

Introduction to Finance

Prepared by
Dr. Mohamed Hussein
Assistant Professor of Accounting

MGM237

Lecture 10



Introduction To Finance

Lecture 10

MGM237 Risks and Returns

Prepared by
Dr. Mohamed Hussein

Chapter

10

Risks and Returns





Chapter

10

Risks and Returns

- **Introduction to Risks and Returns.**
- **The Risk-Return Trade-Off.**
- **Stand-alone Risk.**
- **Risk in a Portfolio Context: The CAPM**

Introduction to Risks and Returns

What Are Returns?

Return :refers to the gain or loss made on an investment over a specific period. It is typically expressed as a percentage of the initial investment. Returns can come in various forms, **including**:

- Capital Gains**: The increase in the value of an asset or investment.
- Dividends and Interest**: Periodic payments received from investments like stocks and bonds.
- Rental Income**: Earnings from real estate investments.
- Royalties**: Income from intellectual property like patents or copyrights



Chapter
10

Introduction to Risks and Returns

Types of Returns

- **Nominal Return:** The total return without adjusting for factors like inflation.
- **Real Return:** The return adjusted for inflation, representing the actual purchasing power gained.
- **Expected Return:** The anticipated return on an investment based on historical data or financial models.
- **Absolute Return:** The return that an investment achieves over a certain period, regardless of market conditions.
- **Relative Return:** The return of an investment compared to a benchmark or market index.



Introduction to Risks and Returns

What Is Risk?

Risk: in finance refers to the uncertainty regarding the returns on an investment. It embodies the possibility that the actual return will differ from the expected return, which can result in either higher or lower gains or even losses.

Types of Risks

- **Market Risk:** The risk of losses due to factors affecting the overall market, such as economic downturns or political instability.
- **Credit Risk:** The possibility that a borrower will default on their obligations.



Introduction to Risks and Returns

Types of Risks

- **Liquidity Risk:** The risk of not being able to buy or sell an investment quickly enough without affecting its price.
- **Operational Risk:** Risks arising from failures in internal processes, systems, or external events.
- **Inflation Risk:** The danger that inflation will erode the purchasing power of returns.
- **Currency Risk:** The risk of loss from fluctuations in exchange rates for international investments.

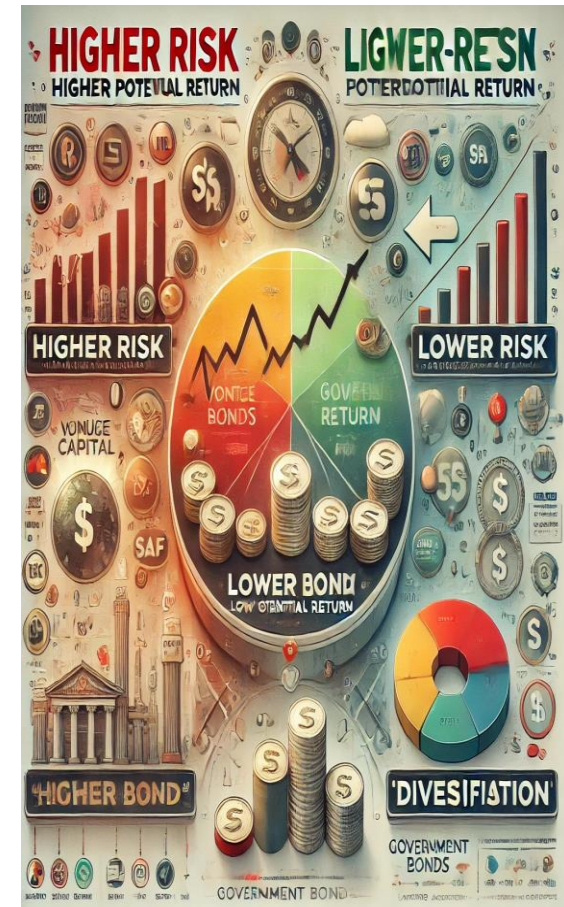


The Risk-Return Tradeoff

One of the foundational principles in finance is the **risk-return tradeoff**, which posits that potential return rises with an increase in risk. Investors must balance their desire for the highest possible returns against their tolerance for risk.

Key Points of the Risk-Return Tradeoff

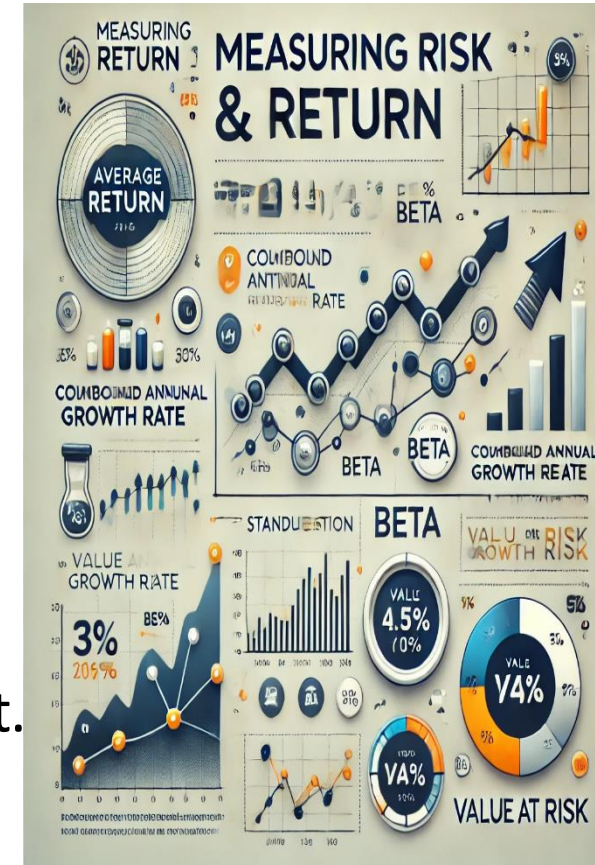
- **Higher Risk, Higher Potential Return:** Investments like stocks or venture capital typically offer higher potential returns but come with greater risk.
- **Lower Risk, Lower Potential Return:** Investments such as government bonds or savings accounts offer lower returns but are generally safer.
- **Diversification:** Spreading investments across various assets can help manage and mitigate risk while aiming to achieve desired returns.



