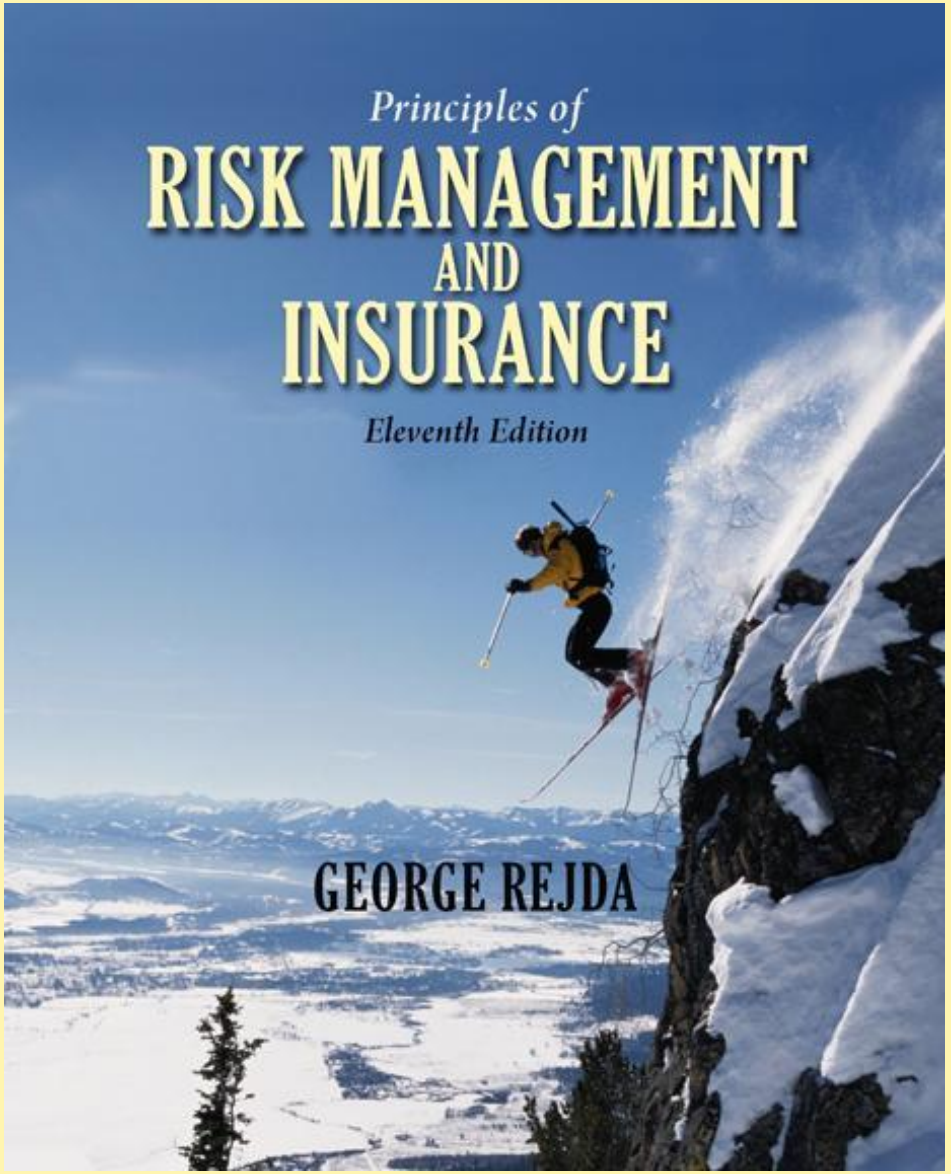
Chapter 4

Advanced Topics in Risk Management



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Agenda

- The Changing Scope of Risk Management
- Enterprise Risk Management
- Insurance Market Dynamics
- Loss Forecasting
- Financial Analysis in Risk Management Decision Making
- Other Risk Management Tools

The Changing Scope of Risk Management

- Today, the risk manager's job:
  - Involves more than simply purchasing insurance
  - Is not limited in scope to pure risks
- The risk manager may be using:
  - Financial risk management
  - Enterprise risk management

