International Management Studies

2024.10.22

Lecture 7

Contents

I. Risk and Return

1. Risk

1) Definition and Types of Risks
2) How to measure them
3) How to manage the risk

1) Definition of risk

Risk refers to the possibility of a negative or undesirable outcome or event occurring due to uncertainty or variability in situations or decisions.

It involves exposure to harm, loss, or damage and is often assessed in terms of the probability of the event happening and the potential impact it could have. Risks can be related to a wide range of areas, such as finance, health, safety, business, or personal decisions, and managing or mitigating risk is a key aspect of planning and decision-making in these contexts.

In different fields, risk can be categorized in various ways:

1. Financial Risk – The potential for monetary loss or economic failure.
2. Operational Risk – The possibility of failure in day-to-day operations, processes, or systems.
3. Health and Safety Risk – The chance of injury, illness, or other adverse effects on individuals.
4. Strategic Risk – Risks related to decisions or actions that impact an organization's long-term goals or plans.
5. Reputation Risk
6. Credit Risk

Risk is often analyzed in terms of two main components:
- Likelihood (or Probability): How likely it is for the event to occur.
- Impact (or Severity): How significant the consequences will be if the event happens.

Risk Analysis Methods

There are two main risk analysis methods. The easier and more convenient method is qualitative risk analysis. Qualitative risk analysis rates or scores risk based on the perception of the severity and likelihood of its consequences. Quantitative risk analysis, on the other hand, calculates risk based on available data.

Types of risk analysis associated with qualitative risk analysis are all root cause analysis (RCA) tools except for failure mode and effects analysis, needs assessment, and risk matrix. Furthermore, the most common types of the latter are the 3×3 risk matrix, 4×4 risk matrix, and 5×5 risk matrix.

	Likelihood	Very Likely	Likely	Unlikely	Highly Unlikely
Severity	Fatality	High	High	High	Medium
	Major	High	High	Medium	Medium
	Minor	High	Medium	Medium	Low
	Negligible	Medium	Medium	Low	Low

SafetyCulture

Risk Assessment Matrix | SafetyCulture

2) How to measure the risk

Need to the know the basics of the statictics

a) Central tendency

Mean, mode, median

b) Dispersion

Range, variance, standard deviation, VAR(Value at Risk), mean deviation

How to calculate the standard deviation

Variance and Standard Deviation Formula

The formulas for the variance and the standard deviation is given below:

Standard Deviation Formula

The population standard deviation formula is given as:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - \mu)^2}$$

Here,

σ = Population standard deviation

N = Number of observations in population

Xi = ith observation in the population

μ = Population mean

For example: Take the values 2, 1, 3, 2 and 4.

1. Determine the mean (average):

> 2 + 1 +3 + 2 + 4 = 12
> 12 ÷ 5 = **2.4 (mean)**

2. Subtract the mean from each value:

> 2 - 2.4 = **-0.4**
> 1 - 2.4 = **-1.4**
> 3 - 2.4 = **0.6**
> 2 - 2.4 = **-0.4**
> 4 - 2.4 = **1.6**

3. Square each of those differences:

> -0.4 x -0.4 = **0.16**
> -1.4 x -1.4 = **1.96**
> 0.6 x 0.6 = **0.36**
> -0.4 x -0.4 = **0.16**
> 1.6 x 1.6 = **2.56**