Accurate measurement of risk and return is essential for making informed investment decisions.

- **Average Return:** The mean of a series of returns over a period.
- **Compound Annual Growth Rate (CAGR):** The annual growth rate of an investment over a specified period longer than one year.

- **Standard Deviation:** A statistical measure that quantifies the variability or volatility of returns.
- **Beta:** A measure of a stock's volatility in relation to the overall market.
- **Value at Risk (VaR):** Estimates the maximum potential loss over a specific time frame with a given confidence level.



Applications in Portfolio Management

Understanding risks and returns is crucial for constructing and managing an investment portfolio.

Modern Portfolio Theory (MPT)

Developed by Harry Markowitz, MPT emphasizes the importance of diversification to optimize the balance between risk and return. The theory suggests that an investor can construct a "frontier" of optimal portfolios offering the maximum possible expected return for a given level of risk.

Capital Asset Pricing Model (CAPM)

CAPM builds on MPT by introducing the relationship between systematic risk (beta) and expected return. It provides a formula to calculate the expected return of an asset based on its beta and the expected market return.



Behavioral Considerations

Beyond quantitative measures, investor behavior significantly influences risk and return outcomes.

- **Risk Perception:** Different investors perceive and tolerate risk differently based on their experiences, financial goals, and psychological factors.
- **Herd Behavior:** Investors may follow the actions of a larger group, sometimes leading to irrational investment decisions.
- **Overconfidence:** Investors might overestimate their ability to predict market movements, leading to excessive risk-taking.



The Risk-Return Trade-Off

The Risk-Return Tradeoff

We start from a very simple premise: **investors like returns and they dislike risk**. This fundamental notion underpins much of investment theory and practice. Understanding this premise is essential for making informed investment decisions

Fundamental Premise

Investors Favor Returns: At the core, investors seek to grow their wealth. Whether through capital appreciation, dividends, interest, or other forms of income, the primary goal is to achieve favorable returns on their investments.



The Risk-Return Tradeoff

Investors Dislike Risk: While seeking higher returns, investors naturally prefer to minimize uncertainty. Risk, in this context, refers to the possibility that an investment's actual return will deviate from the expected return. This deviation can lead to either higher gains or losses, but generally, the aversion to potential losses outweighs the attraction to potential gains.

Key Components of the Tradeoff

1. Low-Risk Investments:

- **Examples:** Government bonds, high-grade corporate bonds, money market instruments.
- **Characteristics:** These investments offer lower returns but come with minimal risk of loss.



2.High-Risk Investments:

- **Examples:** Stocks, real estate, venture capital, cryptocurrencies.
- **Characteristics:** These investments offer the potential for higher returns but come with greater volatility and the possibility of significant losses.

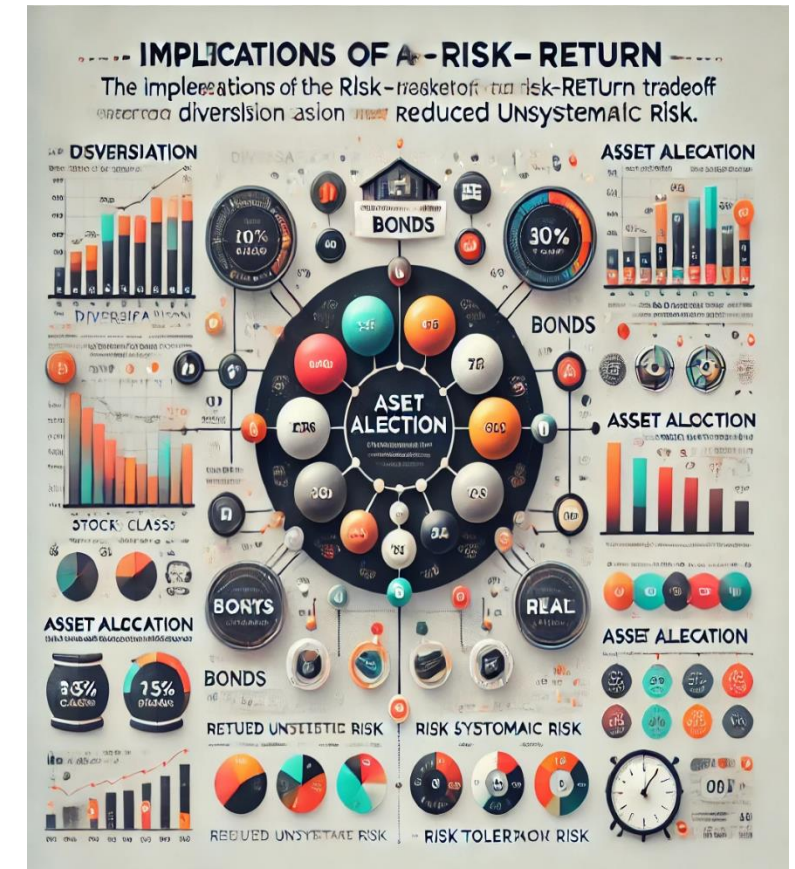
3.Intermediate-Risk Investments:

- **Examples:** Balanced mutual funds, dividend-paying stocks, corporate bonds.
- **Characteristics:** These investments strike a balance between risk and return, offering moderate returns with moderate risk.