The Changing Scope of Risk Management

- Financial Risk Management refers to the identification, analysis, and treatment of speculative financial risks:
  - Commodity price risk is the risk of losing money if the price of a commodity changes
  - Interest rate risk is the risk of loss caused by adverse interest rate movements
  - Currency exchange rate risk is the risk of loss of value caused by changes in the rate at which one nation's currency may be converted to another nation's currency
- Financial risks can be managed with capital market instruments

Exhibit 4.1 Managing Financial Risk—Two Examples

1. Hedging a Commodity Price Risk Using Futures Contracts

A corn grower estimates in May that his production will total 20,000 bushels of corn, with the harvest completed by December. Checking the price of futures contracts, he notices that the price of December corn is $2.90 per bushel. He would like to hedge the risk that the price of corn will be lower at harvest time and can do so by the appropriate use of futures contracts. Because corn futures contracts are traded in 5000 bushel units, he would sell four contracts in May totaling 20,000 bushels in the futures market. In December, he would buy back four contracts to offset his futures position. As demonstrated below, it doesn't matter whether the price of corn has increased or decreased by December. By using futures contracts and ignoring transaction expenses, he has locked in total revenue of $58,000.

If the market price of corn drops to $2.50 per bushel in December:			
Revenue from sale of corn	20,000 × $2.50	=	$50,000
Sale of four contracts at $2.90 in May	58,000		
Purchase of four contracts at $2.50 in December	50,000		
Gain on futures transaction			8,000
Total revenue			$58,000
If the market price of corn increases to $3.00 per bushel in December:			
Revenue from sale of corn	20,000 × $3.00	=	$60,000
Sale of four contracts at $2.90 in May	58,000		
Purchase of four contracts at $3.00 in December	60,000		
Loss on futures transaction			(2,000)
Total revenue			$58,000

Exhibit 4.1 Managing Financial Risk—Two Examples

2. Using Options to Protect Against Adverse Stock Price Movements

Options on stocks can be used to protect against adverse stock price movements. A call option gives the owner the right to buy 100 shares of stock at a given price during a specified period. A put option gives the owner the right to sell 100 shares of stock at a given price during a specified period. While there are many options strategies used to reduce risk, one simple alternative is discussed here: buying put options to protect against a decline in the price of stock that is already owned.

Consider someone who owns 100 shares of a stock priced at $43 per share. The owner may be concerned that the price of the stock will fall. At the same time, however, the owner may not wish to sell the stock as the sale would trigger taxation of a capital gain. In addition, the owner may believe that the price of the stock could increase. The stockholder could purchase a put option to offset a price decline.

Assume there is a put option available with a strike (exercise) price of $40. The owner of the stock could purchase the option. If the price of the stock increases, the stock owner has lost the purchase price of the option (called the premium), but the stock price has increased. But what if the price of the stock declines, say to $33 per share? In the absence of the put option, the stock owner has lost $10 ($43–$33) per share on paper. As owner of the put option, however, the stock holder has the right to sell 100 shares at $40 per share. Thus, the option is "in the money" by $7 per share ($40–$33), ignoring the option premium. The put option could be sold to offset the paper loss. Using put options in this way protects against losing money if the price of the stock declines.

The Changing Scope of Risk Management

- An integrated risk management program is a risk treatment technique that combines coverage for pure and speculative risks in the same contract
- A double-trigger option is a provision that provides for payment only if two specified losses occur
- Some organizations have created a Chief Risk Officer (CRO) position
  - The chief risk officer is responsible for the treatment of pure and speculative risks faced by the organization

