FN241
Risk Management and Insurance
Financial Operations of Insurers

Sakkakom Maneenop

FS of Non-life Insurers

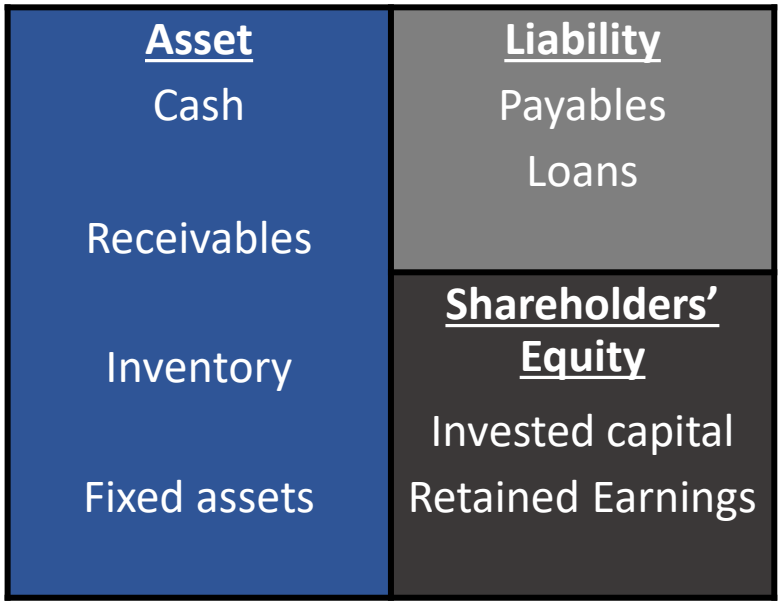
- A balance sheet is a summary of what a company owns (assets) and what it owes (liabilities), and the difference between total assets and total liabilities (owners' equity)

Total Assets = Total Liabilities + Owners' Equity

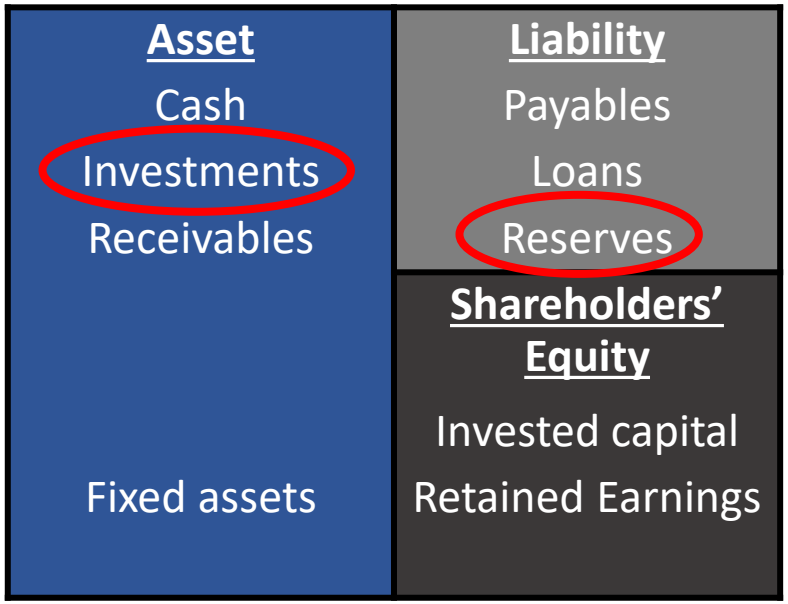
FS of Insurers

How to value an Insurance Company: Balance Sheet

Manufacturing company



Insurance company



ABC Insurance Company

ABC Insurance Company
Balance Sheet
December 31, 2012

Assets:		Liabilities:	
Bonds	$250,000,000	Loss Reserves	$120,000,000
Common Stock	80,000,000	Unearned Premiums	101,000,000
Real Estate	20,000,000	Loss Adjustment Expenses	14,000,000
Cash & Short-term Investments	12,000,000	Commissions Payable	9,000,000
Mortgage-backed Securities	30,000,000	Other Liabilities	11,000,000
Total Invested Assets	$392,000,000	Total Liabilities	255,000,000
Premiums Receivable	29,600,000	Surplus and Capital	
Data Processing Equipment	400,000	Paid-in Surplus	16,000,000
Other Assets	18,000,000	Unassigned Surplus	169,000,000
Total Admitted Assets	$440,000,000	Total Liabilities and Surplus	$440,000,000

