

# Module 21 : Risk Management for Individuals

## 21.1: Human and financial Capital

$$\text{Total Wealth} = \text{Human Capital} + \text{Financial Capital}$$

↑  
discounted PV of future labor      }  
sum of all other assets

### Human Capital

#### EXAMPLE: Estimating HC

Alex Hamilton is 62 and expected to retire in 3 years. His current annual wage is 100,000 and expected to increase 4% per year. The risk-free discount rate is 3%, and his continued employment is considered very risky. A 10% risk premium is assumed. Using this information and the survival probabilities in the table, calculate his HC.

Increase earnings by 4% per year for the 3 years of employment, probability weight the earnings, and discount to the present value (PV) at 13% per year. 13% is the risk-free rate plus the risk premium.

Yr	Prob. of life	Projected Wage.	Prob. Weighted	PV
1	98%	104,000	101,920	90,195
2	98%	108,160	105,997	83,011
3	97%	112,486	109,111	75,619
4	97 %	0		
5	96 %	0		HC = 248,825

$$101,920 \div 1.13 = 90,195$$

## Module 21.2: Risks & Insurance

21.d: Typical risk for individual:

- Earnings risk
- Premature death risk
- Longevity risk
- Property risk
- Liability risk
- Health risk

## Financial Stages of life

Economic net worth = sum(FC, HC) - liabilities

### Education :

Early Career: life insurance may be needed to insure substantial HC against death & the cessation of work  
Career Development:

### Peak Accumulation

### Preretirement

### Early Retirement

### Late retirement:

### The individual's balance sheet

#### 21.c : economic balance sheet

exclude the traditional balance sheet assets to include HC.

##### EXAMPLE: Holistic balance sheet

(The items in bold italics are those not found on a traditional balance sheet.)

Assets (in thousands):		Liabilities (in thousands):	
Financial		Short-term debt	175
Current assets	500	Home mortgage	500
Investment assets	1,500		
Non-marketable		<i>Primary capital to fund lifetime expenses</i>	<i>3,500</i>
Home	750		
DC plan balance	1,450		
<i>Private pension</i>	40	<i>Planned bequests</i>	<i>1,000</i>
<i>Government pension</i>	450		
Human			
<i>Future labor income</i>	250		
Total Assets	4,940	Total Liabilities	5,175

Based only on the traditional balance sheet, the assets of 4,200,000 well exceed explicit debts of 675,000, while the holistic balance sheet shows negative net worth of 235,000. This suggests consumption and bequest plans are unrealistic. However, it is generally more difficult to value the additional items on the economic balance sheet, and the negative net worth could be an estimation error. There could also be missing economic assets such as expected inheritance that need to be included. If net worth is actually negative, it indicates ultimate spending plans will eventually have to change. The relatively low amount of HC (not pension benefits) suggests the individual is near retirement.

For many individuals, total wealth (HC + FC) as well as FC will peak near retirement. Both will then be drawn down in retirement.



### Module Quiz 21.1, 21.2

1. An individual's present value of future defined benefit payments will *most likely* be classified as:
  - A. financial capital.
  - B. human capital.
  - C. financial capital and total wealth.
2. Financial capital is *least likely* to peak at retirement for:
  - A. the very wealthy.
  - B. those with a pension.
  - C. those who purchase an annuity.
3. Individuals are *most likely* to need substantial amounts of life insurance in which stage of life?
  - A. Education.
  - B. Career development.
  - C. Early retirement.
4. An individual with negative net worth on a traditional balance sheet:
  - A. should reduce expenses.
  - B. should increase risk in their investment portfolio.
  - C. may have positive net wealth.
5. An individual with a large alternative investment holding in art work is *most likely* to need:
  - A. property insurance.
  - B. life insurance.
  - C. liability insurance.
6. An individual is about to retire. She will receive her first annual pension payment of \$25,000 immediately upon retirement and immediately spend it on a lavish vacation. Then, one year later, she will receive another payment. Each payment will increase by 5% from the previous payment amount. Given her life expectancy, she expects to receive a total of 11 payments.  
The risk-free discount rate is 3%, and the risk premium for the pension is 8%. Ignoring the first payment, which she will immediately spend, the pension asset of 10 payments to include on the individual's holistic balance sheet is *closest* to:
  - A. 170,000.
  - B. 185,000.
  - C. 200,000.

