

ADVANCED FINANCIAL INSTRUMENTS AND MARKETS
Fall 2013

Lecture No. 02
Risk and Financial Market crisis

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Today's Discussion

- * Session - I
- * Introduction to Probability Theory
- * Financial Returns and Basic Statistical Concepts
- * Independence and Failure of Independence as a Cause for Financial Crises
- * Regression Analysis, Systematic vs. Idiosyncratic Risk
- * Fat-Tailed Distributions and Their Role during Financial Market Crisis.

Introduction to Probability Theory

- * Probability theory is a conceptual framework that mathematicians invented.
- * Probability in its present meaning wasn't even coined until the 1600's.
- * Shakespeare's Probable Man
- * Probability, Sampling and Gambling : Mahabharata Poem
 - * Gambling Story of Nala (The Emperor), Dimiyanti (His Wife) and Khaali (The Demon), Rutupana (Teacher) counted number of leaves.

Probability and Innovations

- * In 1600 people started making life tables (Insurance and Actuarial Sciences)
- * Ancient Room and Burial Funds.
- * Fire Insurance after Fire in London 1656 and Chicago 1871.
 - Probability P , $0 < P < 1$
 - Multiplication rule for independent events:
 $\text{Prob}(A \text{ and } B) = \text{Prob}(A) \cdot \text{Prob}(B)$
 - Probability of n independent accidents = P^n

Likelihood of Certain Number of Accidents (Insurance Law)

- Probability of x accidents in n policies (Binomial Distributon):

$$f(x) = P^x (1 - P)^{(n-x)} \frac{n!}{(x!(n-x)!)}$$

Calculation of Return in Finance

- * HPR
- * HPY

Financial Returns and Basic Statistical Concepts

- * Random Variable
 - * Discrete/Continuous
- * Expected Value
 - * Average/G.M

$$E(x) = \mu_x = \sum_{i=1}^{\infty} \text{prob}(x = x_i)x_i$$

$$E(x) = \mu_x = \int_{-\infty}^{\infty} f(x)x dx$$

$$G(x) = \left(\prod_{i=1}^n x_i \right)^{1/n}$$



Problem - 1

- * The probability distribution of X, the number of red cars John meets on his way to work each morning, is given by the following table:

x	f(x)
0	0.41
1	0.37
2	0.16
3	0.05
4	0.05



Problem - 2

- * A certain software company uses a certain software to check for errors on any of the programs it builds and then discards the software if the errors found exceed a certain number. Given that the number of errors found is represented by a random variable X whose density function is given by

$$f(x) = \begin{cases} \frac{2(2-x)}{3} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

- * Find the average number of errors the company expects to find in a given program.



Problem - 3

* An investment in Project A will result in a **loss** of \$26,000 with probability 0.30, break even with probability 0.50, or result in a profit of \$68,000 with probability 0.20. An investment in Project B will result in a **loss** of \$71,000 with probability 0.20, break even with probability 0.65, or result in a profit of \$143,000 with probability 0.15. Which investment is better?



Variance in Expected Return

$$\text{var}(x) = \sum_{i=1}^n \text{prob}(x = x_i)(x_i - \mu_x)^2$$

$$s_x^2 = \sum_{i=1}^n (x_i - \bar{x})^2 / n$$

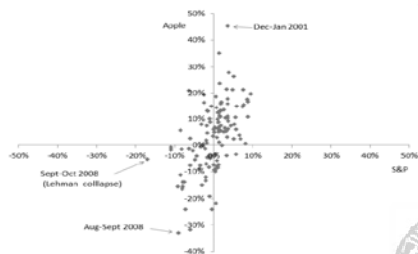
$$\text{cov}(x, y) = \sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y}) / n$$

- A scaled measure of how much two variables move together
- $-1 \leq \rho \leq 1$

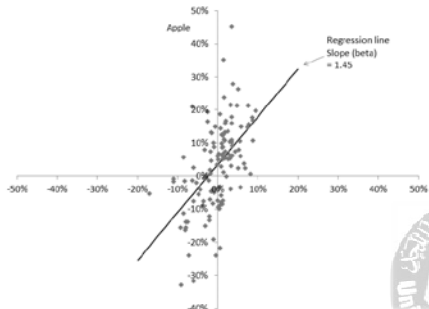
$$\rho = \text{cov}(x, y) / (s_x s_y)$$



Regression



Regression Analysis, Systematic vs. Idiosyncratic Risk



Independence and Failure of Independence as a Cause for Financial Crises

- * US Subprime Mortgage Crisis
- * Mortgage backed securities
- * Collateralized debt obligation
- * Credit Default Swap

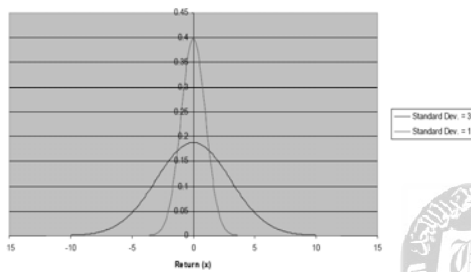
Fat-Tailed Distributions and Their Role during Financial Market Crisis

- * In finance, fat tails are considered **undesirable** because they imply additional risk beyond what would be seen from a normal distribution.
- * For example, an investment strategy may have an expected return that is five times its standard deviation. The likelihood of its failure (negative return) is less than one in a million based on a normal distribution.
- * However, factors influencing an asset's price, such as an earthquake, war, corporate bankruptcy or financial crisis, are not so mathematically "well-behaved". Such factors cause additional risk resulting in a fat-tailed distribution.