Source: RM Exhibit 7.1

FS of Non-life Insurers

- The primary assets for an insurance company are financial assets
- Insurers' liabilities include required reserves
- **1) loss reserve** is an estimated amount for:
  - Claims reported and adjusted, but not yet paid
  - Claims reported and filed, but not yet adjusted
  - Claims incurred but not yet reported to the company

- Loss reserves in non-life can be classified as case reserves, reserves based on the loss ratio method, and reserves for incurred-but-not-reported claims

FS of Non-life Insurers

- The **2) unearned premium** is a liability item that represents the unearned portion of gross premiums on all outstanding policies at the time of valuation
  - To assure policyholders that future losses will be paid, the unearned premium reserve is required
  - It is also needed so that refunds can be paid to policyholders who cancel their coverage
  - It also serves as the basis for determining the amount that must be paid to a reinsurer for carrying reinsured polices

FS of Non-life Insurers

- Policyholders' surplus is the difference between an insurance company's assets and liabilities
  - Balancing term (not calculated directly); or a cushion to use if liabilities are higher than expected
  - The stronger a company's surplus position, the greater the security for its policyholders is
  - The level of surplus is an important determinant of the amount of new business that an insurance company can engage in

FS of Insurers

How are profits calculated for an Insurance Company

P&L of a manufacturing company

Revenue	A
Other income	B
Cost of Goods Sold	
Operating Expenses	C
Commissions	
Operating profit	**A + B - C**

P&L of an insurance company

Premium income	A
Investment income	B
Benefits paid	
Operating expenses	C
Commissions	
Operating profit	**A + B - C**

FS of Insurers

- The income and expense statement summarizes revenues and expenses paid over a specified period of time
  - The 2 principal sources of revenue for an insurance company are *premiums* and *investment income*
  - Premiums are not considered wholly earned until the period of protection has passed
  - Premiums earned are those premiums for which insurance protection has been provided
  - Expenses include the cost of adjusting claims, paying the insured losses that occurred, commissions to agents, and general insurance expenses

ABC Insurance Company

ABC Insurance Company
Income and Expense Statement
January 1, 2012–December 31, 2012

Revenues:			
Premiums Written*	$206,000,000		
Premiums Earned		$205,000,000	
Investment Income:			
Interest	14,000,000		
Dividends	2,400,000		
Rental Income	600,000		
Gain on Sale of Securities	1,000,000		
Total Investment Income		18,000,000	
Total Revenues			$223,000,000

Source: RM Exhibit 7.2

ABC Insurance Company

Expenses:			
Net Losses Incurred	133,600,000		
Loss Adjustment Expenses	14,000,000		
Total Losses and Loss Adj. Expenses		147,600,000	
Commissions	18,000,000		
Premium Taxes	5,050,000		
General Insurance Expenses	41,590,000		
Total Underwriting Expenses		64,640,000	
Total Expenses			212,240,000
Net Income Before Taxes			10,760,000
Federal Income Tax			3,260,000
Net Income			7,500,000

*Premiums written reflect coverage put in force during the accounting period.