4. Determine the average of those squared numbers to get the variance.

> 0.16 + 1.96 + 0.36 + 0.16 + 2.56 = **5.2**
> 5.2 ÷ 5 = **1.04 (variance)**

5. Find the square root of the variance.

> Square root of 1.04 = **1.01**

The standard deviation of the values 2, 1, 3, 2 and 4 is **1.01.**

CALCULATING STANDARD DEVIATION

n = the number of data points

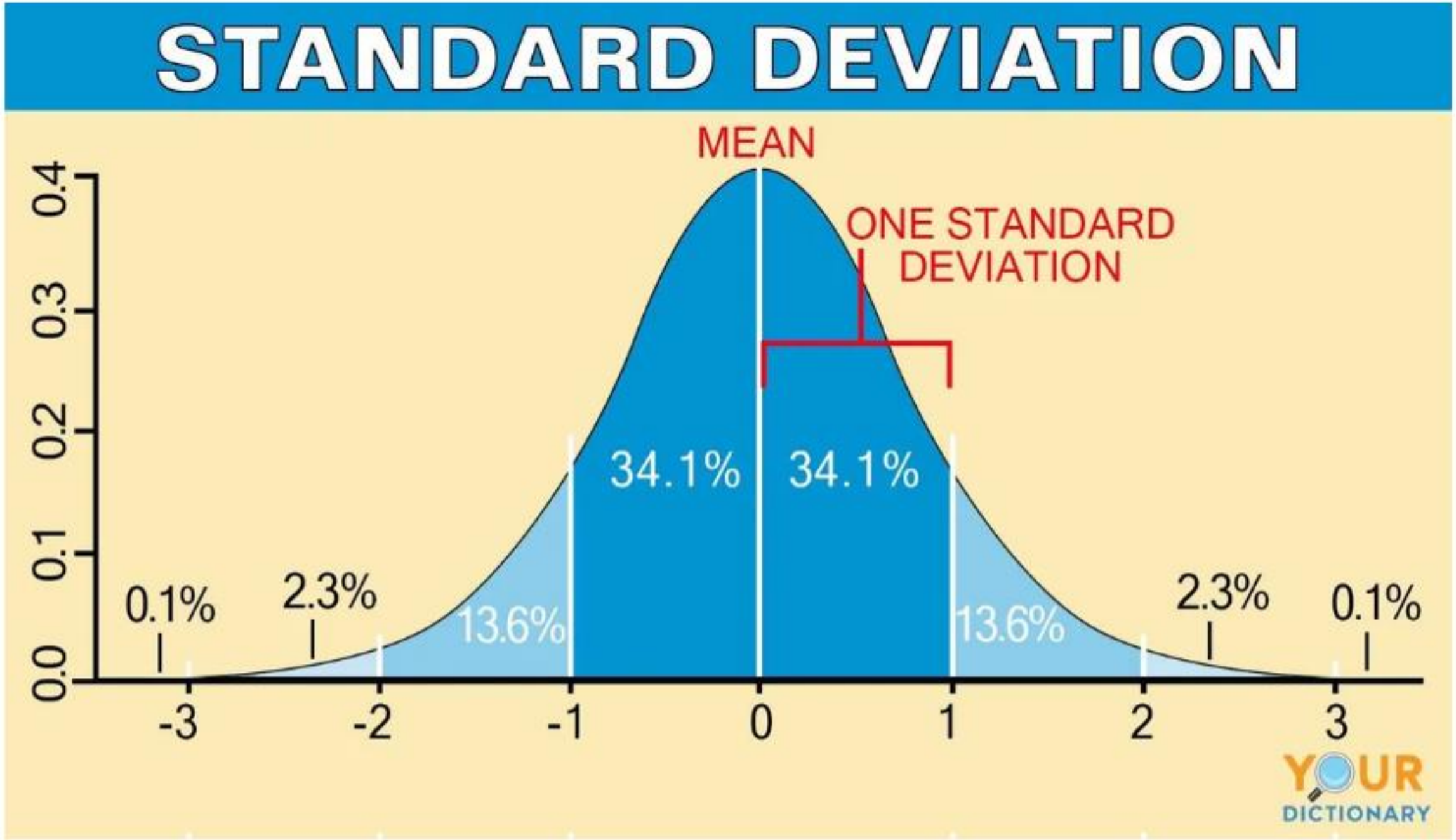
X_i = each of the values of the data

$\overline{X}$ = the mean of X_i

$$S_X = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}}$$

YOUR DICTIONARY

Image Credits


STANDARD DEVIATION
MEAN
ONE STANDARD DEVIATION
0.0
0.1
0.2
0.3
0.4
34.1%
34.1%
13.6%
13.6%
2.3%
2.3%
0.1%
0.1%
-3
-2
-1
0
1
2
3
YOUR DICTIONARY

3) How to manage risk

Managing risk in the business world involves 1) identifying, 2) assessing, and 3) taking steps to minimize or mitigate potential threats to a company's goals, operations, or profitability. An effective risk management process helps businesses navigate uncertainty, reduce exposure to potential losses, and capitalize on opportunities. Here's how businesses can manage risk:

1. Risk Identification
   - Process: Businesses first need to identify the potential risks that could affect their operations, projects, or goals. Risks can be internal (like operational inefficiencies or human error) or external (like economic downturns or regulatory changes).
   - Examples: Market risks, financial risks, operational risks, reputational risks, technological risks, legal risks.