1. C /

2. A / The very wealthy may spend less than the total return & see their FC increase over time.

3. C (B)

4. C /

5. C (A)

6. B /

## 21.3: Life insurance

### Basic terminology

Benefit / face amt : future payout

Premium : cost of insurance

Cash value : what owner can withdraw before payout

Paid up : a date when the insurance is fully paid for & no additional premiums are required

Limitations : restrictions on the payout

Contestability period : time period for the insurance comp.

to investigate

Policy owner : Responsible for the premium payment, often the insured

Riders : additional provisions included in the policy

Modifications : allowable changes can be made to the policy

## 21.e: Types of insurances.

Life insurance:

- 2 main types (temporary / term & permanent)

Insurance terminology is not mutually exclusive, think of term insurance as pure insurance.

- Term insurance covers only a designated period such as 1, 5, 20 years. Term insurance is usually less costly than perm. insurance

- Permanent insurance is more costly, last for the life of the insured. The premium per period is usually fixed & the policy builds value as the premium exceeds the pure cost of the insurance in the initial years. can be categorized as whole life or universal insurance.

- Whole life has fixed annual prem. pmt, cannot be cancelled by insurance comp. as long as premiums are paid. (make participating @ a young age much more desirable)

- Universal life is similar but with more flexibility. Prem. payments can be increased/decreased to increase/decrease the insurance amt and/or the rate at which cash value grows.

There may be investment choices where the premiums are invested. Prem. payments can be discontinued & the insurance continues as long as the cash value & earnings are sufficient to pay the pure cost of insurance each period

## 21.f: Basic elements of a life insurance policy

The pricing model can be broken into 3 issues:

- mortality estimates

goal : avoid adverse selection & undercharging

- Net premiums

based on the estimated mortality rates, the company will estimate the net premium based on an assumed discount rate (i.e. the assumed rate of return on investing prem.).

- Load

(the operating cost of expenses for writing the policy)

load + net premium = gross premium

Pricing a level 5-yr term policy is more complex than pricing 5 1-yr term policy. The premium CONCEPTUALLY should be the weighted avg. of the sequential term premiums but in reality should be higher as the company is at greater risk.

Permanent insurance charges a higher premium b/c of more uncertainty on the ultimate life expectancy. Many policies include a buildup of cash value that the policyholder can access before policy payout. Cash buildup is created by an even higher premium

## 2 approaches to compare insurance policies:

### - net payment cost index

(assumes individual dies at the end of the horizon & no cash value)

### - net surrender cost index

(assumes insurance ceases at the end of the horizon & the cash value is received)

To illustrate the issues, assume a 25-year time horizon till death and a 5% discount rate on a \$100,000 insurance policy.

- Policy XX has annual beginning of year premiums of \$2,000 and an assumed annual end of year dividend (return of premium) of \$500. Terminal 25 year cash value projected (by the insurance company) to be \$25,000.
- Policy YY has annual beginning of year premiums of \$2,200 and an assumed annual end of year dividend (increase in cash value) of \$550. Terminal 25 year cash value projected (by the insurance company) to be \$27,500.

### Net Pmt cost index:

period ① beginning of year

Step ① : Compute FV of premiums due, an annuity due.

$$\text{Policy XX: } 2000 \text{ pmt, } 5\% \text{ i, } 25 \text{ n} \Rightarrow FV = 100,227.$$

$$\text{Policy YY: } 2200 \text{ pmt, } 5\% \text{ i, } 25 \text{ n} \Rightarrow FV = 110,250$$

period ② end of yr

Step ② : Compute FV of dividends; an ordinary annuity

$$\text{Policy XX: } 500 \text{ pmt, } 5\% \text{ i, } 25 \text{ n} \Rightarrow FV = 23,864$$

$$\text{Policy YY: } 550 \text{ pmt, } 5\% \text{ i, } 25 \text{ n} \Rightarrow FV = 26,250$$

Step ③ : FV cost of insurance = ① - ②

Policy XX:  $100,227 - 23,864 = 76,363$

Policy YY:  $110,250 - 26,250 = 84,000$

Step ④ : Annuitize the FV diff

Policy XX:  $76,363$  FV, 5 i<sub>p</sub>, 25n  $\Rightarrow$  PMT = 1,524

Policy YY:  $84,000$  FV, 5 i<sub>p</sub>, 25n  $\Rightarrow$  PMT = 1,676

$(\$100,000 \div 1000 = 100)$

Step ⑤ : Divide by \$1000 of insurance policy amount to index the annual cost.

Policy XX:  $\$1524 / 100 = \$15.24$

Policy YY:  $\$1676 / 100 = \$16.76$

per ④ beginning of year

Net Surrender Cost Index

Step ① : Compute FV of premiums due, an annuity <sup>↓</sup> due.

Policy XX: 2000 pmt, 5 i, 25n  $\Rightarrow$  FV = 100,227.

