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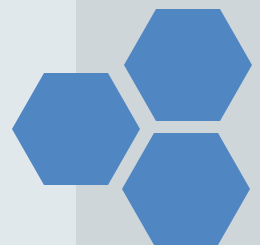


## CFA Level I

**Portfolio 2**

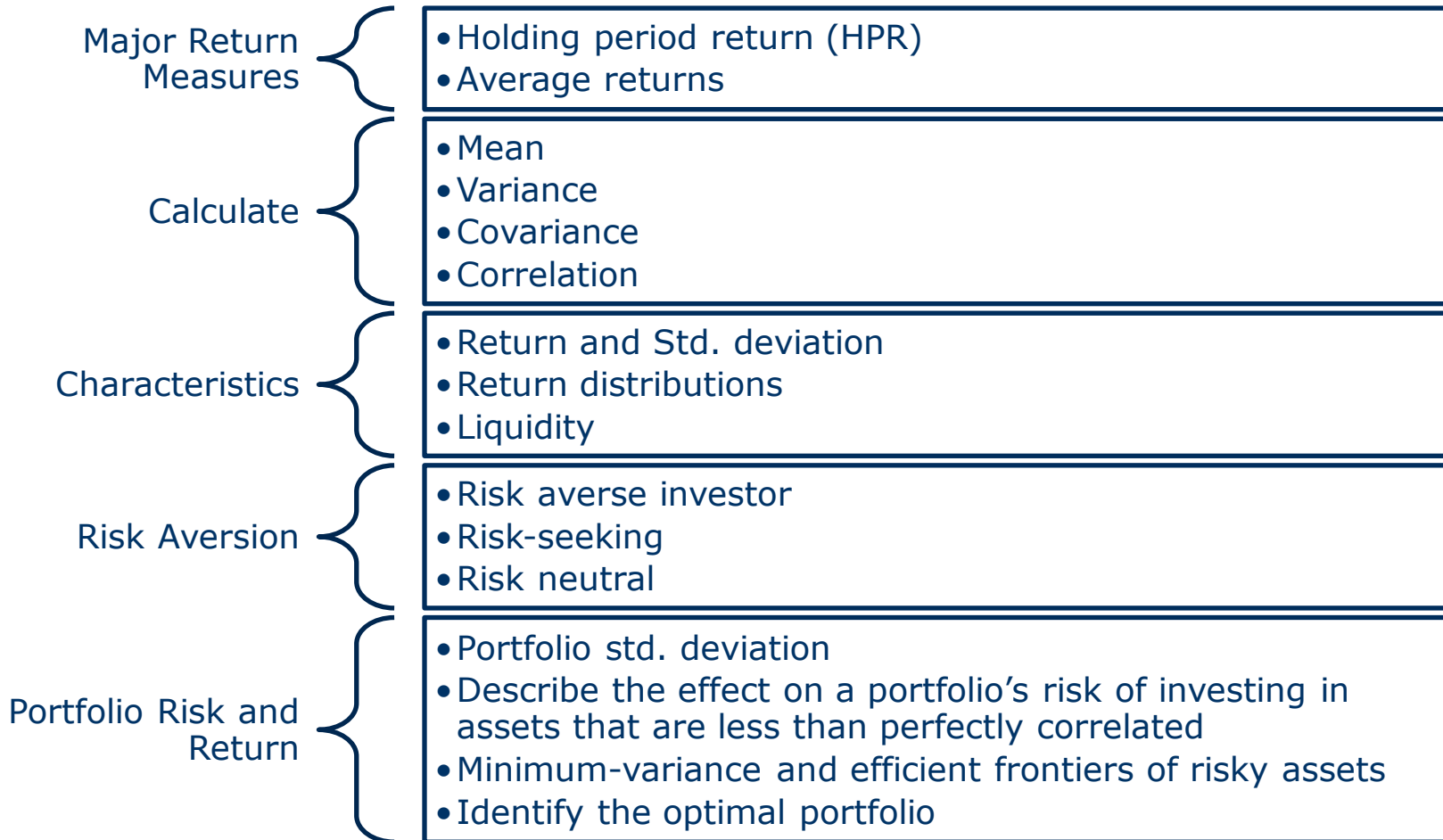
**Portfolio Risk and Return I**

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# Brief Introduction of Portfolio Management



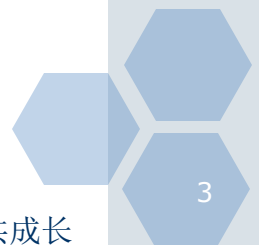


# Return measures

**LOS 43.a: Calculate and interpret major return measures and describe their appropriate uses.**

❖ Holding period return (HPR) is simply the percentage increase in the value of an investment over a given time period:

$$\text{holding period return} = \frac{\text{end-of-period value}}{\text{beginning-of-period value}} - 1 = \frac{P_t + \text{Div}_t}{P_0} - 1 = \frac{P_t - P_0 + \text{Div}_t}{P_0}$$





# Return measures

## Average Returns

- **Arithmetic mean** return is the simple average of a series of periodic returns.

$$\text{arithmetic mean return} = \frac{(R_1 + R_2 + R_3 + \dots + R_n)}{n}$$

- The **geometric mean** return is a compound annual rate.

$$\text{geometric mean return} = \sqrt[n]{(1 + R_1) \times (1 + R_2) \times (1 + R_3) \times \dots \times (1 + R_n)} - 1$$



# Return measures

- ❖ The **money-weighted** rate of return is the internal rate of return on a portfolio based on all of its cash inflows and outflows.
- $PV_{\text{inflow}} = PV_{\text{outflow}}$
- ❖ **Inflows:** the beginning value and additional deposits of cash by the investor
- ❖ **Outflows:** withdrawals of cash, interest, and dividends (which are additional cash available to be withdrawn) and the ending value



## Return measures - example

- ❖ An investor's transactions in a mutual fund and the fund's returns over a four-year period are provided in the table below:

	Year			
	1	2	3	4
New investment at the beginning of the year	\$2,500	\$1,500	\$1,000	\$0
Investment return for the year	-20%	65%	-25%	10%
Withdrawal by investor at the end of the year	\$0	-\$500	-\$500	\$0

Based on these data, the money-weighted return (or internal rate of return) for the investor is *closest* to:

- A. 2.15%.
- B. 3.96%.
- C. 7.50%.