Source: RM Exhibit 7.2

Measuring Profit or Loss

- The loss ratio is the ratio of incurred losses and loss adjustment expenses to premiums earned

$$Loss\ Ratio = \frac{Incurred\ Losses + Loss\ Adjustment\ Expenses}{Premiums\ Earned}$$

- The expense ratio is equal to the company's underwriting expenses divided by written premiums

$$Expense\ Ratio = \frac{Underwriting\ Expenses}{Premiums\ \ Written}$$

- The combined ratio is the sum of the loss ratio and the expense ratio. *A ratio greater than 1 indicates an underwriting loss*

Measuring Profit or Loss

- The investment income ratio compares net investment income to earned premiums

$$Investment\ Income\ Ratio = \frac{Net\ Investment\ Income}{Earned\ Premiums}$$

- The overall operating ratio is equal to the combined ratio minus the investment income ratio

FS of Life Insurers

- The balance sheet – Primarily **financial assets** with some major differences from non-life
  - The assets of a life insurer have a longer duration, on average, than those of non-life insurers
  - Because many life insurance policies have a savings element, life insurers keep an interest-bearing asset called “contract loans” or “policy loans”
  - A life insurance company may have separate accounts for variable annuities, unit-linked products, etc.

FS of Life Insurers

- The balance sheet - **Liabilities**
  - Policy reserves are the major liability item of life insurers
  - Under the level-premium method of funding cash-value life insurance, premiums paid during early years are higher than necessary, while those paid in later years are insufficient
  - The excess premiums collected in early years must be accounted for and held for future payment as a death claim
  - Laws specify the minimum basis for calculating policy reserves

FS of Life Insurers

Income statements

- Major sources of revenues are premiums and income from investments
- Benefit payments, including health insurance benefits, surrender benefits, matured endowments, death benefits paid to beneficiaries, and annuity benefits paid to annuitants, are the life insurer's major expenses
- Other important expenses include increased reserves, general insurance expenses, agents' commissions and fees
- A life insurer's net gain from operations (or net income) equals total revenues less total expenses, policyowner dividends, and income taxes

Ratemaking in Life Insurance

- Life insurance actuaries use a mortality table or individual company experience to determine the probability of death at each attained age
- Expected future payments are discounted back to the start of the coverage period and summed to determine the net single premium or level installment premiums
- The annual expected value of death claims equals the probability of death times the amount the insurer must pay if death occurs

Calculation of Life Insurance Premiums

- The net single premium (NSP) is defined as the present value of the future death benefit

- The NSP is based on three assumptions:
  - Premiums are paid at the beginning of the policy year
  - Death claims are paid at the end of the policy year
  - The death rate is uniform throughout the year

Calculating the Net Single Premium for Term Insurance

- For yearly renewable term insurance, the cost of each year's insurance is easily determined:

$$\left(\begin{array}{c}\text{amount of}\\ \text{insurance}\end{array}\right)\times\left(\begin{array}{c}\text{probability}\\ \text{of death}\end{array}\right)\times\left(\begin{array}{c}\text{PV \$1 for period}\\ \text{funds are held}\end{array}\right)$$

Table of Mortality, Male Lives

Age	*Number Living at Beginning of Designated Year*	*Number Dying During Designated Year*	*Yearly Probability of Dying*
30	9,800,822	11,173	0.00114
31	9,789,650	11,062	0.00113
32	9,778,587	11,050	0.00113
33	9,767,537	11,233	0.00115
34	9,756,305	11,512	0.00118
35	9,744,792	11,791	0.00121
36	9,733,001	12,458	0.00128
37	9,720,543	13,026	0.00134
38	9,707,517	13,979	0.00144
39	9,693,539	14,928	0.00154
40	9,678,610	15,970	0.00165

SOURCE: Excerpted from 2001 CSO Composite Ultimate, Male, ANB.

