FIN 4500
Chapter 4
Risk Management and Shareholder Value

Xin Li, Ph.D.

- What drives firm value?
- Cost of capital and risk management
- Expected cash flow and risk management
  - Loading
  - Service
  - Likelihood of raising capital
  - Likelihood of bankruptcy

The Basic Valuation Model

- Value of all equity financed firm:

Value = PV(expected cash flows)

$$\text{Value} = \sum_{t=1}^{\infty} \frac{E(Cash\ Flow_t)}{(1+r)^t}$$

- where r = cost of equity capital

- **Key Issues:**
  - How does risk management affect
    - Expected Cash Flows?
    - Opportunity cost of capital?

Example: cost of capital = 10%

Expected Cash Flows:

Today	1 year	2 years
	$11	$12.1

Value today = $11/1.1 + 12.1/1.1^2

= $10 + $10

= $20

The Basic Valuation Model - An Example

- Assumptions:
  - Firm exists for one year
  - Cash flows at end of year = $300 if no loss
  - Cash flows at end of year = $200 if a loss
  - Loss occurs with probability 0.2
  - Cost of capital = 10%
- Value at beginning of year = $\frac{300 * 0.8 + 200 * 0.2}{1.1} = 254.55$

Introduce Insurance

- What if full insurance is available at a price of $20?

- What is the expected claim payment from the insurer?

  $100*20%=$20

- What is the price of insurance based on the expected claim payment?

  $18.18

- What is the loading on this insurance?
  - Loading = price – PV(expected claim payment)

    = $20-18.18 = $1.82
  - PV(expected claim payment): actuarially fair premium

More on the Example

- What is the expected cash flow if the firm purchases the insurance?

  300

- Does the cost of capital change if the firm purchases insurance?

  No

- What is firm value after purchasing insurance?

$$\frac{300}{1.1} - 20 = 252.73$$

Shall the firm buy the insurance

- Value of the firm without insurance: $254.55
- Value of the firm with insurance: $252.73
- $252.73 < $254.55
- Any comments on these two numbers above?

Shall the firm buy the insurance

- $254.55 - $252.73 = $1.82
- What is the loading of the insurance?
- Why?

What can we learn from the example?

Tradeoff in conducting risk management

- Benefit: Insurance/risk management is to reduce the loss to insured when there is a loss
- Cost: Loading is a cost to manage a risk

To increase firm value

- Increase expected cash flow – increase
- Reduce cost of capital

This is related to two notions of risk

Components of the Cost of Capital

- Cost of capital =

  expected return investors could earn on a comparable risky security

- If project has no risk,
  - then opportunity cost of capital = Return on U.S. govt bonds

- If the project has risk

  then opportunity cost of capital = Return on U.S. govt bonds + Risk Premium

Investor Diversification and Risk Premium

- Intuitively, the risk premium should reflect the risk of the cash flows
  - riskier cash flows ==> **Higher risk premium**
- However, investors can diversify some risk on their own
  - Divide cash flow risk into two components:
    - Total Risk = diversifiable risk + non-diversifiable risk
- Risk premium only depends on **non-diversifiable risk**

Investor Diversification and Risk Premium

- Total risk of cash flows

= Diversifiable risk + Non-diversifiable risk

↓ does not affect cost of capital

↓ increases cost of capital

  - Other terms for non-diversifiable risk:
    - market risk
    - systematic risk
  - Non-diversifiable risk is often measured by Beta (β)

Capital Asset Pricing Model

- Under the capital asset pricing model,

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f]$$

$$E(R_i) - R_f = \beta_i[E(R_m) - R_f]$$

where

$E(R_i)$: expected return of investment

R_f: risk free rate

β_i: beta of the investment

$E(R_m) - R_f$: market risk premium

Assumptions of CAPM

- Securities markets are competitive and efficient
  - relevant information about the companies is quickly and universally distributed and absorbed

- Investors are **rational** and **risk-averse**, who seek to maximize satisfaction from returns on their investments
  - Cauchy-Buniakowsky-Schwarz Inequality
  - Convex function VS Concave function

Does Insurance Affect the Cost of Capital?

- What type of risk does insurance typically reduce?

  (Think about liability losses) **Diversifiable risk**

  ==> Insurance typically will **NOT** affect the cost of equity capital

  ==> Insurance does not increase firm value if it only reduces diversifiable risk

Does Hedging Affect the Cost of Capital?

- The same analysis applies to hedging using derivatives
- If hedging only reduces diversifiable risk, then hedging will **not** reduce the opportunity cost of capital

The other case

- Hedging that reduces systematic risk (non-diversifiable risk) will reduce the cost of capital

- However,
  - Systematic risk must be borne by someone

➔ The counterparty who takes on the systematic risk will **require compensation** for bearing this risk

➔ The cost of compensating the counter-party will cause expected cash flows to **decrease**

- Firm Value = $\sum_{t=1}^{\infty} \frac{E(Cash\ Flow_t)}{(1+r)^t}$

- Provided all parties view the cost of bearing systematic risk identically, then the two effects will offset each other and firm value will not change

Now, Consider the Numerator

- Now consider risk mitigation (loss prevention, loss control), i.e., actions that reduce

Expected Losses

(increase expected cash flow)

Recall the example:

- Cash flows at end of year = $300 if no loss
- Cash flows at end of year = $200 if a loss
- Loss occurs with probability 0.2
- Cost of capital = 10%
- Value at beginning of year = 254.55

A Risk Mitigation Program

- Say we can spend $3 and reduce the probability of the loss to 0.15. What happens to expected cash flows at the year end?

