Lecture 2: Risk and Financial Crises

Economics 252, Spring 2011
Prof. Robert Shiller, Yale University
Return

\[ \text{Return}_t = \frac{\text{Price}_{t+1} - \text{Price}_t + \text{Dividend}_t}{P_t} \]

\[ \text{Gross Return} = 1 + \text{Return} \]
Expected Value, Mean, Average

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

\[ E(x) = \mu_x = \int_{-\infty}^{\infty} f(x)xdx \]

\[ \bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i \]

\[ G(x) = \left( \prod_{i=1}^{n} x_i \right)^{1/n} \]
Variance and Standard Deviation

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

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

\[ \text{cov}(x, y) = \sum_{i=1}^{n} \frac{(x_i - \overline{x})(y_i - \overline{y})}{n} \]
Correlation

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

$$\rho = \frac{\text{cov}(x, y)}{(s_x s_y)}$$
Variance of Sum

- $\text{var}(x + y) = \text{var}(x) + \text{var}(y) + 2\text{cov}(x, y)$
Stock Market Level, 2000-2010, 2000=100
Apple, Inc. and S&P 500 Monthly Adjusted Price
First Decade of 2000s. 2000=100
Apple, Inc. and S&P 500 Monthly Returns, First Decade of 2000s
Scatter, Apple vs S&P 500

- Dec-Jan 2001
- Sept-Oct 2008 (Lehman collapse)
- Aug-Sept 2008

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Same Scatter with Regression Line

Regression line
Slope (beta) = 1.45
Normal Distribution with Zero Mean

- Standard Dev. = 3
- Standard Dev. = 1
Normal Versus Fat Tailed Distributions

- Normal Distribution
- Cauchy Distribution

Return $x$
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Changes since 1928

-20.47% Oct 19, 1987
12.53% Oct 30, 1929