Implications for Investors

- **Diversification:** By spreading investments across various asset classes and securities, investors can manage and mitigate risk while aiming to achieve their desired returns. Diversification does not eliminate risk but can reduce unsystematic risk specific to individual investments.
- **Asset Allocation:** Determining the appropriate mix of asset classes (e.g., stocks, bonds, real estate) based on an investor's risk tolerance, investment goals, and time horizon is crucial. Proper asset allocation seeks to optimize the balance between risk and return.



The Risk-Return Trade-Off

Implications for Investors

• **Risk Tolerance Assessment:** Investors must assess their own risk tolerance, which can be influenced by factors such as financial goals, investment timeline, income stability, and psychological comfort with market fluctuations.

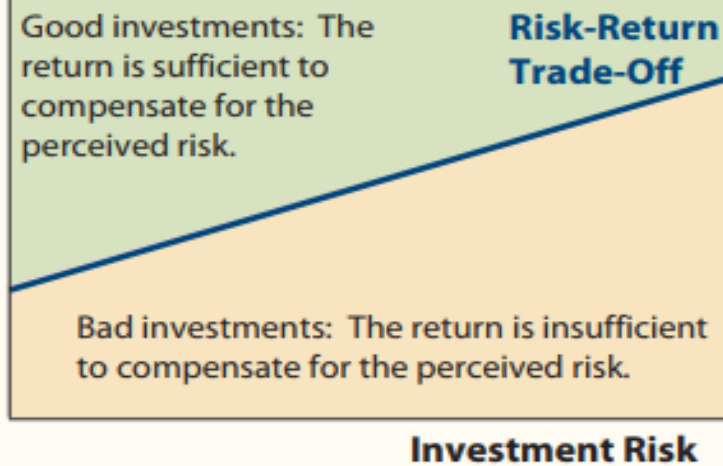
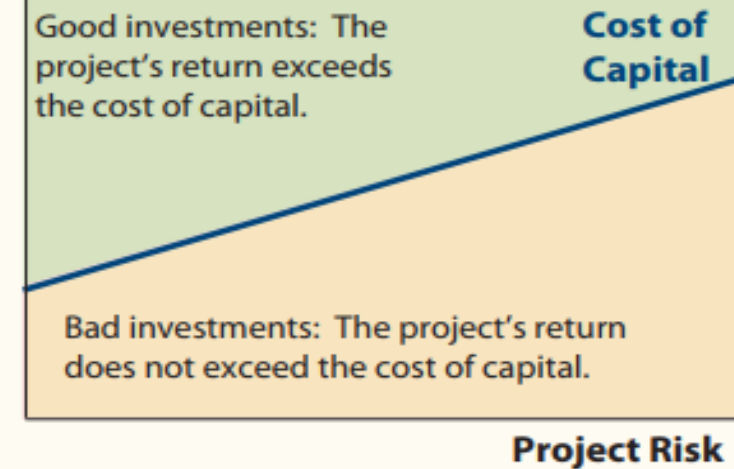
Balancing Risk and Return

Achieving the optimal balance between risk and return involves several strategies:

- **Understanding Investment Options.**
- **Setting Clear Financial Goals.**
- **Regular Portfolio Review.**
- **Long-Term Perspective.**



The Risk-Return Trade-Off

FIGURE 8.1**The Trade-Off between Risk and Return****Panel a: The Individual Investor's Perspective****Investment
Return****Panel b: Perspective of a Company Raising Money to Invest in Risky Projects****Project
Return**

1. Individual Investor's Perspective :

1. **As investment risk increases**, investors expect higher returns to justify taking on that risk.
2. **Good investments**: The return is sufficient to compensate for the risk.
3. **Bad investments**: The return is insufficient to justify the risk.

2. Company Perspective:

1. **A company evaluates projects** by comparing the project's return with the **cost of capital**.
2. **Good investments**: The project's return exceeds the cost of capital, making it a profitable choice.
3. **Bad investments**: If the project's return does not exceed the cost of capital, it is considered unprofitable.



Risk is defined by Dictionary as “a hazard; a peril; exposure to loss or injury.”

- Thus, risk refers to the chance that some **unfavorable event** will occur.
- If you engage in skydiving, you are taking a chance with your life—skydiving is risky.
- If you bet on the horses, you are risking your money.
- individuals and firms invest funds today with the expectation of receiving additional funds in the future. Bonds offer relatively low returns, but with relatively little risk—at least if you stick to Treasury and high-grade corporate bonds.



Stand-Alone Risk

- **Stocks offer the chance of higher returns**, but stocks are generally riskier than bonds. If you invest in speculative stocks (or, really, any stock), you are taking a significant risk in the hope of making an appreciable return.
- **An asset's risk can be analyzed** in two ways: (1) on a stand-alone basis, where the asset is considered by itself and (2) on a portfolio basis, where the asset is held as one of a number of assets in a portfolio.
- **Thus, an asset's stand-alone risk** is the risk an investor would face if he or she held only this one asset.
- **Most financial assets, and stocks in particular**, are held in portfolios, but it is necessary to understand stand-alone risk to understand risk in a portfolio context.



Returns on the stock would be much harder to predict. **In the worst case**, the company would go bankrupt, and the investor would lose all of his or her money, in which case the return would be -100%.



When evaluating this investment, the investor might analyze the situation and conclude that the expected rate of return, in a statistical sense, is 20%, but the actual rate of return could range from, say, +1,000% to -100%. Because there is a significant danger of earning much less than the expected return, such a stock would be relatively risky.

