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Academy of Professional Finance 专业金融学院

CFA Level I

Portfolio 2

Portfolio Risk and Return I

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Brief Introduction of Portfolio Management

Major Return Measures	• Holding period return (HPR) • Average returns
Calculate	• Mean • Variance • Covariance • Correlation
Characteristics	• Return and Std. deviation • Return distributions • Liquidity
Risk Aversion	• Risk averse investor • Risk-seeking • Risk neutral
Portfolio Risk and Return	• Portfolio std. deviation • Describe the effect on a portfolio's risk of investing in assets that are less than perfectly correlated • Minimum-variance and efficient frontiers of risky assets • Identify the optimal portfolio

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.

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

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

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

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.

- $PV_{inflow} = PV_{outflow}$

- **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- **Outflows:** withdrawals of cash, interest, and dividends (which are additional cash available to be withdrawn) and the ending value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
- $Pv_{inflow} = Pv_{outflow}$

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:

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

O=.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:

$$\text{Var}_{\text{portfolio}} = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\text{Cov}_{12}$$

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

$$\sigma_{\text{portfolio}} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{12}\sigma_1\sigma_2}$$

Portfolio Risk

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

$$\sigma_{portfolio} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{12}\sigma_1\sigma_2}$$

$\rho_{12} < 0$, 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:

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

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Thank You!