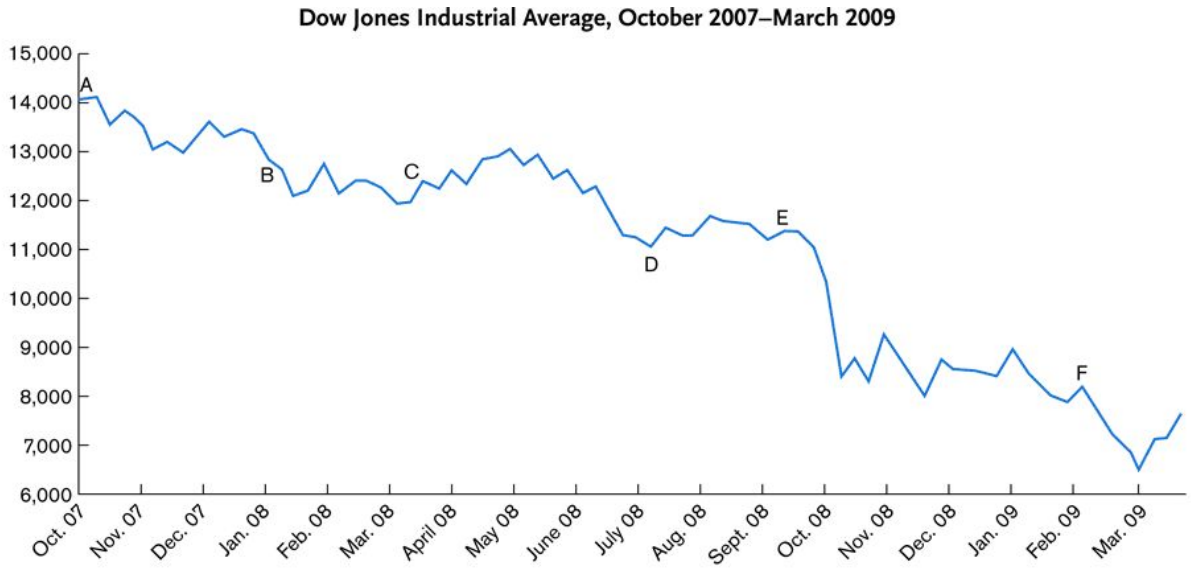
Enterprise Risk Management

- Enterprise Risk Management (ERM) is a comprehensive risk management program that addresses the organization's pure, speculative, strategic, and operational risks
  - Strategic risk refers to uncertainty regarding an organization's goals and objectives
  - Operational risks are risks that develop out of business operations, such as product manufacturing
  - As long as risks are not positively correlated, the combination of these risks in a single program reduces overall risk
  - Nearly half of all US firms have adopted some type of ERM program
  - Barriers to the implementation of ERM include organizational, culture and turf battles

The Financial Crisis and Enterprise Risk Management

- The US stock market dropped by more than fifty percent between October 2007 and March 2009
  - The meltdown raises questions about the use of ERM
  - Only 18 percent of executives surveyed said they had a well-formulated and fully-implemented ERM program

Exhibit 4.2
Timeline of Events Related to the Financial Crisis



A - Citigroup posts a surprise 57% drop in third quarter earnings, fueled by $6.5 billion subprime-related write-downs and losses. The CEO resigns November 2007.

B - Bank of America pays $4 billion for Countrywide Financial after the mortgage lender fails because of risky loans to poor credit risks. UBS announces $4 billion of write-downs, pushing total subprime-related write-downs to $18.4 billion.

C - Bear Stearns sold to U.S. investment bank JP Morgan Chase for about $2 per share (the price is later revised to $10 per share).

D - U.S. banking regulators seize IndyMac Bancorp Inc. as the largest publicly traded U.S. mortgage lender collapses as depositors withdrew over $1.3 billion over 11 days; the Federal Reserve effectively take over mortgage finance agencies Fannie Mae and Freddie Mac to support the U.S. housing market.

E - Wall Street's worst day since markets reopened after the 9/11 attacks; Lehman Brothers is largest U.S. bankruptcy; Merrill Lynch taken over by Bank of America; American International Group (AIG), once the world's largest insurer, searches for capital because of losses on its mortgage-related securities; central banks inject billions of dollars into money markets to ease tensions and prevent the global financial system from freezing; AIG shares drop almost 50 percent; the Fed announces plan for $85 billion AIG rescue loan in return for an 80 percent stake in the company; Britain's Barclays buys parts of Lehman's assets for $1.75 billion; Shares in Goldman Sachs and Morgan Stanley fall sharply; SEC curbs short-selling rules; details emerge about the U.S. government plan for $700 billion bailout for firms burdened by bad mortgage debt; Goldman Sachs and Morgan Stanley are transformed into bank holding companies.

F - JP Morgan Chase and Citigroup announce a temporary stoppage of residential foreclosures. The moratoriums will remain in effect until March 6 for JP Morgan and March 12 for Citigroup; S&P 500 Index closes at a level not seen since December 1996, and closes the two-month period beginning January 1, 2009, with the worst two-month opening to a year in history, losing 18.62 percent.