When evaluating No investment should be undertaken unless the expected rate of return is high enough to compensate for the perceived risk. In our example, it is clear that few if any investors would be willing to buy the oil exploration stock if its expected return didn't exceed that of the T-bill. This is an extreme example. Generally, things are much less obvious, and we need to measure risk in order to decide whether a potential investment should be undertaken.

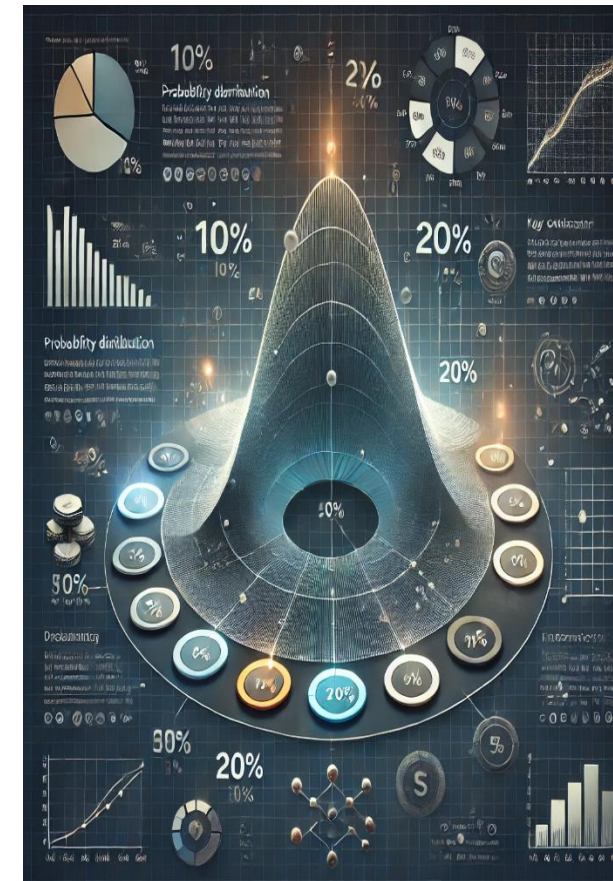


Probability Distributions

Listings of possible outcomes or events with a probability (chance of occurrence) assigned to each outcome.

Example:

Table 8.1 gives the probability distributions for Martin Products, which makes engines for long-haul trucks (18-wheelers), and for U.S. Water, which supplies an essential product and thus has very stable sales and profits. Three possible states of the economy are shown in column 1, and the probabilities of these outcomes, expressed as decimals rather than percentages, are given in column 2 and then repeated in column 5. There is a 30% chance of a strong economy and thus strong demand, a 40% probability of normal demand, and a 30% probability of weak demand.



Probability Distributions and Expected Returns

TABLE 8.1

	A	B	C	D	E	F	G	H
16	Economy, Which Affects Demand (1)	Martin Products				U.S. Water		
17		Rate of				Rate of		
18		Probability	Return			Probability	Return	
19		of this	if this			of this	if this	
20		Demand	Demand	Product		Demand	Demand	Product
21		Occurring	Occurs	(2) × (3)		Occurring	Occurs	(5) × (6)
22		(2)	(3)	(4)		(5)	(6)	(7)
23	Strong	0.30	80%	24%		0.30	15%	4.5%
24	Normal	0.40	10%	4%		0.40	10%	4.0%
25	Weak	0.30	−60%	−18%		0.30	5%	1.5%
26		1.00	Expected return =	10%		1.00	Expected return =	10.0%
27								

Overview of the Table:

1.Economic Conditions (Column A): These describe the state of the economy (Strong, Normal, or Weak), which impacts demand for the products.

2.Probability of Demand (Columns B and F): For each economic condition (Strong, Normal, Weak), there is a probability associated with how likely it is that demand for the product will occur. The sum of all probabilities for each product must equal 1 (or 100%).

3.Rate of Return (Columns C and G): This represents the expected return on the product if the respective demand condition occurs. For example:

- For Martin Products, if demand is strong, the rate of return is 80%, and if demand is weak, the rate of return is -60%.
- For U.S. Water, if demand is strong, the rate of return is 15%, and if demand is weak, it is 5%.

Expected Return (Column D and H):

This is **the calculated expected return for each product**. To find it, you multiply the probability of each demand occurring by the rate of return for that condition, and then **sum those values. The formula is:**

$$\text{Expected Return} = (P \text{ Strong} \times R \text{ Strong}) + (P \text{ Normal} \times R \text{ Normal}) + (P \text{ Weak} \times R \text{ Weak})$$

Where:

Example: For Martin Products:

- **Strong Economy (30% chance):** Expected return of 80%.
- **Normal Economy (40% chance):** Expected return of 10%.
- **Weak Economy (30% chance):** Expected return of -60%.

The expected return for Martin Products is:

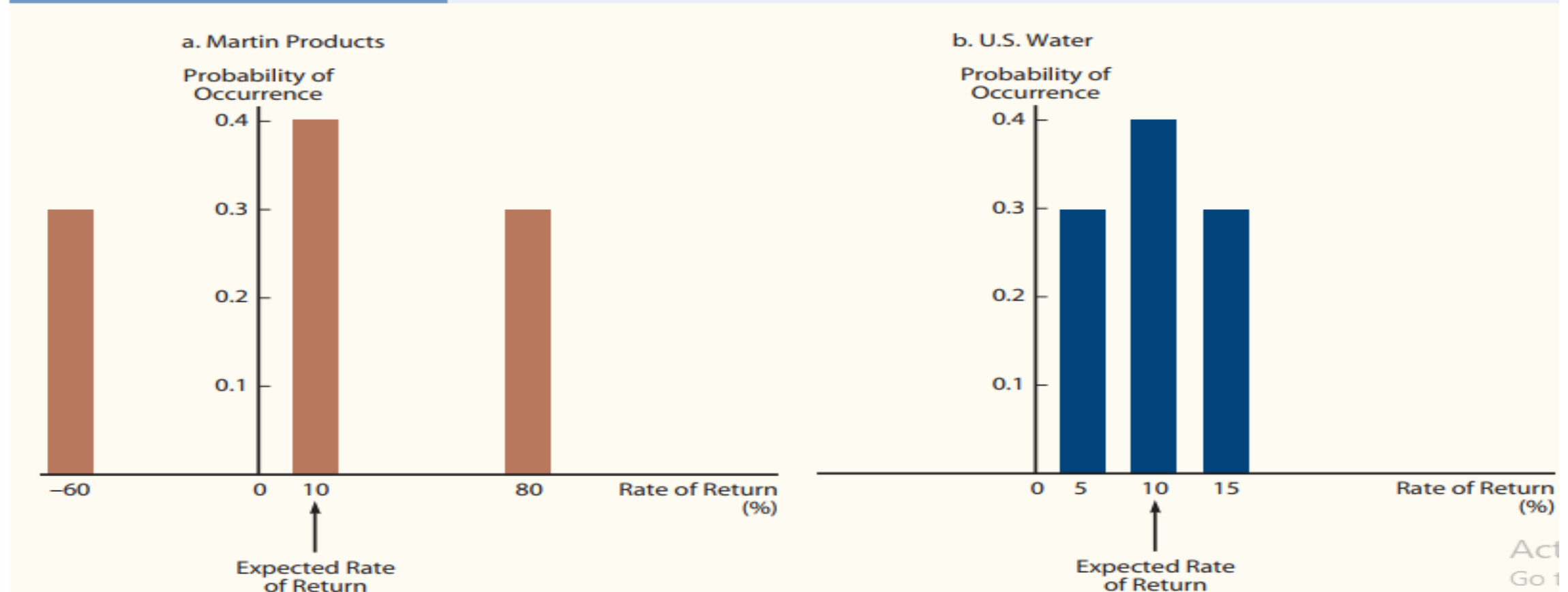
$$(0.30 \times 80\%) + (0.40 \times 10\%) + (0.30 \times -60\%) = 24\% + 4\% - 18\% = 10\%$$

For U.S. Water, a similar calculation gives an expected return of 10%.

Stand-Alone Risk

FIGURE 8.2

Probability Distributions of Martin Products's and U.S. Water's Rates of Return

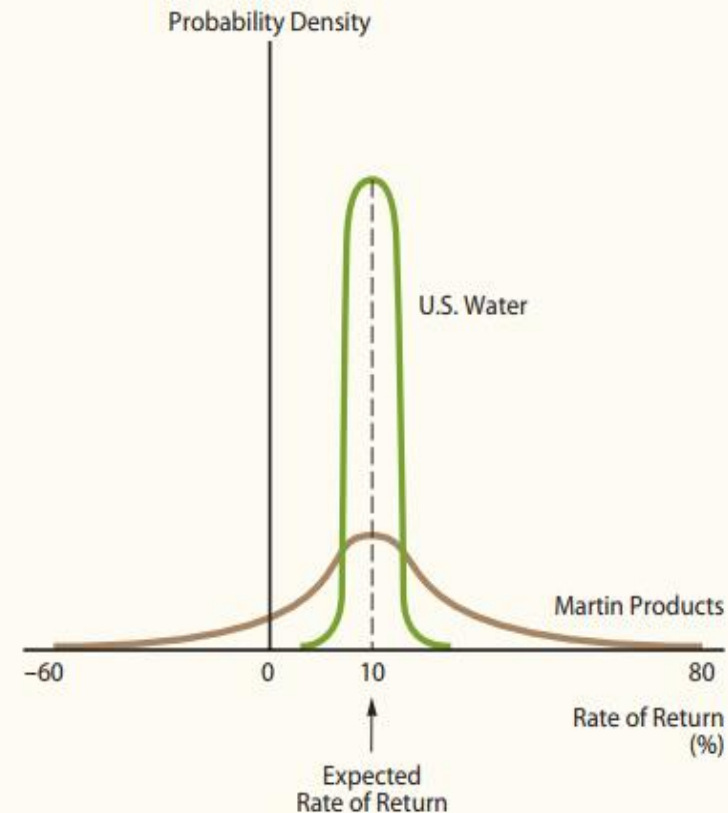


STAND-ALONE RISK: THE STANDARD DEVIATION

It is useful to measure risk for comparative purposes, but risk can be defined and measured in several ways. A common definition that is satisfactory for our purpose is based on probability distributions such as those shown in Figure 8.3:

