FIN 4500
Chapter 3
Risk, Cost of Risk, and Risk Management

Xin Li, Ph.D.

1). Two notions of Risk

2). Risk is costly – Direct/Indirect losses, Uncertainty

3). Alternative risks

4). Risk management and its process

5). Minimize cost of risk vs. Maximize firm value

(materials from Chapters 1 and 2, HN)

Two Useful Notions of Risk

- 2 Common & Useful Ways that People think of Risk
  - A situation is riskier than another when

    (1) there is greater expected loss (probability of a loss or severity of loss)

    Example: young drivers are riskier than middle-aged drivers

    (2) there is greater uncertainty (less predictability) of outcomes

    Example: a bio-tech stock is riskier than a utility stock

    <u>A conventional definition of risk in finance</u>

Risk is often Costly

- Greater risk often imposes costs (reduces value)
  - Example:
    - Property value with zero prob of damage = $100,000
    - Introduce risk:
      - Loss of $60,000 occurs with prob 0.1 during the next week
      - What is the property worth today (ignoring time value of money)?

      - Expected value of the property = $94,000

Calculate Expected Asset Value

Loss Distribution

	Loss	Probability
No Loss	0	90%
Loss	60,000	10%

Expected losses
= 0*90% +60,000*10%
= 6,000

Expected Asset value
= 100,000 – 6,000
= 94,000

Asset value distribution

	Asset Value	Probability
No Loss	100,000	90%
Loss	40,000	10%

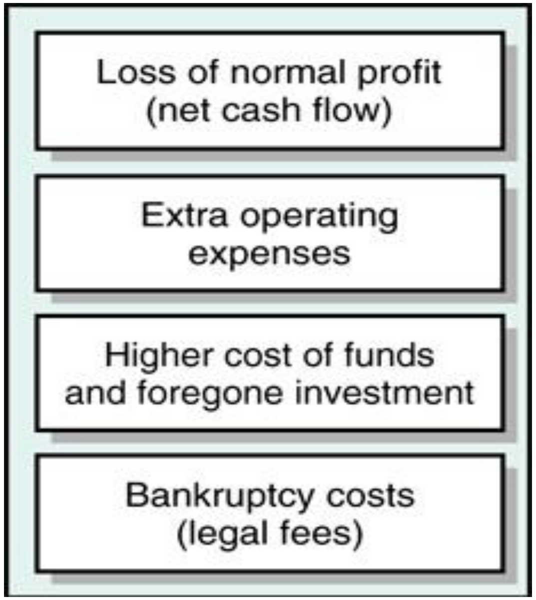
Expected Asset Value
= 100,000*90% +40,000*10%
= 94,000