The Financial Crisis and Enterprise Risk Management

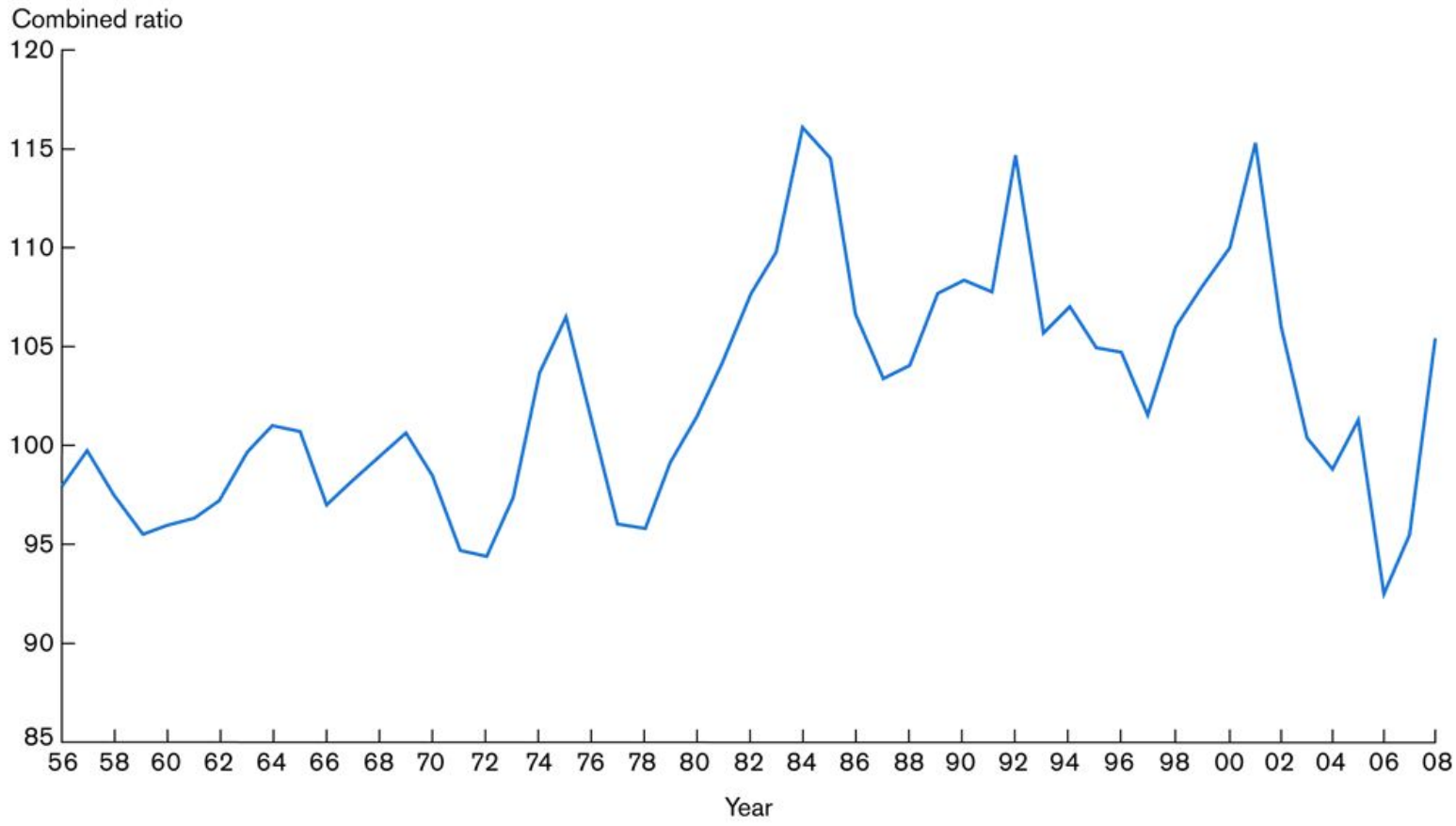
- AIG mentions an active ERM program in its 2007 10-K Report
  - Riskiness of the Financial Products Division was not fully appreciated
    - The division was issuing credit default swaps
    - A credit default swap is an agreement in which the risk of default of a financial instrument is transferred from the owner of the financial instrument to the issuer of the swap
    - The default rate on mortgages soared and the company did not have the capital to cover guarantees
- The lessons learned by risk managers from the financial crisis will influence ERM in the future