Policy YY: 2200 pmt, 5 i, 25n  $\Rightarrow$  FV = 110,250

Step ② : Compute FV of dividends; an ordinary <sup>↓</sup> annuity

Policy XX: 500 pmt, 5 i, 25n  $\Rightarrow$  FV = 23,864

Policy YY: 550 pmt, 5 i, 25n  $\Rightarrow$  FV = 26,250

Step ③ : FV cost of insurance = ① - ② - Projected cash val.

Policy XX:  $100,227 - 23,864 - 25,000 = 51,363$

Policy YY:  $110,250 - 26,250 - 27,500 = 56,500$

/ /

Step ④: Annuitize the FV diff

Policy XX: 51,363 FV, 5 i<sub>p</sub>, 25n  $\Rightarrow$  PMT = 1,025

Policy YY: 56,500 FV, 5 i<sub>p</sub>, 25n  $\Rightarrow$  PMT = 1,127

$$(\$100,000 \div 1000 = 100)$$

Step ⑤: Divide by \$1000 of insurance policy amount to index the annual cost.

Policy XX:  $\$1,025 / 100 = \$10.25$

Policy YY:  $\$1,127 / 100 = \$11.27$

Other types of insurance:

- disability income insurance
- Property insurance
- Health & medical insurance
- Liability insurance



MODULE QUIZ 21.3

1. The volatility of human capital and the demand for life insurance are:
  - uncorrelated.
  - positively correlated.
  - negatively correlated.
2. Which of the following statements regarding the pricing of life insurance policies is most accurate?
  - Mortality tables are built to reflect past experiences of mortality.
  - For a level payment five-year term policy, the level premium should be higher than the Year 5 premium for an annual term policy.
  - Based on the assumed mortality rates, the insurance company estimates the net premiums to charge for insurance based on the assumed rate of return on investing the premiums.
3. Consider the following policy:

Insurance amount	= \$250,000
Annual premium	= \$4,850
Expected annual dividend	= \$1,190
Time to maturity	= 30 years
Expected surrender value	= \$70,000

Based on a discount rate of 8%, the net surrender cost index per 1,000 of insurance is closest to:
  - \$12.70.
  - \$13.10.
  - \$13.80.

1. B (C)

2. A (C)

3.  $(4850 \text{ Annuity} - 1190 \text{ Annuity} - 70,000) \rightarrow PV / 1000$   
X  
not needed

= (A)

## 21.4: Annuities

def: an one-time premium payment in exchange for fixed payout received for the life of the annuitant.

Basic terminology includes:

- insurer collects prem. & makes payout
- annuitant receives payout
- Contract owner pays the premium (usually is the annuitant)
- beneficiary receives the remaining value of the contract  
② the death of the annuitant.
- the premium can also be referred as the value of the contract.

## 21.9: Use of annuity in personal financing planning

e.g. DB plan from a private company or government that pays for the life of the retiree

**Deferred Annuity:** annual receipts start @ a deferred time.

**Deferred common Annuity:** allow owner to select from a list of investment options

**Deferred fixed Annuity:** pays a fixed benefit for life that starts at a defined future date.

**Advanced life deferred Annuity:** like deferred fixed Annuity but the delay before start is long (mainly to hedge the longevity risk)

**Immediate variable annuities:**

**Immediate fixed annuities:**

## 21.h: relative advantages & disadvantages of fixed & variable annuities

- Volatility
- Flexibility
- Future market expectations
- inflation
- Taxes



### MODULE QUIZ 21.4

1. Insured individuals who live longer than the statistical average are *most likely* to earn a positive (benefit from the) mortality credit with:
  - life insurance.
  - an annuity.
  - both life insurance and an annuity.
2. In which of the following situations would an individual be *most likely* to purchase a variable rather than a fixed annuity?
  - They need a more certain income stream.
  - They want to avoid higher fees.
  - They want the flexibility to redeem the annuity in the future.
3. An individual should *most likely* purchase insurance for a risk that:
  - poses high standard of living risk and is infrequent.
  - poses high standard of living risk and is frequent.
  - is smaller in amount and infrequent.

1. B

2. C

3. A

## Module 21.5: Comprehensive Example & Review

**MODULE QUIZ 21.5**

1. An individual in a high-risk job will *most likely*:
  - A. increase their allocation to industries that are highly correlated with their wage income.
  - B. increase their allocation to risk-free assets.
  - C. reduce their savings.
2. The need for retirement savings is *most likely* higher for:
  - A. a recent college graduate with very young children.
  - B. a young couple who has recently received a large inheritance.
  - C. an older couple in their peak earnings years but employed in a declining industry.

1. B

2. C