2. Risk Assessment and Analysis
   - Evaluate Likelihood and Impact: Once identified, risks are assessed based on their probability of occurring and the potential impact on the business. This helps prioritize which risks require immediate attention.
      - Likelihood: The chances of the risk occurring (e.g., rare, likely, almost certain).
      - Impact: The consequences if the risk occurs (e.g., minor, moderate, catastrophic).
   - Risk Matrix: A common tool used is the risk matrix, which plots risks based on likelihood and impact to classify them as low, moderate, or high risk.

3. Risk Mitigation Strategies

Businesses adopt strategies to either reduce the likelihood of a risk happening or lessen its impact. Common approaches include:

- **Risk Avoidance**: Avoiding activities or decisions that could lead to exposure to risk. For example, a company might decide not to enter a volatile market.
- **Risk Reduction**: Implementing measures to reduce the risk. This can include strengthening internal controls, diversifying product offerings, improving cybersecurity, or training employees.
- **Risk Sharing or Transfer**: Shifting the risk to another party. This is commonly done through insurance, outsourcing, or entering partnerships where risks are shared.
- **Risk Acceptance**: Acknowledging that certain risks are unavoidable and choosing to bear them, especially if the cost of mitigation exceeds the potential loss.

4. Risk Monitoring and Reporting
- Ongoing Monitoring: Risk management is not a one-time process. Businesses continuously monitor risks to track changes in the environment, new threats, or the effectiveness of mitigation strategies.
- Reporting: Regular risk reports should be generated and communicated to key stakeholders, such as management, employees, and investors, to ensure transparency and allow timely decision-making.

5. Contingency Planning
- Create Backup Plans: For critical risks, businesses develop contingency plans to respond quickly if the risk materializes. This might include business continuity plans (BCP), disaster recovery plans, or crisis management strategies.

6. Risk Culture and Governance
- Leadership Role: Senior management plays a key role in fostering a risk-aware culture. They must ensure that risk management is embedded into the company's strategy and daily operations.
- Employee Involvement: Everyone in the organization should be aware of the risks they may encounter in their roles and be trained to identify and report them. This empowers employees to contribute to risk mitigation efforts.
- Governance**: A formal risk management framework, often led by a risk management team or Chief Risk Officer (CRO), helps standardize how risks are handled across the organization. Many companies use frameworks like COSO (Committee of Sponsoring Organizations) or ISO 31000 to guide their risk management practices.

7. Risk Financing
- Insurance: Purchasing insurance is a common way for businesses to manage risks related to property, liability, and other exposures.
- Reserves: Businesses may also set aside financial reserves to cover unexpected losses or manage financial risks such as currency fluctuations.

8. Compliance and Legal Risk Management
- Regulatory Adherence: Businesses need to comply with laws and regulations relevant to their industry. Legal risks arise from failure to follow such regulations, leading to fines, lawsuits, or reputational damage. A proactive approach to compliance and maintaining up-to-date knowledge of regulatory changes is essential.

9. Technology in Risk Management
- Risk Management Software: Many companies leverage risk management software to streamline the process of identifying, tracking, and responding to risks.
- Data Analysis: Advanced data analytics can help in predicting risks and assessing their potential impacts more accurately.

MODERN PORTFOLIO THEORY (H. MAR KOWITZ)

- The expected return of a portfolio is a weighted average of t he expected returns of each of the securities in the portfolio

$$E(R_p) = \Sigma X_i R_i$$

- The weights (X_i) are equal to the percentage of the portfolio's value which is invested in each security and R_i is the [expecte d] return for each asset i in the portfolio.

What Is the Modern Portfolio Theory (MPT)?