Insurance Market Dynamics

- Decisions about whether to retain or transfer risks are influenced by conditions in the insurance marketplace
- The Underwriting Cycle refers to the cyclical pattern of underwriting stringency, premium levels, and profitability
  - "Hard" market: tight standards, high premiums, unfavorable insurance terms, more retention
  - "Soft" market: loose standards, low premiums, favorable insurance terms, less retention
  - One indicator of the status of the cycle is the combined ratio:

$$\text{Combined Ratio} = \frac{\text{Paid Losses} + \text{Loss Adjustment Expenses} + \text{Underwriting Expenses}}{\text{Premiums}}$$

Exhibit 4.3 Combined Ratio for All Lines of Property and Liability Insurance, 1956–2008*



*Data from 1998–2008 include state funds

SOURCE: *Best's Aggregates & Averages—Property/Casualty* (Oldwick, NJ: A.M. Best Company, 2008), p. 408.

Insurance Market Dynamics

- Many factors affect property and liability insurance pricing and underwriting decisions:
  - Insurance industry capacity refers to the relative level of surplus
    - Surplus is the difference between an insurer's assets and its liabilities
    - Capacity can be affected by a clash loss, which occurs when several lines of insurance simultaneously experience large losses
  - Investment returns may be used to offset underwriting losses, allowing insurers to set lower premium rates