Expected loss in a week reduces firm value

Indirect Losses

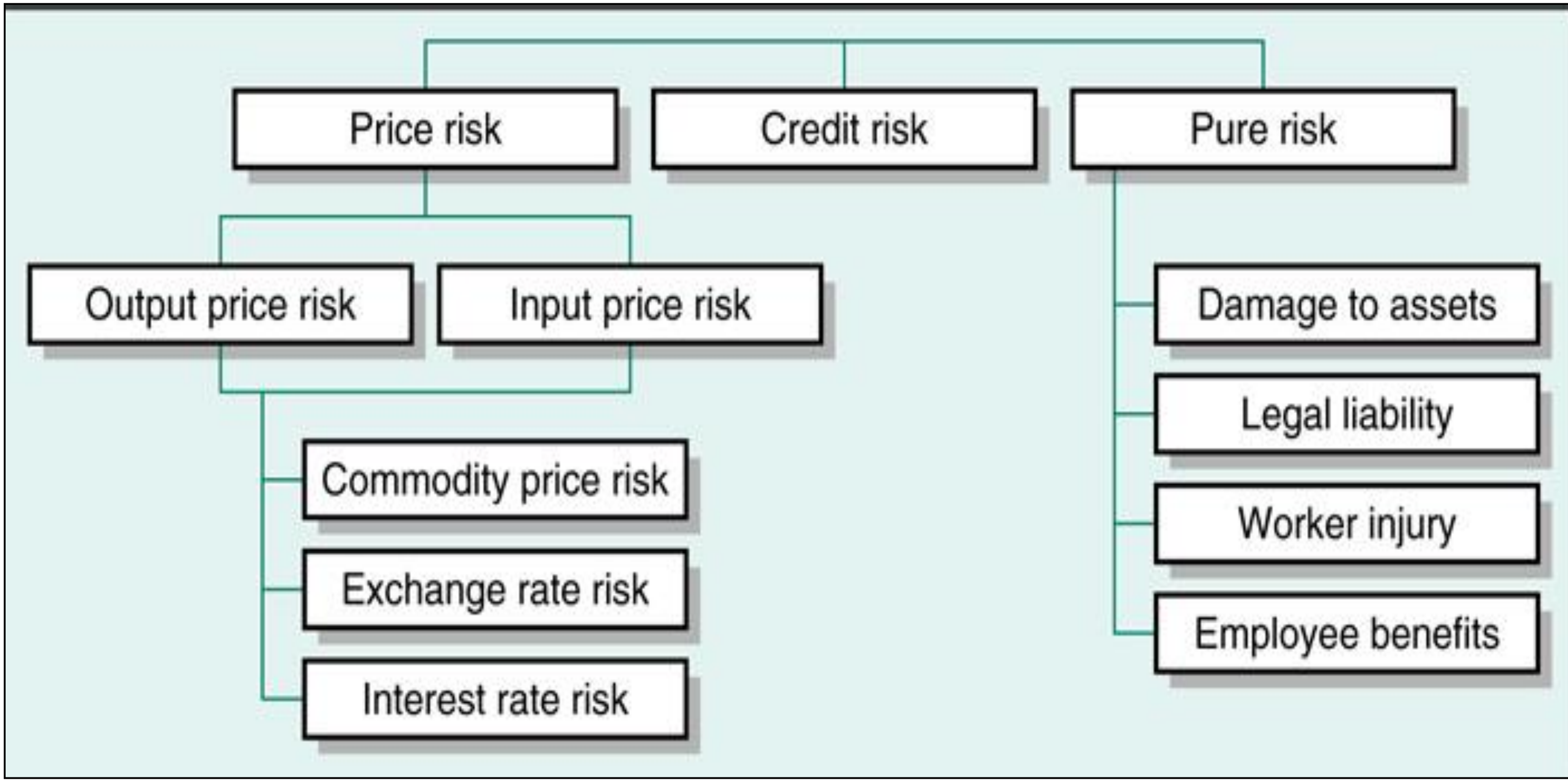
- Direct Losses often cause indirect losses

Example: What are the direct and indirect losses if a manufacturing plant experiences a major fire?