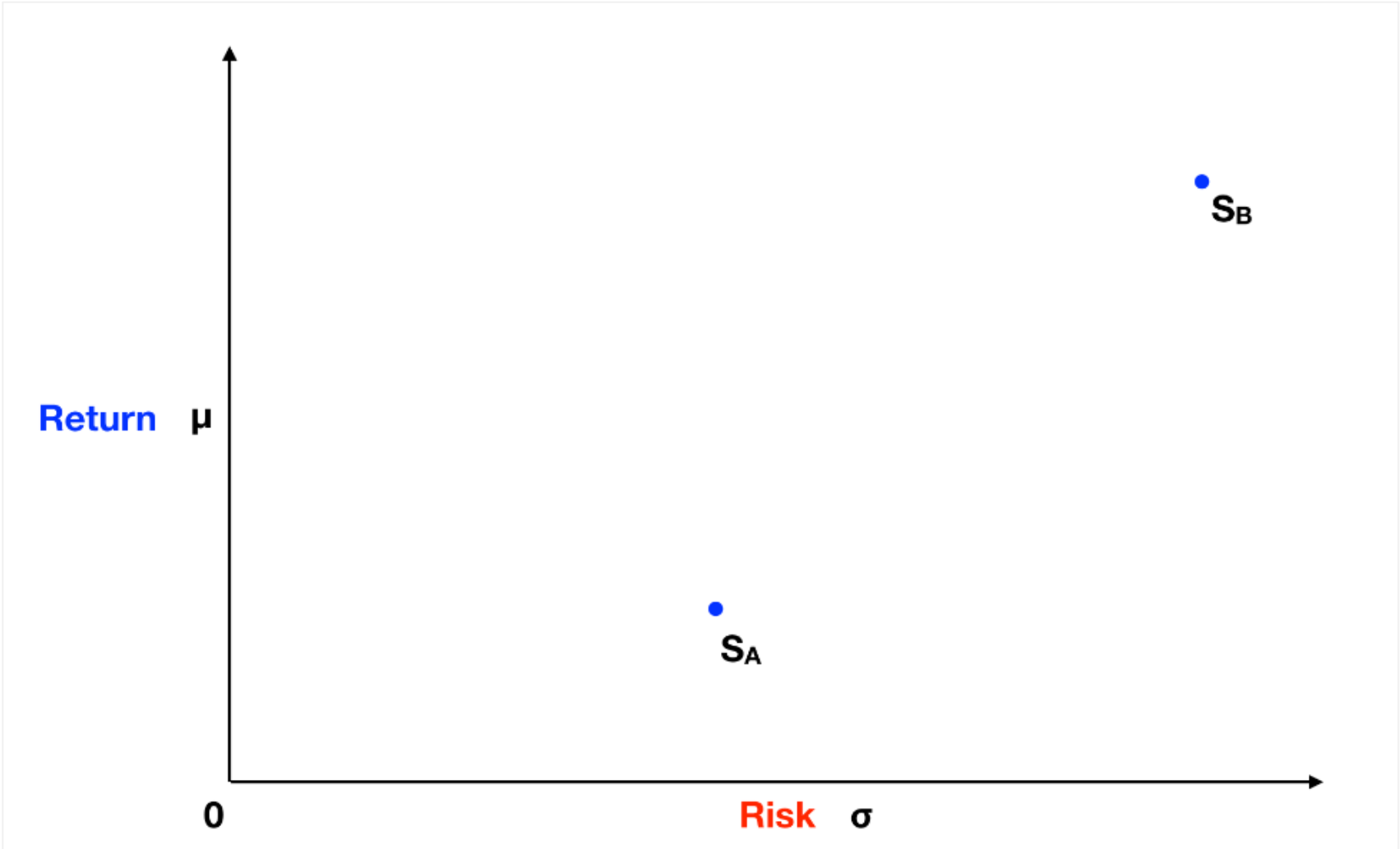
The modern portfolio theory (MPT) is a practical method for selecting investments in order to maximize their overall returns within an acceptable level of risk. This mathematical framework is used to build a portfolio of investments that maximize the amount of expected return for the collective given level of risk.

American economist Harry Markowitz pioneered this theory in his paper "Portfolio Selection," which was published in the Journal of Finance in 1952.[1] He was later awarded a Nobel Prize for his work on modern portfolio theory.[2]

A key component of the MPT theory is diversification. Most investments are either high risk and high return or low risk and low return. Markowitz argued that investors could achieve their best results by choosing an optimal mix of the two based on an assessment of their individual tolerance to risk.