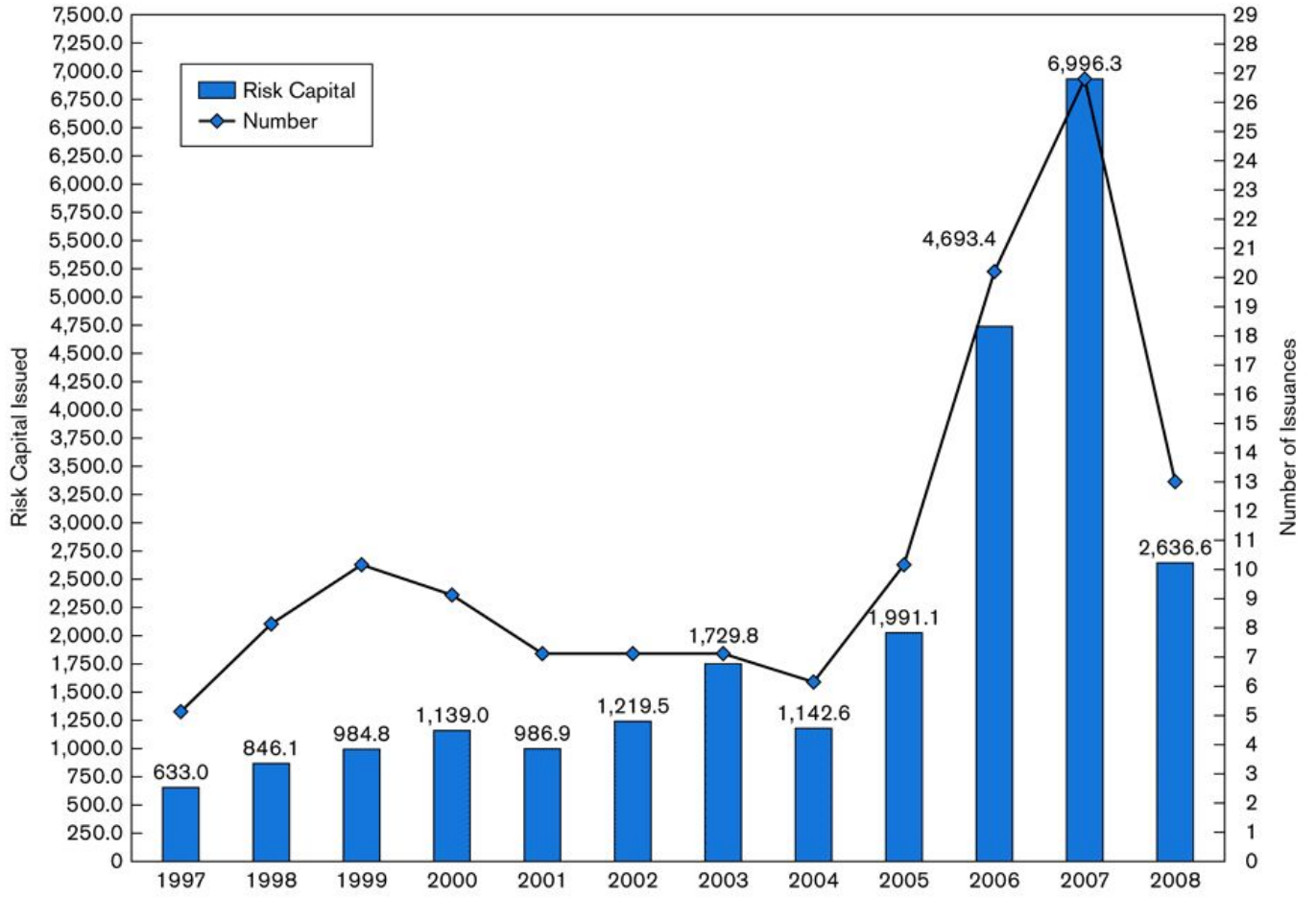
Insurance Market Dynamics

- The trend toward consolidation in the financial services industry is continuing
  - Consolidation refers to the combining of businesses through acquisitions or mergers
    - Due to mergers, the market is populated by fewer, but larger independent insurance organizations
    - There are also fewer large national insurance brokerages
      - An insurance broker is an intermediary who represents insurance purchasers
  - Cross-Industry Consolidation: the boundaries between insurance companies and other financial institutions have been struck down
    - Financial Services Modernization Act of 1999
    - Some financial services companies are diversifying their operations by expanding into new sectors

Capital Market Risk Financing Alternatives

- Insurers are making increasing use of capital markets to assist in financing risk
  - Securitization of risk means that insurable risk is transferred to the capital markets through creation of a financial instrument:
    - A catastrophe bond permits the issue to skip or defer scheduled payments if a catastrophic loss occurs
  - An insurance option is an option that derives value from specific insurance losses or from an index of values.
    - A weather option provides a payment if a specified weather contingency (e.g., high temperature) occurs
  - The impact of risk securitization is an increase in capacity for insurers and reinsurers
    - It provides access to the capital of many investors

Exhibit 4.4 Catastrophe Bonds: Annual Number of Transactions and Issue Size



* All amounts in USD millions.

SOURCE: Guy Carpenter & Company, LLC and GC Securities, a division of MMC Securities Corp., a U.S. registered broker-dealer and member FINRA/SIPC.

Loss Forecasting

- The risk manager can predict losses using several different techniques:
  - Probability analysis
  - Regression analysis
  - Forecasting based on loss distribution
- Of course, there is no guarantee that losses will follow past loss trends

