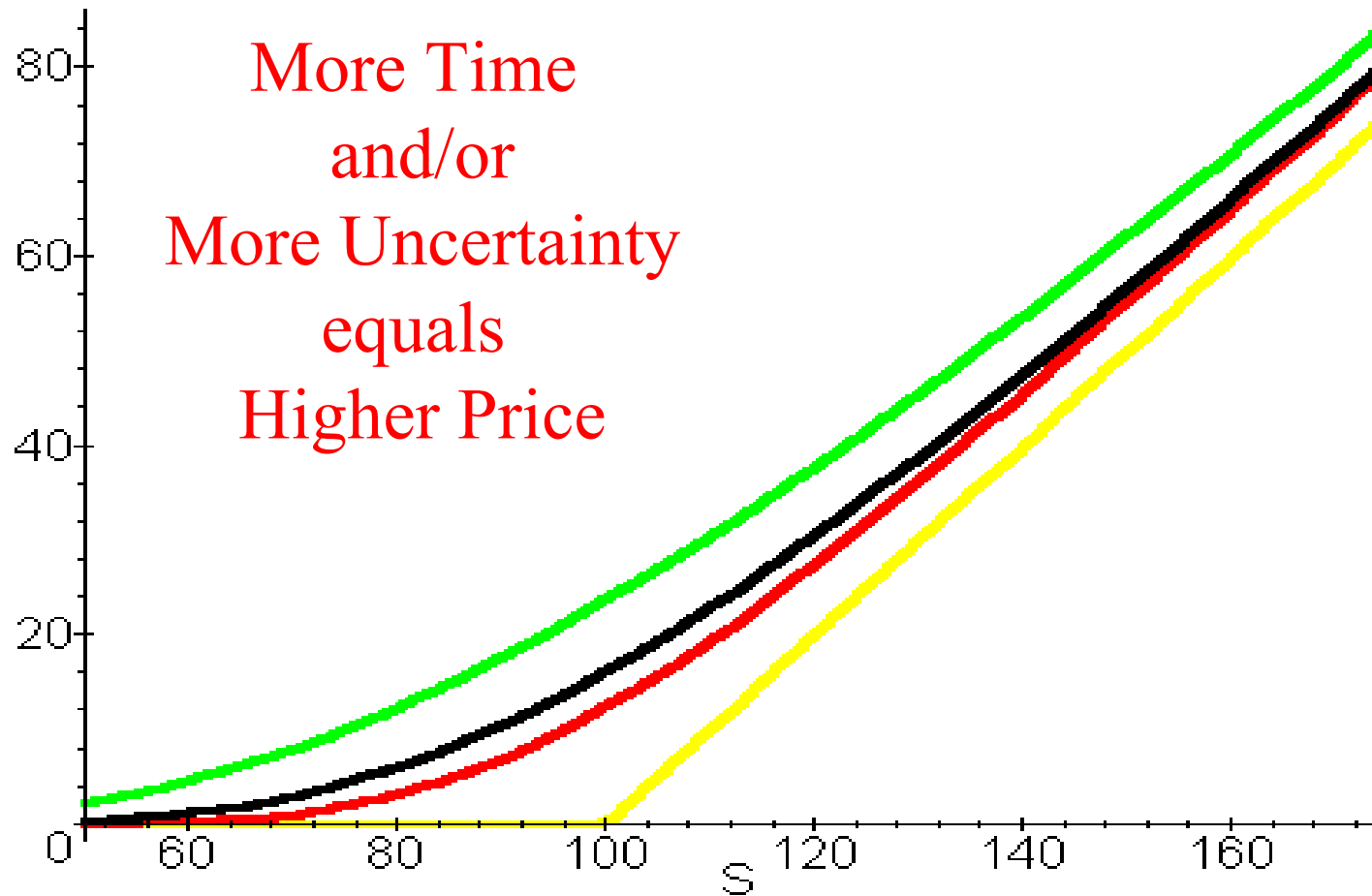
- A **financial option** is the **right**, but not the obligation to **buy/sell** an asset at a fixed **price**, during a certain **period**.
- Incentive stock options, exchange traded puts & calls, and car leases are examples of financial options.
- Volatility and time induce option value.
- **Real options** are the Human Capital equivalent of **financial options**

Example of a Real Option




- You own a gold mine in South America with 10,000 estimated ounces of reserves.
- The cash extraction costs are \$400 USD per ounce, while the market price is \$270.
- The Net Present Value (NPV) of the gold mine, using standard methods, is zero.
- Is the mine (project) worth anything?
- **Yes:** It contains a Real Option

Call Option Price Function



University Education: The Real Option to Expand



- New students must choose a subject major early in their (academic) life.
- The wrong major eliminates, or greatly reduces, certain career opportunities.
- There is an **option to expand** that comes from choosing a flexible major, even at the expense of lost wages and time.
- Tastes will change. Do Not Rush!