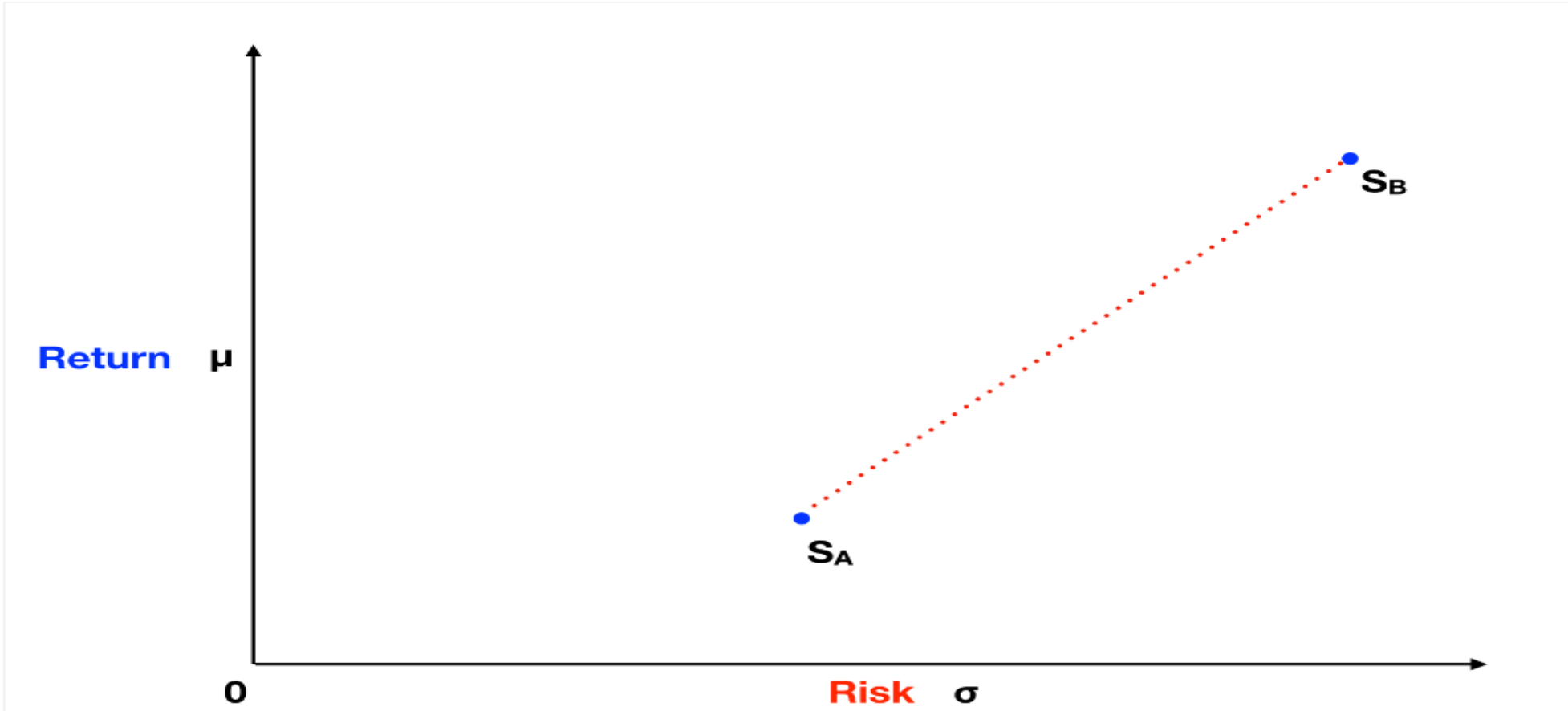
Comparing Assets

Let's start by defining two assets, stock A and stock B, in terms of their expected return and risk, where risk is determined by the stock's volatility in the market. We can then plot and compare these two stocks on the following graph, where the Y axis represents the expected return and the X axis the risk of the stocks.