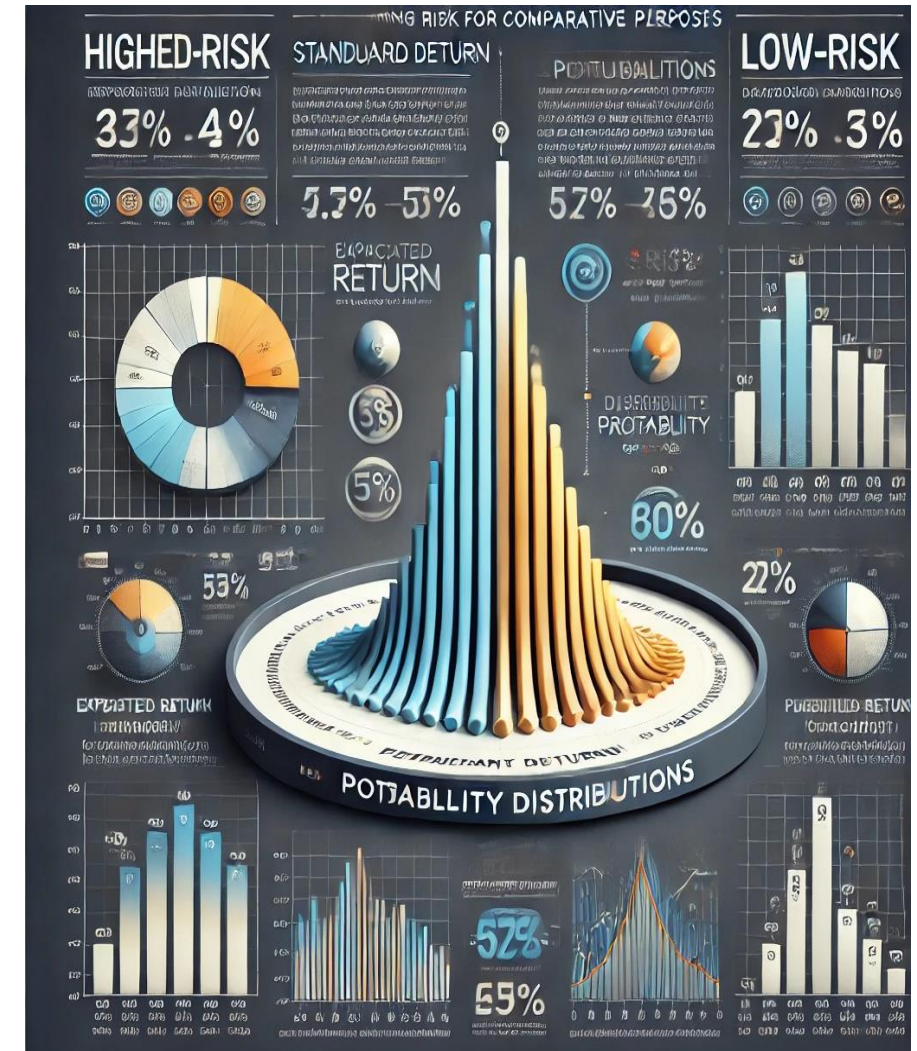
FIGURE 8.3

Continuous Probability Distributions of Martin Products's and U.S. Water's Rates of Return



STAND-ALONE RISK: THE STANDARD DEVIATION

- **The tighter** the probability distribution of expected future returns, **the smaller** the risk of a given investment. According to this definition, U.S. Water is less risky than Martin Products because there is a **smaller chance** that the actual return of U.S. Water will end up far below its expected return.
- We can use the standard deviation (σ , pronounced “sigma”) to quantify the tightness of the probability distribution.⁷ The smaller the standard deviation, the tighter the probability distribution and, accordingly, the lower the risk.



STAND-ALONE RISK: THE STANDARD DEVIATION

TABLE 8.2

Calculating Martin Products's Standard Deviation

	A	B	C	D	E	F	G	H
33	Economy, Which Affects Demand (1)	Probability of this Demand Occurring (2)	Rate of Return if this Demand Occurs (3)	Deviation: Actual – 10% Expected Return (4)	Deviation Squared (5)	Squared Deviation × Prob. (6)		
34								
35								
36								
37								
38								
39	Strong	0.30	80%	70%	0.4900	0.1470		
40	Normal	0.40	10%	0%	0.0000	0.0000		
41	Weak	0.30	–60%	–70%	0.4900	0.1470		
42		1.00						
43					Σ = Variance:	0.2940		
44					Standard deviation = square root of variance: $\sigma =$	0.5422		
					Standard deviation expressed as a percentage: $\sigma =$	54.22%		

Breakdown of the Table

1.Column A (Economy): Represents different economic conditions (Strong, Normal, Weak) affecting the demand for Martin Products.

2.Column B (Probability): Displays the probability of each economic condition occurring, which are:

1. Strong: 30% (0.30)
2. Normal: 40% (0.40)
3. Weak: 30% (0.30)

3.Column C (Rate of Return): Shows the rate of return if the corresponding demand condition occurs:

1. Strong: 80%
2. Normal: 10%
3. Weak: -60%

4.Column D (Deviation from Expected Return): Represents the difference between the actual rate of return and the **expected return** of 10%. The deviation is calculated as:

Strong: $80\% - 10\% = 70\%$

Normal: $10\% - 10\%$

Weak: $-60\% - 10\% = -70$

5.Column E (Deviation Squared): The squared values of the deviations are calculated:

Strong: $(70\%)^2 = 0.49$

Normal: $(0\%)^2 = 0.00$

Weak: $(-70\%)^2 = 0.49$

6.Column F (Squared Deviation × Probability): The squared deviations are multiplied by the probability of the corresponding economic condition:

Strong: $0.49 \times 0.30 = 0.147$

Normal: $0.00 \times 0.40 = 0.000$

Weak: $0.49 \times 0.30 = 0.147$

7.Sum of Squared Deviation × Probability (Variance): The sum of these values gives the variance:

$0.147 + 0.000 + 0.147 = 0.294$

8.Standard Deviation (σ): The standard deviation is the square root of the variance:

$$\sigma = \sqrt{0.294} \approx 0.5422 \text{ or } 54.22\%$$

6.Column F (Squared Deviation × Probability): The squared deviations are multiplied by the probability of the corresponding economic condition:

Strong: $0.49 \times 0.30 = 0.147$

Normal: $0.00 \times 0.40 = 0.000$

Weak: $0.49 \times 0.30 = 0.147$

7.Sum of Squared Deviation × Probability (Variance): The sum of these values gives the **variance**:

$0.147 + 0.000 + 0.147 = 0.294$

8.Standard Deviation (σ): The standard deviation is the square root of the variance:



STAND-ALONE RISK: THE STANDARD DEVIATION

USING HISTORICAL DATA TO MEASURE RISK

In the last section, we found the mean and standard deviation based on a subjective probability distribution. If we had actual historical data instead, the standard deviation of returns could be found as shown in Table 8.3.