Marriage: The Option to Delay



- Projects are mutually exclusive.
- Costs incurred, when trying to reverse or abandon, are high.
- What are the probabilities of locating a better project?
- Evidence that delay is correlated with the availability of competition.

Housing and Mortgages

- The transaction costs associated with selling (or buying) a house can be substantial.
- It provides an incentive to delay purchases.
- Rent vs. Buy comparison should account for all the **real options** in the two choices.
- Floating rate open mortgages contain the embedded **real option** to lock-in at any time.
- Home improvement is a **real option**.

Protected Investment Funds



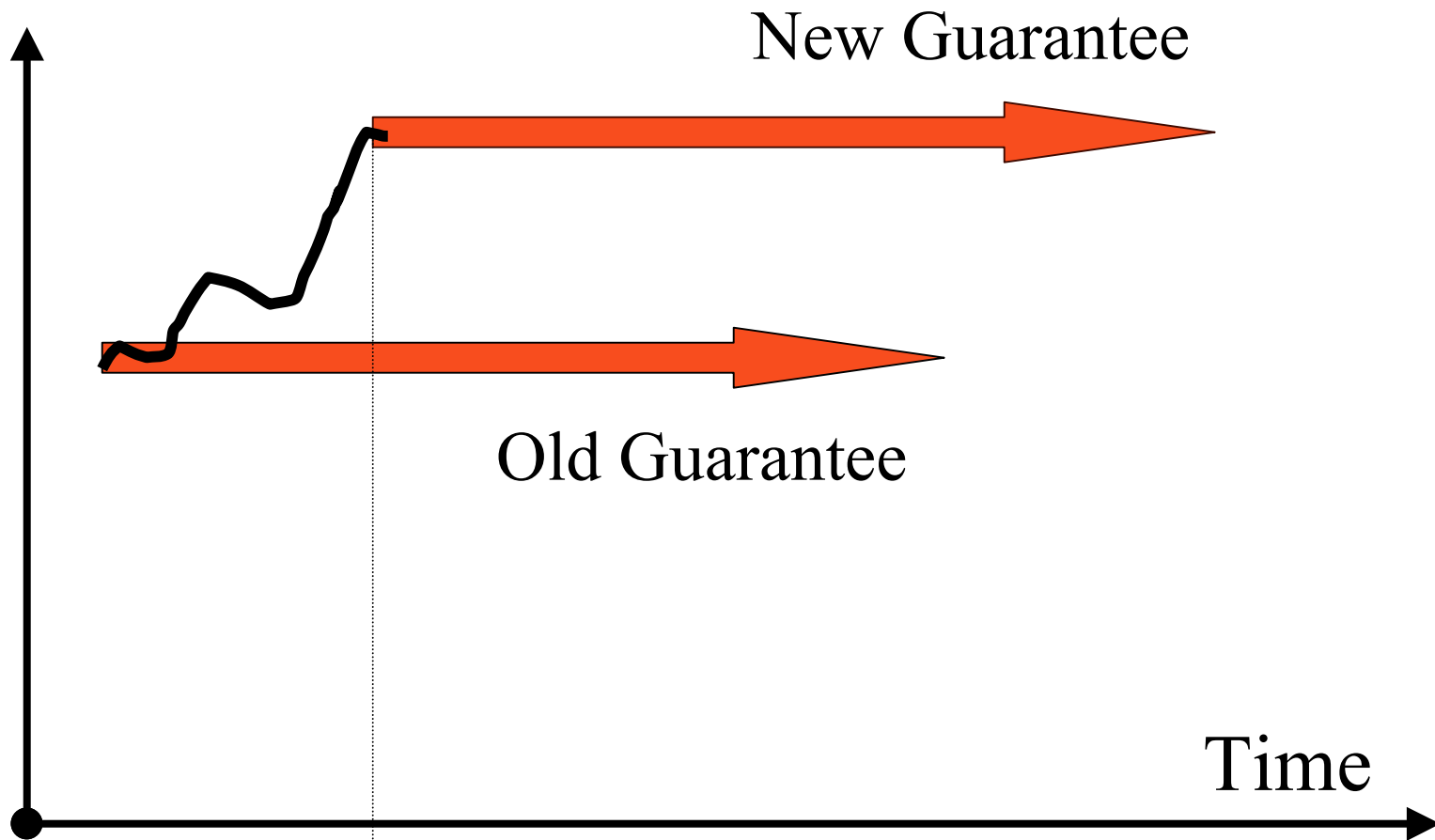
- Many contain a 100% maturity guarantee.
- This put option has some value.
- Is it worth the extra cost?
- Do you need the protection?
- You have a **real option** to re-establish the basis of the guarantee.