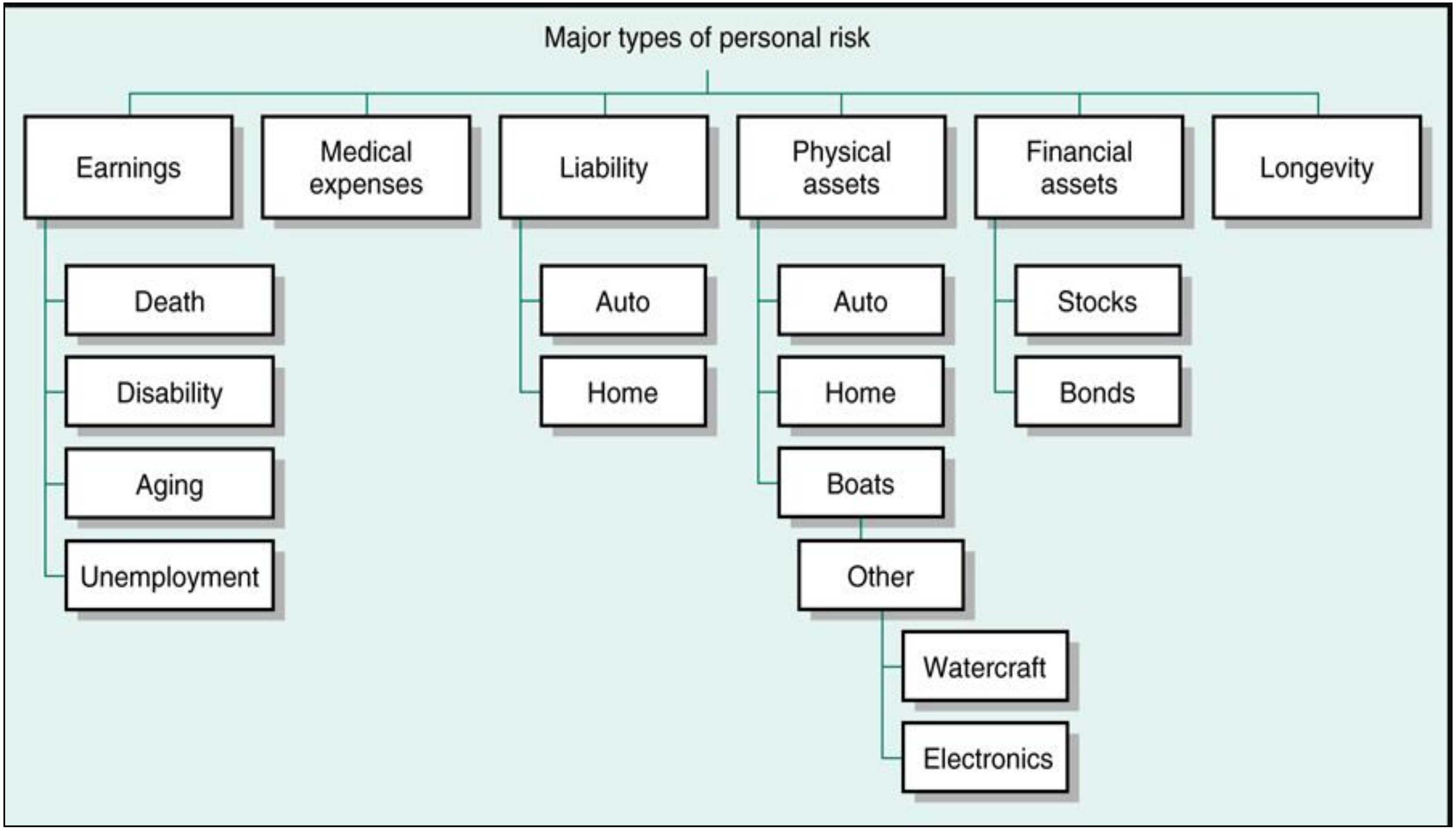


- Indirect losses often involve uncertainties

Major Types of Business Risk



Major Types of Personal Risks



Michigan Tech

Definitions

- Price risk: uncertainty over the magnitude of cash flows due to possible changes in output and input prices
  - Commodity price risk
  - Exchange rate risk
  - Interest rate risk
- Credit risk: the risk that a firm's customers and borrowers will delay or fail to make promised payments
- Pure risk: a risk involving only losses and no losses for properties
  - Mainly handled by insurance

More on Pure Risk

- Demand to assets: The risk of reduction in value of business assets due to physical damage, theft and expropriation

- Legal Liability: The risk of legal liabilities for damages for harm to customers, supplies, shareholders, and other parties

- Worker injury: The risk associated with paying benefits to injured workers

- Employee Benefits: The risk of death, illness, and disability to employees

Pure Risk versus Other Types of Risk

- Generalizations:
  - Pure risk usually involves large potential losses relative to the expected loss
  - Pure risk involves events that are firm-specific
  - Price risk affects many firms
  - Pure risk is managed by **insurance**
  - Price risk is managed by **derivatives**
  - Pure risk involves wealth losses to society
  - Price risk often involves wealth redistributions in society
- Nevertheless, use the same framework for management of pure risk and price risk

The Risk Management Process

(1) Identification of risks

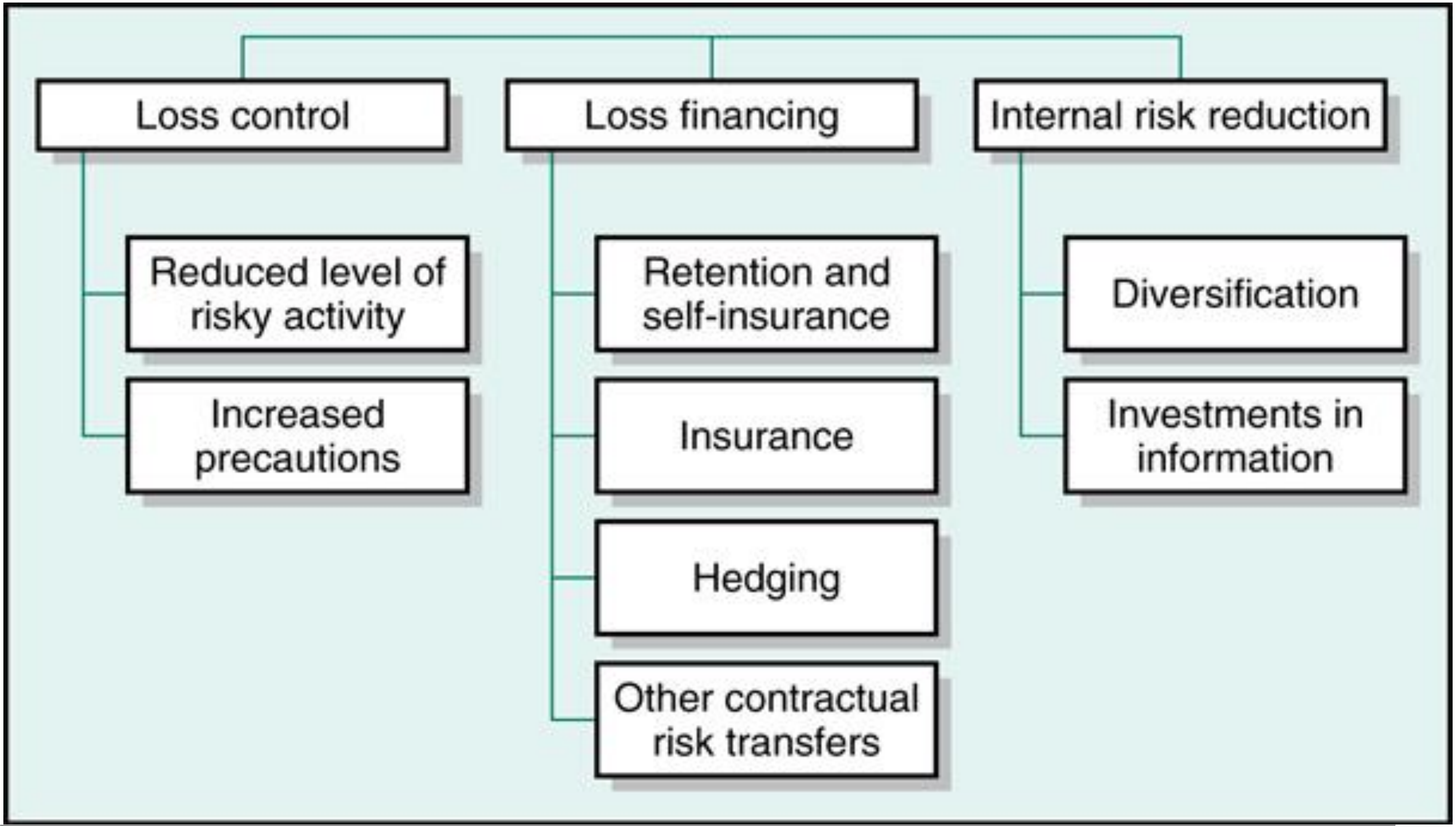
(2) Evaluation of frequency and severity of losses