Finding σ Based on Historical Data

TABLE 8.3

	A	B	C	D	E	F	G	H
73				Deviation				
74				from			Squared	
75	Year	Return		Average			Deviation	
76	(1)	(2)		(3)			(4)	
77	2015	30.0%		19.8%			0.0390	
78	2016	-10.0%		-20.3%			0.0410	
79	2017	-19.0%		-29.3%			0.0856	
80	2018	40.0%		29.8%			0.0885	
81	Average	10.3%		Sum of Squared Devs (SSDevs):			0.2541	
82				SSDevs/(N - 1) = SSDevs/3:			0.0847	
83				Standard deviation = Square root of SSDevs/3: $\sigma =$			29.10%	

Breakdown of the Table:

1.Column A (Year): Shows the years for which the return data is available: 2015, 2016, 2017, and 2018.

2.Column B (Return): Displays the return for each year:

1. 2015: 30.0%
2. 2016: -10.0%
3. 2017: -19.0%
4. 2018: 40.0%

The **average return** (calculated in row 81) is 10.3%.

Breakdown of the Table:

3.Column C (Deviation from Average): The deviation of each year's return from the average return (10.3%) is calculated:

1. 2015: $30.0\% - 10.3\% = 19.8\%$
2. 2016: $-10.0\% - 10.3\% = -20.3\%$
3. 2017: $-19.0\% - 10.3\% = -29.3\%$
4. 2018: $40.0\% - 10.3\% = 29.8\%$

4.Column D (Squared Deviation): Each deviation is squared:

1. 2015: $(19.8\%)^2 = 0.0390$
2. 2016: $(-20.3\%)^2 = 0.0410$
3. 2017: $(-29.3\%)^2 = 0.0856$
4. 2018: $(29.8\%)^2 = 0.0885$

STAND-ALONE RISK: THE STANDARD DEVIATION

Breakdown of the Table:

5.Column E (Sum of Squared Deviations):

$$0.0390+0.0410+0.0856+0.0885=0.2541$$

6.Column F (Squared Deviation divided by N-1): The sum of squared deviations is divided by N-1 (where N is the number of data points, which is 4 in this case):

$$\frac{0.2541}{3} = 0.0847$$

This is the **variance** of the returns.

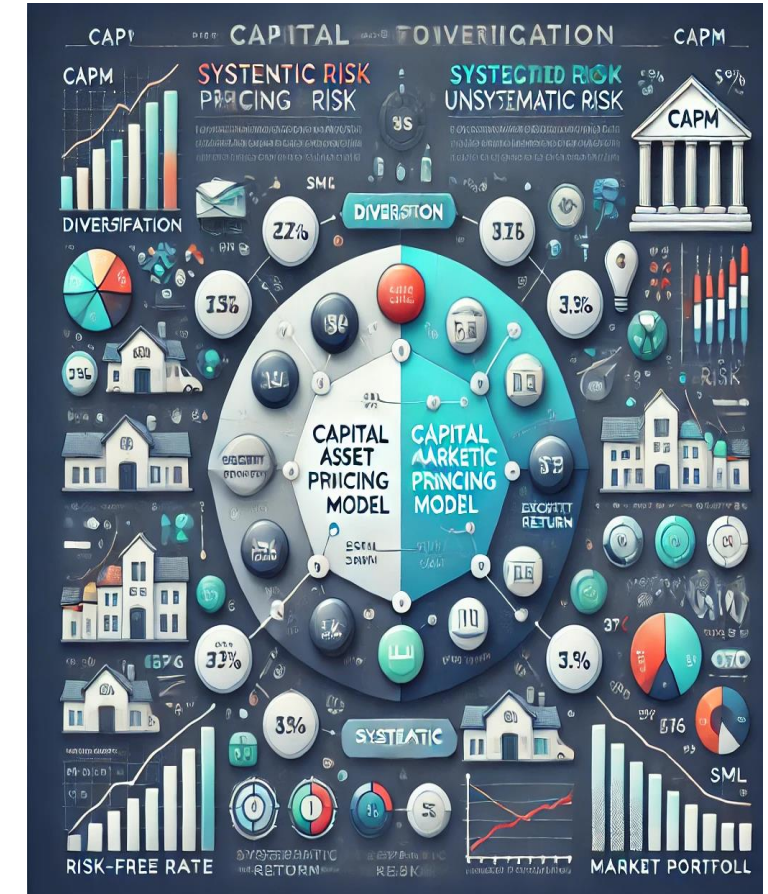
7.Column G (Standard Deviation): The **standard deviation** is the square root of the variance:

$$\sigma = \sqrt{0.0847} = 0.2910 \text{ or } 29.10\%$$

Capital Asset Pricing Model (CAPM) is a widely used theory in finance that explains the relationship between **expected return** on a stock and its **risk** when it is held in a portfolio. The model is based on the idea that investors demand a premium for taking on additional risk, but they can eliminate certain risks by diversifying their investments.