What are the chances of dying during the next ten years?

Current Age	Female	Male
40	1%	3%
50	3%	6%
60	9%	16%
70	22%	35%
80	50%	66%

Source: StastCan 1996

When is it optimal to lapse?



Real Options in Life Insurance



- Guaranteed insurability is a **real option**.
- Should you purchase a cash value policy, or should you buy convertible-term, and retain the **real option** to convert later?
- Buy-term and invest-the-difference analysis misses the **real option** value.
- Tax policy might change in the future.

Pension Savings



- Savings: qualified or outside the shelter?
- Should you contribute now or later?
- The high return from contributions may not exceed the lost option value to delay.
- Instead of collapsing a pension, borrow at higher rate, since you lose the option.
- Options in converting from DB to DC.

Option to Work and Retire



- Once retired it is difficult to return to the labor force and start working again.
- Early retirement exercises a **real option**.
- It might be best to delay retirement until you are absolutely sure the **option to work** has no future utility.

Real Option to Start a Pension Annuity



- The purchase of a lifetime (pension) annuity is non-reversible, but can always be delayed.
- The benefit is protection against longevity risk, the cost is the loss of liquidity.
- When is the optimal time to exercise this real option?
- Detailed analysis follows (time permitting)

Case Study: Annuitization



- At retirement, most people must decide how much of their liquid wealth should be voluntarily annuitized.
- Few people choose to buy life annuities, despite strong reasons for annuitization.
- The decision is irreversible, can always be delayed and therefore contains an option.