(3) Choosing **risk management methods**

(4) Implementation of the chosen methods

(5) Monitoring the performance and suitability (evaluation)

Major Risk Management Methods



Michigan Tech

Tradeoffs

- Risk is **Costly**, but
- **<u>Treatment is almost always costly</u>**

- Property Example:
  - An asset has a value of $100,000. Risk reduced value to say $90,000
  - What if mitigation reduced probability of loss to 0, but costs $12,000?
  - What if full insurance costs $8,000?

Cost of Risk

- Key points:
  - Do NOT minimize risk,
    - **MINIMIZE THE COST OF RISK**
  - Find optimal **combination** of risk management methods

Components of Cost of Risk

- Expected losses
  - Direct vs. indirect losses
- Cost of loss control
  - Increased precaution & reduced activities
- Cost of loss financing
  - Insurance, self insurance, hedging
- Cost of internal risk retention
  - Diversification; investing in information
- Cost of residual uncertainty
  - Effect on shareholders

Tradeoffs among Components

- Expected loss vs. loss control cost
- Cost of loss financing vs. expected loss
- Cost of loss financing vs. internal risk reduction
- Cost of loss financing vs. cost of residual reduction

Risk and Firm Value

- Firm value is determined by **expected cash flow**
- For a firm with a highly risky cash flow, the firm value is **low**
- So one could increase firm value by lowering firm risk
  - Again: achieving the efficiency goal does **not** eliminate risks or losses

Firm Value Max & the Cost of Risk

- Define:
  - Cost of risk = Value without risk – Value with risk
    - <u>Value without risk is the optimal firm value when risk is completely hedged</u>
- Rearrange:
  - Value with risk = Value without risk – Cost of risk
- Implication:
  - Maximize Value ←→ Minimize Cost of Risk

Other Goals

- To keep the realized cost of insured losses <u>below a specified percent of revenues</u>
- Purchasing <u>insurance</u> against any loss that could be large enough to seriously disrupt operations
- Making decisions to comply with terms in loan contracts on the types and amounts of insurance that must be purchased
- Spending money on loss control <u>when the savings on insurance premiums are sufficient to outweigh the costs</u>
- …
- These goals may or may not be consistent with cost of risk minimization/firm value maximization

Value of Insurance/Risk Management: First look

- How much capital one needs to hold to hedge the risk by himself?
- How much capital does an **insurer** hold for each insured when the insurer has a well-diversified insurance portfolio?
- What is the benefit for the insured to purchase insurance?
- Does the insurer need to hold additional capital?
  - Cost of risk

Useful Websites

- http://finance.yahoo.com
- www.naic.org
- www.ambest.com
- www.nationalunderwriter.com
- www.garp.org (global association of risk professionals)
- http://www.spencered.org/