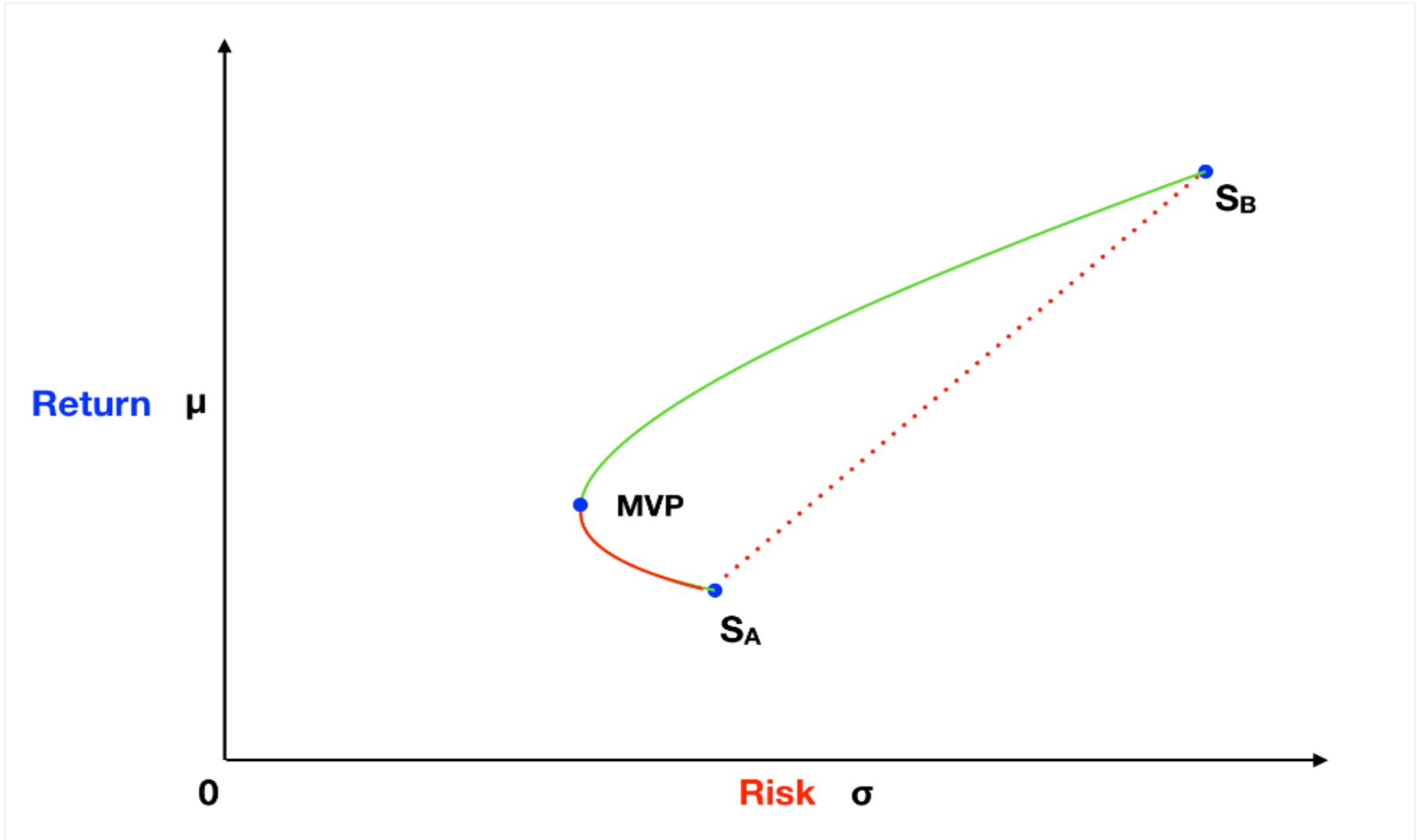


Basic Intuition

We can easily see that stock B has a higher expected return and higher risk than stock A. But can you predict where in this graph is a portfolio with a 50% weight split between these two stocks? Our natural inclination says that such portfolio is half way on a straight line between stock A and stock B. And that a portfolio with 75% weight on stock A and 25% weight on stock B, is one fourth of the way going up that line. The red dotted line on the graph below represents all the possible portfolios between stock A and stock B, as predicted by our basic intuition.



In this case, our intuition is wrong! The line of all possible portfolios of stock A and stock B is not straight, it is curved in the direction of the Y axis, having a hyperbola shape. This is pretty amazing, because it means that we can create portfolios with stock A and stock B, which have less risk than either of these stocks! On the next graph, the blue dot with the label MVP, shows one of these possible portfolios, specifically called the *Minimum Variance Portfolio*.



Correlation Magic

So where is the magic? How is that possible? To solve this puzzle, we need to understand how the portfolio expected return and risk are calculated. I am going to use the two-asset portfolio formula provide on the Wikipedia page for Modern Portfolio Theory. These formulas are easy to deduct with the use of algebra and basic finance knowledge, but I'll spare you the math, so we can focus on the results.

The portfolio expected return calculation is quite simple. It's just a weighted average of the individual stock returns, as illustrated by the following formula:

$$E(R_p) = \omega_A * E(R_A) + \omega_B * E(R_B) = \omega_A * E(R_A) + (1 - \omega_A) * E(R_B)$$

Portfolio Expected Return Formula

Where E(R) is the expected return and ω is the weight allocated to each stock.