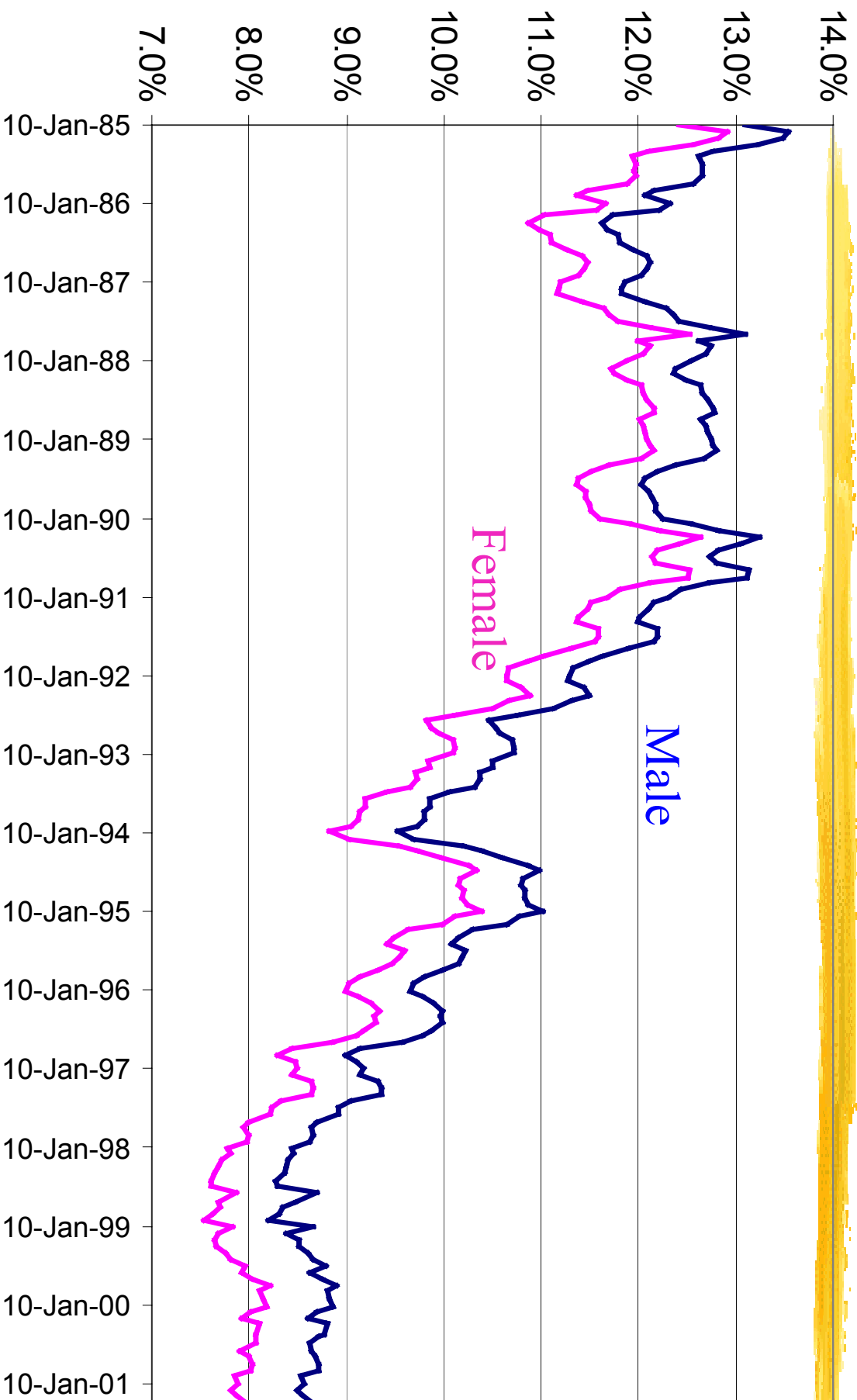
Life Annuity Quotes: Male

Per \$100,000 Purchase (Zero Guarantee)

InsCo	<u>60</u>	<u>65</u>	<u>70</u>	<u>75</u>	<u>80</u>
A.	665	741	849	1,002	1,222
B.	650	706	778	890	1,050
C.	679	772	891	1,042	
D.	675	752	864	1,026	
E.	667	738	834	983	1,194
F.	646	716	816	958	1,160

Source: CANNEX, April 4, 2001

Evolution of the Annuity Yield Curve Age 65 with 10yr pc: 1985 - 2001



You Are 65 Years Old: How Long Will You Live?

Live to Age:	Female:	Male:
70	94.0%	89.2%
75	85.5%	75.1%
80	73.4%	57.6%
85	56.6%	38.2%
90	35.9%	20.1%
95	18.6%	7.5%

Source: Statistics Canada 1995/1996 Health Tables

Fixed IA Pricing: Payment Contingent on Life

$$a_x = L + (1 + l) \sum_{i=1}^{\infty} \frac{({}_i p_x)(c_i)}{(1 + r_i)^i}$$

Three Ingredients:

- 1.) Explicit Loading
- 2.) Mortality Rates
- 3.) Discount Rates

Annuity Factor

Can you 'beat' the rate of return from a life annuity?