# Return measures - example

❖ Answer: B

$$\text{❖ } P_{v_{\text{inflow}}} = P_{v_{\text{outflow}}}$$

Year	1	2	3	4
Starting balance (\$)	0.00	2,000.00	5,275.00	4,206.25
New investment at the beginning of the year (\$)	2,500.00	1,500.00	1,000.00	0.00
Net balance at the beginning of year (\$)	2,500.00	3,500.00	6,275.00	4,206.25
Investment return for the year	-20%	65%	-25%	10%
Investment gain (loss) (\$)	-500.00	2,275.00	-1,568.75	420.63
Withdrawal by investor at the end of the year (\$)	0.00	-500.00	-500.00	0.00
Balance at the end of year (\$)	2,000.00	5,275.00	4,206.25	4,626.88

The money-weighted return is calculated by solving for  $i$  in the equation below:

$$2500 + \frac{1500}{(1+i)^1} + \frac{1000}{(1+i)^2} = \frac{500}{(1+i)^2} + \frac{500}{(1+i)^3} + \frac{4626.88}{(1+i)^4}$$

$$0 = .0396$$





# Return measures

## Other Return Measures

- Gross return
- Net return
- Pretax nominal return
- After-tax nominal return
- Real return
- Leveraged return





# Variance and covariance

**LOS 43.b: Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.**

Variance

- Population variance,

$$\sigma^2 = \frac{\sum_{t=1}^T (R_t - \mu)^2}{T}$$

- Sample variance

$$s^2 = \frac{\sum_{t=1}^T (R_t - \bar{R})^2}{T - 1}$$



# Variance and covariance

- ❖ Covariance measures the extent to which two variables move together over time.

$$\text{Cov}_{1,2} = \frac{\sum_{t=1}^n \{[R_{t,1} - \bar{R}_1][R_{t,2} - \bar{R}_2]\}}{n-1}$$

- ❖ The magnitude of the covariance depends on the magnitude of the *individual stocks' standard deviations* and *the relationship between their co-movements*.
- ❖ The covariance of the returns of two securities can be standardized and is called correlation.

$$\rho_{1,2} = \frac{\text{Cov}_{1,2}}{\sigma_1 \sigma_2}$$



## Variance and covariance - example

- ❖ A correlation matrix of the returns for securities A, B, and C is reported below:

Security	A	B	C
A	1.0		
B	0.5	1.0	
C	0.0	-0.5	1.0

Assuming that the expected return and the standard deviation of each security are the same, a portfolio consisting of an equal allocation of which two securities will be *most effective* for portfolio diversification? Securities:

- A. A and B.
- B. A and C.
- C. B and C.



## Variance and covariance - example

- ❖ C is correct. The negative correlation of  $-0.5$  between investment instruments B and C is lowest and therefore is most effective for portfolio diversification.





# Characteristics to consider

**LOS 43.c: Describe the characteristics of the major asset classes that investors consider in forming portfolios.**

Characteristics  
to Consider

- Risk
- Return
- Return distribution: Skewness & Kurtosis
- Liquidity



# Rise aversion

**LOS 43 .d: Explain risk aversion and its implications for portfolio selection.**

3 types of investors

- A **risk-averse** investor is simply one that dislikes risk (i.e., prefers less risk to more risk).
- A **risk-seeking** (risk-loving) investor actually prefers more risk to less and, given equal expected returns, will choose the more risky investment.
- A **risk-neutral** investor has no preference regarding risk and would be indifferent between two such investments.



# Portfolio Risk Measures

**LOS 43.e: Calculate and interpret portfolio standard deviation.**

- ❖ The variance of returns for a portfolio of two risky assets is calculated as follows:

$$\text{Var}_{\text{portfolio}} = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \text{Cov}_{12}$$

- ❖ The stand deviation of returns for a portfolio of two risky assets is calculated as follows:

$$\sigma_{\text{portfolio}} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{12} \sigma_1 \sigma_2}$$



# Portfolio Risk

**LOS 43.f: Describe the effect on a portfolio's risk of investing in assets that are less than perfectly correlated.**

$$\sigma_{\text{portfolio}} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{12} \sigma_1 \sigma_2}$$

$\rho_{12} < 0$ , reduces portfolio risk

➤ Conclusion: investing in assets with low return correlations will bring risk-reduction benefits.





# Portfolio Risk - example

- ❖ The standard deviation of returns for shares of Oakmont Corporation and Sunrise Corporation are 14% and 12% respectively. If the correlation between the two stocks is 0.25, a portfolio consisting of 35% invested in Oakmont and 65% in Sunrise has a standard deviation *closest* to:
  - ❖ A. 10.2%
  - ❖ B. 12.7%
  - ❖ C. 35.0%



# Portfolio Risk - example

❖ Answer: A

❖ The standard deviation of portfolio returns is:

$$\sqrt{(0.35^2)(0.14^2) + (0.65^2)(0.12^2) + 2(0.35)(0.65)(0.25)(0.14)(0.12)} = 10.2\%$$



# Thank You!