Loss Forecasting

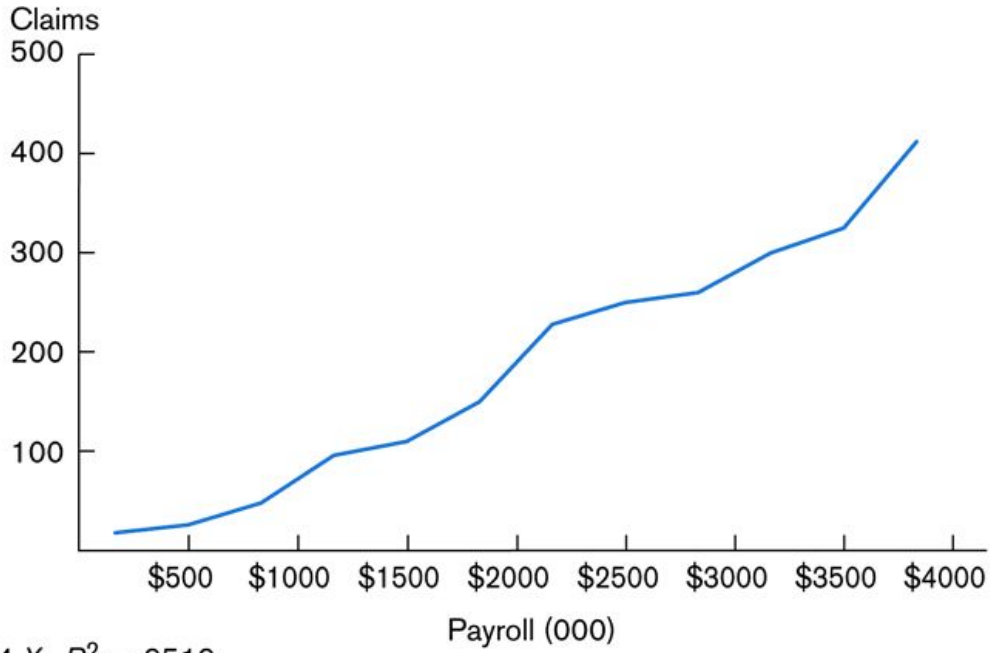
- Probability analysis: the risk manager can assign probabilities to individual and joint events
  - The probability of an event is equal to the number of events likely to occur (X) divided by the number of exposure units (N)
    - May be calculated with past loss data
  - Two events are considered independent events if the occurrence of one event does not affect the occurrence of the other event
  - Two events are considered dependent events if the occurrence of one event affects the occurrence of the other
  - Events are mutually exclusive if the occurrence of one event precludes the occurrence of the second event

Loss Forecasting

- Regression analysis characterizes the relationship between two or more variables and then uses this characterization to predict values of a variable
  - For example, the number of physical damage claims for a fleet of vehicles is a function of the size of the fleet and the number of miles driven each year

Exhibit 4.5 Relationship Between Payroll and Number of Workers Compensation Claims

Year	Payroll in thousands	Workers compensation claims
1998	$ 400	18
1999	520	26
2000	710	48
2001	840	96
2002	1200	110
2003	1500	150
2004	1630	228
2005	1980	250
2006	2300	260
2007	2900	300
2008	3400	325
2009	4000	412



Regression results: $Y = -6.1413 + .1074\,X$, $R^2 = .9519$

Predicted number of claims next year, if the payroll is $4.8 million:

$Y = -6.1413 + (.1074 \times 4800)$

$Y = 509.38$

Loss Forecasting

- A loss distribution is a probability distribution of losses that could occur
  - Useful for forecasting if the history of losses tends to follow a specified distribution, and the sample size is large
  - The risk manager needs to know the parameters of the loss distribution, such as the mean and standard deviation
  - The normal distribution is widely used for loss forecasting

Financial Analysis in Risk Management Decision Making

- The time value of money must be considered when decisions involve cash flows over time
  - Considers the interest-earning capacity of money
  - A present value is converted to a future value through compounding
  - A future value is converted to a present value through discounting
- Risk managers use the time value of money when:
  - Analyzing insurance bids
  - Making loss control investment decisions
    - The net present value is the sum of the present values of the future cash flows minus the cost of the project
    - The internal rate of return on a project is the average annual rate of return provided by investing in the project

Other Risk Management Tools

- A risk management information system (RMIS) is a computerized database that permits the risk manager to store and analyze risk management data
  - The database may include listing of properties, insurance policies, loss records, and status of legal claims
  - Data can be used to predict and attempt to control future loss levels
- Risk Management Intranets and Web Sites
  - An intranet is a web site with search capabilities designed for a limited, internal audience
- A risk map is a grid detailing the potential frequency and severity of risks faced by the organization
  - Each risk must be analyzed before placing it on the map

Other Risk Management Tools

- Value at risk (VAR) analysis involves calculating the worst probable loss likely to occur in a given time period under regular market conditions at some level of confidence
  - The VAR is determined using historical data or running a computer simulation
  - Often applied to a portfolio of assets
  - Can be used to evaluate the solvency of insurers
- Catastrophe modeling is a computer-assisted method of estimating losses that could occur as a result of a catastrophic event
  - Model inputs include seismic data, historical losses, and values exposed to losses (e.g., building characteristics)
  - Models are used by insurers, brokers, and large companies with exposure to catastrophic loss