This formula is consistent with our initial intuition, that the plot of portfolios created with stock A and stock B would be on a straight line between these two stocks. Now, let's analyze the formula for portfolio variance, which is the square of standard deviation, our chosen measure of risk.

$$\sigma_p^2 = \omega_A^2 * \sigma_A^2 + \omega_B^2 * \sigma_B^2 + 2 * \omega_A * \omega_B * \sigma_A * \sigma_B * \rho_{AB}$$

Portfolio Variance Formula

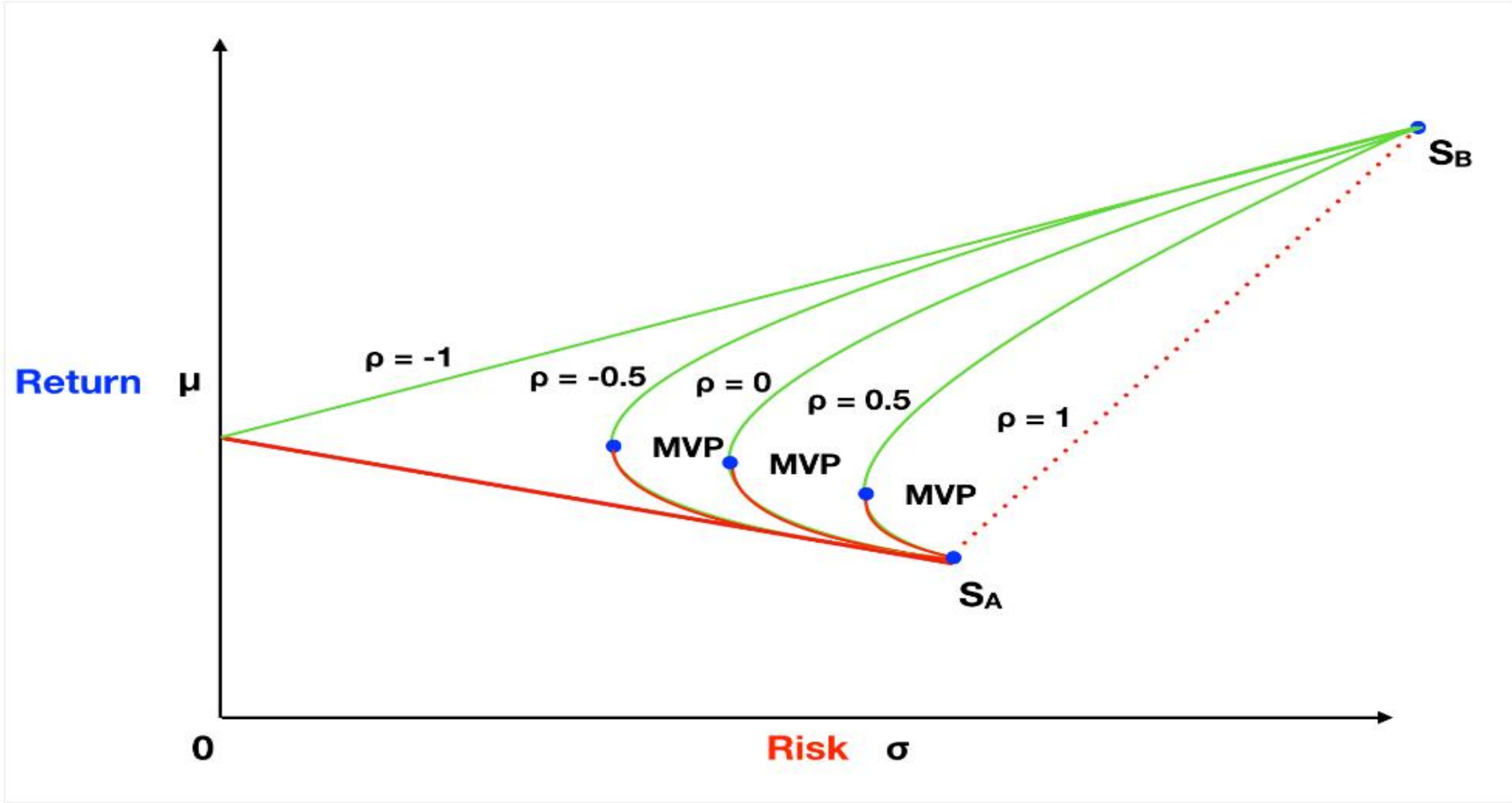
Where σ is the standard deviation of each stock and ρ is the correlation between stocks.