Source: RM Exhibit A1

Present Value of $1 at 5.5% Compound Interest

Number of Years	5.5%
1	0.9479
2	0.8985
3	0.8516
4	0.8072
5	0.7651
6	0.7252
7	0.6874
8	0.6516
9	0.6176
10	0.5854

Source: RM Exhibit A2

Calculating the NSP for Term Insurance

- For a 5-yr term policy (Male, age 32), the cost of each year's mortality must be computed separately for each of the five years and then added together to determine the NSP

Age	*Amount of Insurance*		*Probabiity of Death*		*Present Value of $1 at 5.5%*		*Cost of Insurance*
32	$1000	×	11,050 / 9,778,587	×	.9479	=	$1.07 (year 1)
33	$1000	×	11,233 / 9,778,587	×	.8985	=	1.03 (year 2)
34	$1000	×	11,512 / 9,778,587	×	.8516	=	1.00 (year 3)
35	$1000	×	11,791 / 9,778,587	×	.8072	=	0.97 (year 4)
36	$1000	×	12,458 / 9,778,587	×	.7651	=	0.97 (year 5)
					NSP	=	$5.04

Calculating the NSP for Ordinary Life Insurance

- For an ordinary life insurance policy, the cost of each year's mortality must be computed separately for each year to the end of the mortality table, and then added together to determine the NSP
- If the remaining calculations are performed, the NSP for a $1,000 ordinary life insurance policy will be $109.49

Calculating the NALP

- In the event of an early death, the cost of insurance is high compared with the annual cost.
- Most people cannot afford the single premium.
- If premiums are paid annually, **the net annual level premium (NALP)** must be mathematically equivalent of the NSP.
- The net annual level premium (NALP) cannot be determined by simply dividing the NSP by the number of years of premium payments.
  - Some insureds die early → loss of future premiums
  - Installment payments result in loss of interest income

Calculating the NALP

- The net annual level premium is calculated using a formula:

$$\text{NALP} = \frac{\text{Net single premium}}{\text{PVLAD of \$1 for the premium - paying period}}$$

- If premiums are paid for life, the premium is called a whole life annuity due
- If premiums are paid for only a temporary period, the premium is called a temporary life annuity due

Calculating the NALP

Age 32	\$1 due immediately	\$1.00
Age 33	$\frac{9{,}767{,}537}{9{,}778{,}587} \times \$1 \times .9479 = 0.95$	
Age 34	$\frac{9{,}756{,}305}{9{,}778{,}587} \times \$1 \times .8985 = 0.90$	
Age 35	$\frac{9{,}744{,}792}{9{,}778{,}587} \times \$1 \times .8516 = 0.85$	
Age 36	$\frac{9{,}773{,}001}{9{,}778{,}587} \times \$1 \times .8072 = 0.81$	
	PVLAD of \$1	= \$4.51

$$\text{NALP} = \frac{\text{NSP}}{\text{PVLAD of \$1}} = \frac{\$5.04}{\$4.51} = \$1.12$$