Fat-Tailed Distributions and Their Role during Financial Market Crisis

* Fat tails in market return distributions also have some behavioral origins (investor excessive optimism or pessimism leading to large market moves) and are therefore studied in behavioral finance. In marketing, the familiar 80-20 rule frequently found (e.g. "20% of customers account for 80% of the revenue") is a manifestation of a fat tail distribution underlying the data.

Fat-Tailed Distributions and Their Role during Financial Market Crisis



End of Session - I

Session -II

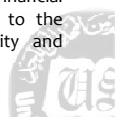
- * Financial Intermediation and Problems
- * Depository Institutions, Characteristics and Activities.
- * Central Banks and Creation of Money
- * Monetary Policy



Financial Intermediaries

* An entity that acts as the middleman between two parties in a financial transaction. While a commercial bank is a typical financial intermediary, this category also includes other financial institutions such as investment banks, insurance companies, broker-dealers, mutual funds and pension funds. Financial intermediaries offer a number of benefits to the average consumer including safety, liquidity and economies of scale.

* Source: <http://www.investopedia.com>



Types of Risks Faced by FIs

- * Credit Risk
- * Regulatory Risk
- * Interest Rate Risk



Liquidity Concerns

- * Ways to obtain funds to accommodate withdrawals and loan demand:
- * Attract additional deposits
- * Use currently-owned securities as collateral for loans from other institutions
- * Raise short-term funds in the money market
- * Sell currently-owned securities



Depository Institutions

- * Commercial Banks
- * Savings and Loan Associations
- * Savings Banks
- * Credit Unions



Bank Services

- * Consumer Banking
 - * Installment loans, residential mortgage loans, credit card loans, brokerage services, student loans, etc.
- * Global Banking
 - * Corporate finance, institutional banking
 - * Commercial real estate finance, leasing, factoring
 - * Capital market and foreign exchange market products and services



Bank Income

- * Bid-Ask spread
- * Capital gains on securities and gains on foreign currency transactions
- * Spread between interest income and cost of funds



Sources of Bank Funds

- * Deposits
 - * Demand Deposits
 - * Time Deposits
- * Non-deposit Borrowing
 - * Fed Discount Window
 - * Federal Funds Market
- * Other Non-deposit Borrowing
 - * Issuance of Debt Securities
- * Retained Earnings and Sale of Equity Securities



Bank Regulations

- * Interest Rates on Deposit Accounts
- * Geographical Restrictions on Branch Banking
- * Permissible Activities for Commercial Banks
- * Capital Requirements for Commercial Banks



Capital Requirement

- * Basle Accord on Bank Regulation and Supervisory Practices
 - * Capital adequacy standards
 - * Risk-based capital guidelines
- * Basle I.....?
- * Basle II.....?
- * Basle III.....?



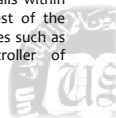
Saving and Loan Association

- * Principal assets
 - * Mortgages
 - * Mortgage-backed securities
 - * Government securities
- * Principal sources of funds
 - * Passbook savings accounts
 - * Time deposits
- * Regulation



Financial Sector of Pakistan

- * The financial sector in Pakistan comprises of Commercial Banks, Development Finance Institutions (DFIs), Microfinance Banks (MFBs), Non-banking Finance Companies (NBFCs) (leasing companies, Investment Banks, Discount Houses, Housing Finance Companies, Venture Capital Companies, Mutual Funds), Modarabas, Stock Exchange and Insurance Companies. Under the prevalent legislative structure the supervisory responsibilities in case of Banks, Development Finance Institutions (DFIs), and Microfinance Banks (MFBs) falls within legal ambit of State Bank of Pakistan while the rest of the financial institutions are monitored by other authorities such as Securities and Exchange Commission and Controller of Insurance.



Financial Sector of Pakistan

- * At present there are 41 scheduled banks, 6 DFIs, and 2 MFBs operating in Pakistan whose activities are regulated and supervised by State Bank of Pakistan. The commercial banks comprise of 3 nationalized banks, 3 privatized banks, 15 private sector banks, 14 foreign banks, 2 provincial scheduled banks, and 4 specialized banks.
- * The State Bank is empowered to determine Statutory Liquidity and Cash Reserve Requirements for banks/DFIs. Presently the Cash Reserve Requirement is 5% on weekly average basis subject to daily minimum of 4% of Time & Demand Liabilities.

Financial Sector of Pakistan

- * In addition to that banks are required to maintain Statutory Liquidity Requirement (SLR) @ 15% of their Time & Demand Liabilities. Similarly, DFIs are required to maintain SLR of 14% and Cash Reserve of 1% of their specified liabilities.
- * Additionally, The Banking Companies Ordinance had been amended in 1997 which empowers the State Bank to prescribe capital requirements for banks. In exercise of these powers the State Bank has laid down Minimum Capital Requirements for banks based on Basle capital structure.

Financial Sector of Pakistan

- * The banks have to maintain a Capital Adequacy Ratio in a way that their capital and unencumbered general reserves are, at the minimum, 8% of their risk weighted assets, and effective from 1st January, 2003 banks are required to maintain a minimum paid up capital level of Rs.1 Billion.