Fact: $a_x (1 + K) - 1 \geq a_{x+1}$

If: $K = \frac{1}{{}_1P_x} (1 + r) - \frac{l}{a_x} - 1$

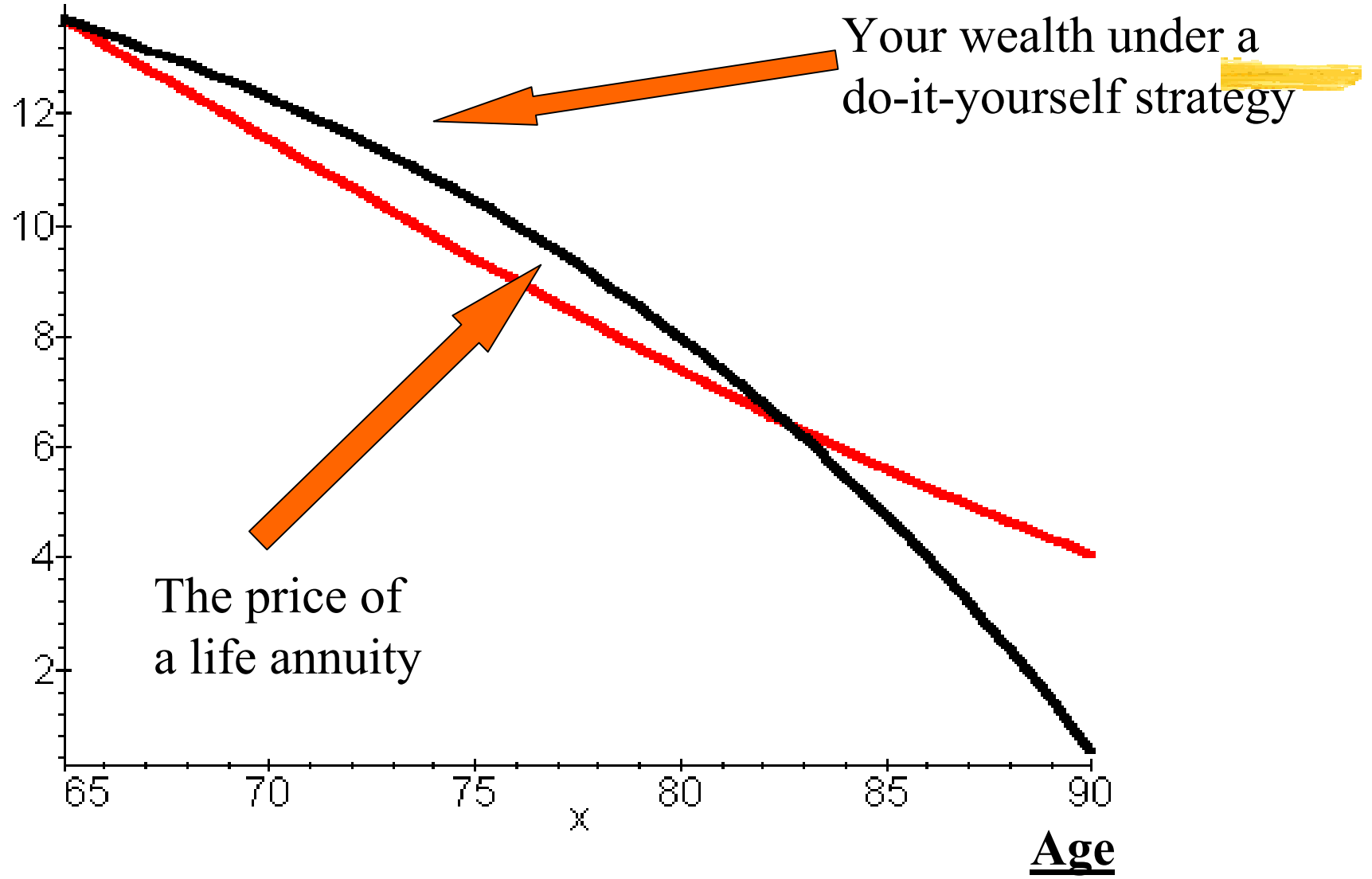
...when the actuarial load and the interest rate are constant.

Numerical Example: How To Beat a Life Annuity

Age	Death Probability	Required Return
55	2.26/1000	6.2%
65	5.76/1000	6.6%
75	16.34/1000	7.8%
85	54.05/1000	12.1%
90	95.84/1000	17.2%

Assumptions: R=6%, load=0%, IAM1996 Table

Evolution of Wealth v.s. Cost of Annuity



The Real Option Value:

Female (Male)

Age	CRRA = 1	CRRA = 2
60	44% (32%)	15% (9%)
65	33% (22%)	10% (4%)
70	23% (12%)	5% (1%)
75	12% (4%)	1% (0%)
80	4% (0%)	0% (0%)
85	0% (0%)	0% (0%)


Source: Milevsky & Young, 2001

Conclusion: Life Annuity



- The decision is irreversible.
- Do not buy it too early, since you are losing the option to buy it later.
- Do-it-yourself and-then-switch gives the best odds of success.
- Later in life (80+), the return from life annuities are very high.

Real Options in Your Life: A Litmus Test

- Is it difficult or impossible to reverse the decision you are about to make?
- Will time tell whether or not you made the right decision?
- Is your downside-risk limited if you wait?
- Can your preferences change?
-  The Real Option Has Value
- Wait!

Summary



- We should manage the individual balance sheet like a corporation.
- Assets of Me Inc. should include **human capital** and **real options**.
- The **value** is not trivial to determine.
- We can employ **risk management** and **optimal timing** concepts for individuals.

Next Week...



- Discuss the products that have been developed by the **insurance industry** to better manage personal financial risk.
- How to **price, reserve** and set **capital** for these innovative products that merge financial and actuarial risk.
- Using shortfall **probabilities** to manage asset allocation for individual portfolios.

How to Reach Me:



- Milevsky@YorkU.ca
- Tel: (416) 736-2100 ext: 66014
- Fax: (416) 736-5487

www.milevsky.com