Policy Reserves

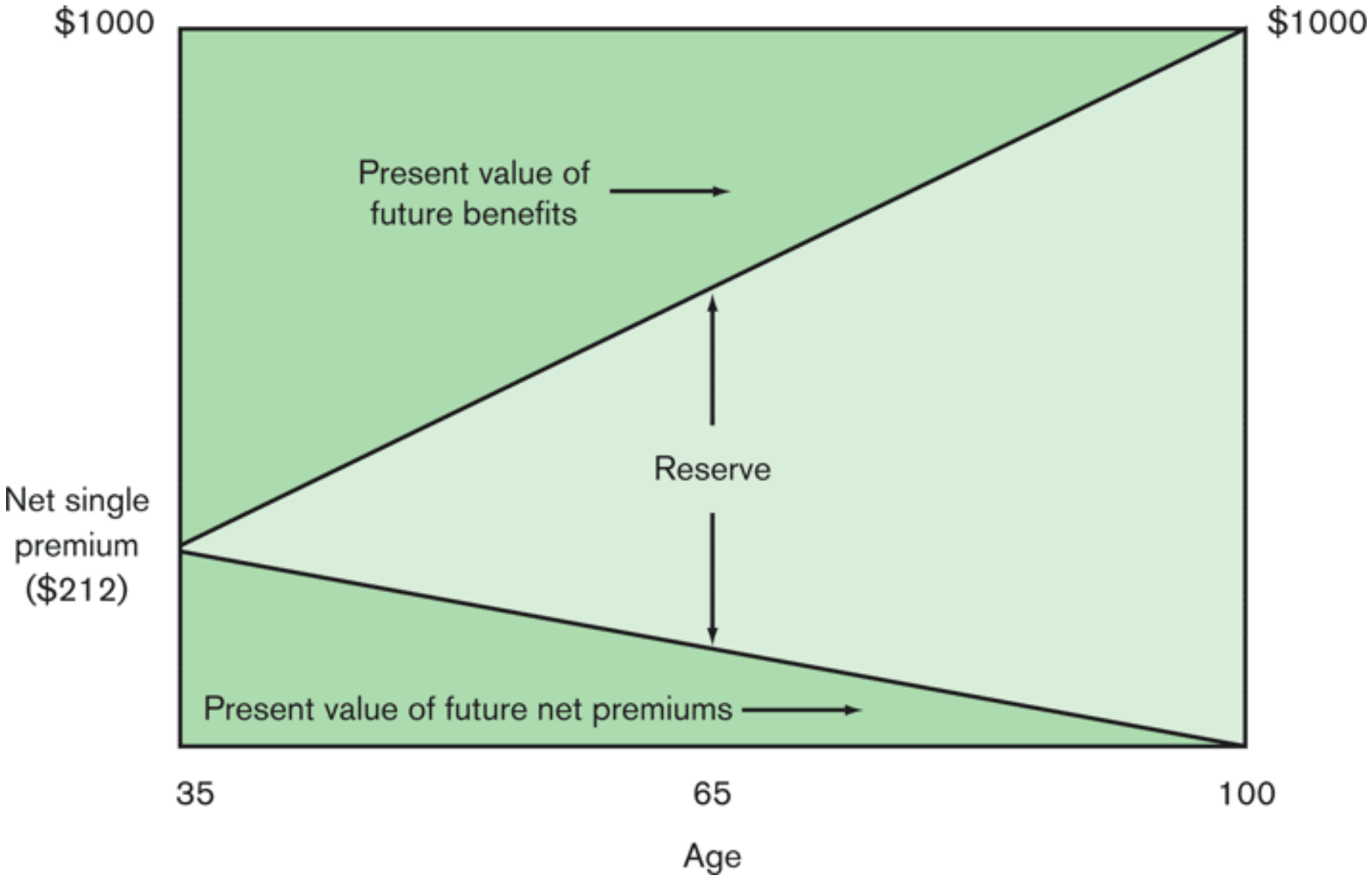
- Under the level-premium method for paying premiums, premiums paid during early years are higher than necessary to pay death claims
- The excess premiums are reflected in the policy reserve
- Policy reserves are a liability item on the insurer's balance sheet that must be offset by assets equal to that amount

Policy Reserves

- The policy reserve has two purposes:
  - Formal recognition of the insurer's obligation to pay future claims
  - Legal test of the insurer's solvency

- The policy reserve is the difference between the PV of future benefits and the PV of future net premiums
- The prospective reserve is the difference between the present value of future benefits and the present value of future net premiums

Prospective Reserve — Whole Life Insurance



Policy Reserves

- The retrospective reserve represents the net premiums collected by the insurer for a particular block of policies, plus interest earnings at an assumed rate, less the assumed death claims paid out

- Both methods will produce the same level of reserves at the end of any given year under the same actuarial assumptions

Policy Reserves

- A terminal reserve is the reserve at the end of any given policy year

- The initial reserve is the reserve at the beginning of any policy year

- The mean reserve is the average of the terminal and initial reserves. It is used to indicate the insurer's reserve liabilities on its annual statement

Policy Reserves

Age at Beginning of Year	*Number Living at Beginning of Designated Year*	*Number Dying During Designated Year*	*Present Value of $1 at 5.5%*	
			Year	*Factor*
30	9,800,822	11,173	1	0.9479
31	9,789,650	11,062	2	0.8985
32	9,778,587	11,050	3	0.8516
33	9,767,537	11,233	4	0.8072
34	9,756,305	11,512	5	0.7651