This is where our intuition is failing us. The portfolio variance formula has an additional, and unexpected, component: the correlation between the stocks. Correlation is a number varying between -1 and 1 and describes how the stock returns are related. If the two stocks had a perfect positive correlation, ρ would be equal 1, and the formula would look like this:

$$\sigma_p^2 = \omega_A^2 * \sigma_A^2 + \omega_B^2 * \sigma_B^2 + 2 * \omega_A * \omega_B * \sigma_A * \sigma_B * \rho_{AB} = (\omega_A * \sigma_A + \omega_B * \sigma_B)^2$$

Portfolio Variance Formula → A and B Correlation = 1

This would be coherent with our initial intuition, that all portfolios formed with stock A and stock B would be on the straight line between A and B. But in the market, stocks rarely have perfect positive correlation. Stock A could go up by 1% and stock B go up by 2% in one month, and then on the following month, stock A goes up by 0.5% and stock B goes down by 0.7%. So ρ will probably be a number lower than 1, therefore, reducing the overall portfolio variance. The graph below shows hypothetical hyperbola curves, each using a different correlation, of portfolios created by combining stock A and B. You can easily see that the lower the correlation of these two stocks, the bigger the reduction in portfolio variance, hence, the lower the portfolio risk.



Risk and Return Graph For Two Assets → Varying Correlations

Next: Portfolio Management

MODERN PORTFOLIO THEORY

C. The riskiness of a portfolio is more complex; it is the square root of the sum of the weighted (X^2i) times the variances (s^2) of each se curity and the correlation (r - rho) between each pair of securities i n a 2-Asset Portfolio.

$$\sigma_p = (X^2_i \sigma^2_i + X^2_j \sigma^2_j + 2 X_i X_j \rho_{i,j} \sigma_i \sigma_j)^{1/2}$$

- The correlation coefficient ($\rho_{i,j}$) can be positive (+1), zero, or negative (-1)
- If the average correlation of securities in the portfolio is positive – the riski ness of the portfolio will be larger.
- If the average correlation of securities in the portfolio is negative – the risk iness of the portfolio is smaller: the third term will be negative

MODERN PORTFOLIO THEORY

- The following conclusions can be drawn:
  - When the holding period returns of two securities move in the same direction, by the same amount at the same time, the pair is perfectly positively correlated: rho = 1
  - When the holding period returns of two securities are totally unrelat ed to each other, the pair is uncorrelated; rho = 0
  - The risk of a portfolio is the weighted average of the risk of each se curity in the portfolio, and the correlations between each pair of sec urities in the portfolio
  - Some textbooks use the covariance terms in the third term of Eq. 17 -4: $\sigma_{i,j} = \rho_{i,j}\,\sigma_i\,\sigma_j\rho$ = rho (r)

Risk Reduction: Benefits of Diversification

- Portfolio diversification
  - Diversification can increase the risk/return tradeoff if the average correlatio n coefficient between individual securities in the portfolio is less than 1.0
  - The benefits of diversification increase as the correlation coefficient gets s maller
- Diversification across securities
  - As the number of securities in a portfolio increases the portfolio risk decre ases and approaches the risk of the total market
  - Market risk is inherent from business cycles, inflation, interest rates, and ec onomic factors
  - Firm-specific risk is tied to the company's labor contracts, new product dev elopment and other company related factors

Risk Reduction: Benefits of Diversification

C. Forms of Diversification

- Mathematical: Increasing the number of stocks reduces the portfolio risk
- Diversification across time
- Dollar cost averaging
- Naive Diversification
  - Naive diversification occurs when investors select stocks at random, and purch ase and equal dollar amount of each security
  - When N becomes large enough, naive diversification averages out the firm-sp ecific (unsystematic) risk of the stocks in the portfolio, so that only the market (or systematic) risk remains

Capital Asset Pricing Model (CAPM)

- Equation that defines the risk/return relationship
  - The CAPM assumes two assets: the risk-free asset and the risky mark et portfolio
  - The two asset CAPM world results in a linear efficient frontier: Capita l Market Line (CML)
  - The risk aversion characteristic of the investor will determine how m uch is invested in the risk-free asset and how much is invested in th e risky market portfolio
  - The standard deviation of the risk-free asset is zero.
  - Based on the idea that investors accept a higher risk only for a high er return

III. Valuation (Firm and Stock)

1. Absolute Valuation

Fundamental Approach
(Top-down Approach vs Bottom-up Approach)

2. Relative Valuation

1. Top-down Approach

1) Global Macro Analysis

2) Industry Analysis

3) Company Analysis

IV. Probable Questions for the Mid-term Exam

1. The size of global GDP in 2023, and its proportion by country (1~10 top countries)
2. Time Value of Money

2.1 Future Value

2.2 Present Value with multiple future cash flows

2.3 Present Value with annuity

3. How to calculate the NPV and decision making rule
4. Basics of Statistics (central tendency, dispersion)
5. Risk (definition, how to measure the risk, how to measure them, how to manage them)
6. Portfolio Theory and its application
6. etc