  Expected cash flow = 300*.85+200*0.15=285

- What happens to cost of capital?

  No change

- What is the new firm value?

  V=(300*.85+200*0.15)/1.1-3 =256.09

Risk Mitigation

- Should we spend another $3 to reduce the probability of the loss to 0.13?

  Firm value = (300*0.87+200*0.13)/1.1-6=254.91

  No, the firm should not spend extra $3.

- Implication: it is not always good to reduce firm risk. (minimizing cost of risk; not minimizing risk)

Channels for Risk Management Affecting Expected Cash Flows

Description	Effect on Expected Cash Flows
Loading on insurance / Transaction cost of hedging	Decrease
Decrease cost of obtaining services	Increase
Decrease **likelihood** of having to raise new funds	Increase
Decrease likelihood of incurring bankruptcy / financial distress costs	Increase
Decrease expected tax payments	Increase
Regulation requires insurance	Increase

Insurance Premium Loadings

- Example:
  - Cash flows = $100 with probability 0.9
    $70 with probability 0.1
    - I.e., Loss of $30 occurs with probability 0.1
  - Expected cash flows w/o insurance = 97
  - Expected cash flows with insurance depends on the insurance premium

Insurance Premium Loadings

- Assume full insurance can be purchased for $3
  - Then loading = $0
  - Expected cash flows with insurance = $100-$3 = $97 or $90+$10-$3= $97
- Assume full insurance costs $4
  - Then loading = $1
  - Expected cash flows with insurance = $96
- Main Point: Ignoring other factors, <u>insurance reduces expected cash flows by the premium loading</u>

Effect of Loading

- Expected cash flow with insurance
  - = expected cash flow without insurance – loading

- **Loading = Actual premium – PV[E(Loss)]**

Services Provided by Insurers

- But, part of loading is the cost of services
  - Loss control
  - Claims processing

- Bundle insurance with services?
- Question that you may ask:
  - Is premium loading less than cost of obtaining services elsewhere?

Decrease Likelihood of Raising Costly External Capital

- Raising external capital is costly
  - transaction costs (investment banking fees)
  - may issue at a price that is below true value
- If not insured or hedged, the firm has an increased likelihood of having to raise new capital to finance investment ➔
  - Increased likelihood of paying the costs of raising capital
  - Increased likelihood that you will **forego** good projects b/c of the costs of raising capital

Decrease the Likelihood of Bankruptcy

- High probability of bankruptcy is costly
  - High probability of incurring explicit bankruptcy costs (e.g., attorney fees)
  - Probability of bankruptcy adversely affects the terms at which other claimants contract with the firm
    - lenders
    - employees
    - customers
    - suppliers
  - Less costly for the firm to reduce risk than it is to compensate other claimants for the expected costs that they would incur if the firm went bankrupt

Management Compensation Example

- J.R. works for Garven Corp.
- Garven Corp's end of year cash flows without insurance

  = $1 million with probability 0.95 and $0 with probability 0.05 due to a lawsuit
- If cash flows = $0, then J.R. does not get paid
- J.R. would accept $100,000 in compensation if he were certain to be paid
- J.R. requires $125,000 given the uncertainty about getting paid (expected compensation = 125,000 * 0.95 = $118,750)

Management Compensation Example

- Garven can purchase $400,000 of liability insurance for $25,000
    - expected claim cost = .05 x $400,000 = $20,000
      ==> premium loading = $5,000

- Insurance allows J.R. to be paid even if a lawsuit occurs
- J.R. accepts $100,000

- What is the change in firm's expected cash flow?
    - Reduction in expected compensation = 118,750 - 100,000 = $18,750
    - Loading from the insurance = $**5000**

    - So, net increase in expected cash flows = $18,750 - $5,000 = $13,750

Management Compensation Example

- Main point: insurance improved the contractual terms with J.R. and therefore increased value to the owners of Garven Corp.

Protect Firm Intangible Assets

- Much of firm value (known as going concern) comes from intangible assets
  - Brand name, trademark
  - Knowledge employees have that is unique to the business

- Reducing bankruptcy probabilities protect corporate intangible assets

Example (Protect Intangible Value)

- Let's say that a firm has assets in place that's worth $100 (i.e., replacement cost of equipment is $100). However, due to the intangible assets ($200), the total market value of the firm is $300.

- A potential fire risk is associated with the firm:
  - with 20% chance the firm's equipment will be destroyed and the firm is bankrupt;
  - with 80% chance, the loss won't happen so there is $0 loss

- What is the value of the firm without insurance?

  Firm value = 20%*0+80%*300=$240

Example (Cont'd)

- Now let's assume that there is an insurance firm that offers a total coverage for the loss of $100 (equipment damage). For simplicity, we assume the insurance market is perfectly competitive so they earn zero surplus (i.e., loading = 0). The insurance premium is
- 20%*100+80%*0=$20

- What is the firm value after purchasing insurance?
- 100%*300 – 20 = $280

Value Creation by Insurance

- By avoiding bankruptcy, the firm keeps its intangible assets

- Value of insurance
- = firm value w/ ins – firm value w/o ins.
- = 280 – 240
- = $40
- = 200*20% (intangible value saving from avoiding bankruptcy)