CAPM and Diversification:

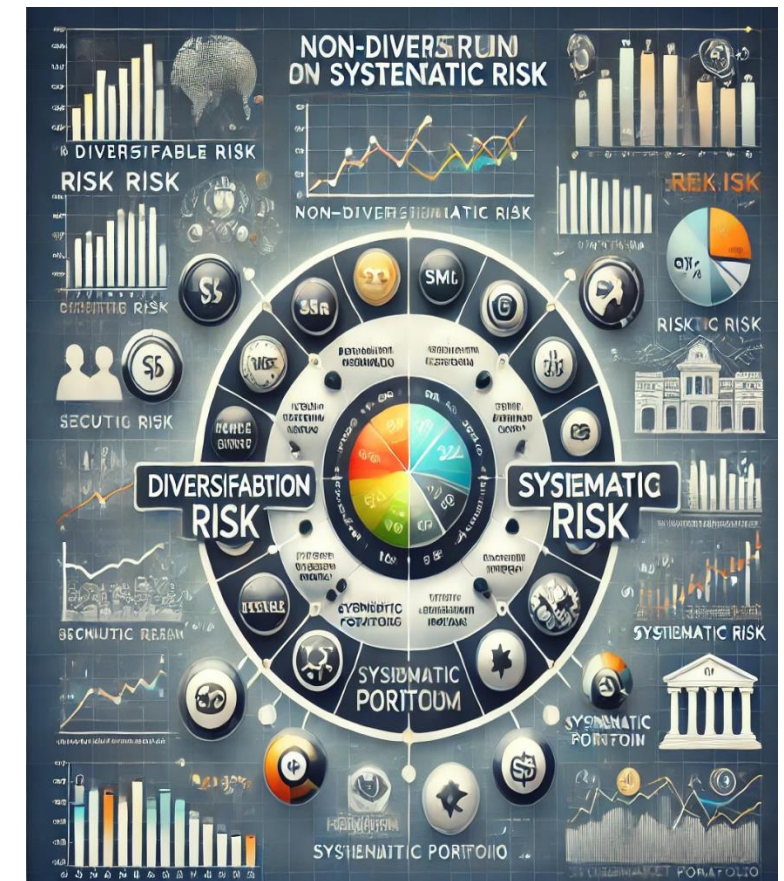
CAPM is based on the premise that **diversification** helps eliminate a significant portion of an asset's **unsystematic risk** (the risk unique to individual stocks), leaving only the **systematic risk** (the risk tied to the overall market).



Capital Asset Pricing Model (CAPM)

CAPM and Diversification:

- **Diversifiable Risk:** Risk that can be eliminated by holding a portfolio of assets. It's the unique risk associated with individual stocks (e.g., company-specific factors like management, competition, etc.).
- **Non-Diversifiable (Systematic) Risk:** Risk that cannot be eliminated by diversification. It's related to market-wide factors (e.g., economic recessions, interest rates, inflation). According to CAPM, once a stock is part of a diversified portfolio, the investor is left with **only systematic risk**, which is what determines the required return on that stock. The risk premium in the formula reflects the return needed to compensate the investor for the systematic risk of the stock after diversification.



Practical Applications of CAPM:

1. Investment Decisions:

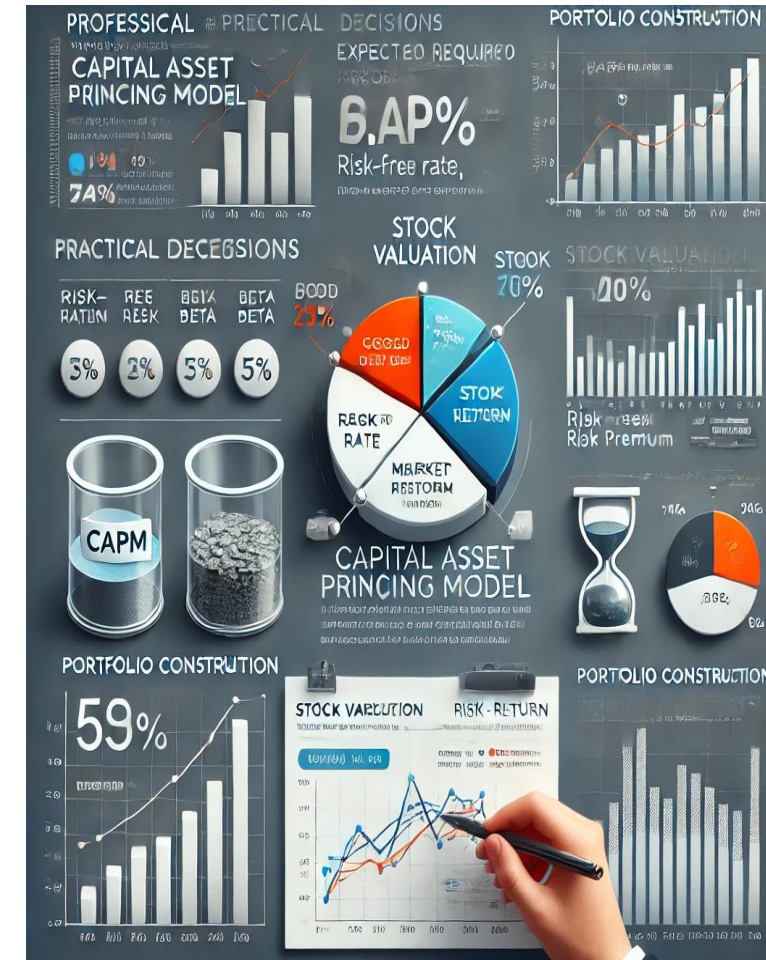
1. Investors use CAPM to determine whether an investment offers an adequate return for its risk level. If the expected return based on CAPM is higher than the actual expected return, the stock may be considered a good investment.

2. Stock Valuation:

1. CAPM can help estimate the **required return** of a stock, which can then be used to assess whether the stock is **under- or over-valued**.

3. Portfolio Construction:

1. CAPM helps investors understand the relationship between risk and return when choosing which stocks to include in their portfolios.





Thank You