

What is Diversification?

Worksheet

Diversification spreads investments across multiple assets to lower overall portfolio risk without reducing expected return. More assets = less volatility; fewer assets = more risk.

$$\text{Portfolio Risk} = \sqrt{\sum_{i=1}^n w_i^2 \sigma_i^2 + 2 \sum_{i < j} w_i w_j \rho_{ij} \sigma_i \sigma_j}$$

w_i = Weight of asset i (%)

σ_i = Standard deviation (volatility) of asset i (%)

ρ_{ij} = Correlation between assets i and j (-1 to +1)

n = Number of assets

Questions

1. Diversification reduces which type of risk?

- A) Systematic risk
- B) Unsystematic risk
- C) Interest rate risk
- D) Inflation risk

2. 60% stocks (20% volatility) + 40% bonds (8% volatility), -0.3 correlation. Approximate portfolio risk?

- A) 14%
- B) 11%
- C) 16%
- D) 8%

3. Two highly correlated investments ($\rho=0.95$)?

- A) Excellent diversification
- B) Poor diversification
- C) No risk
- D) Maximum safety

4. Why add international stocks to a US portfolio?

- A) Higher returns always
- B) Lower correlation = diversification benefit
- C) No extra cost
- D) Simplicity

5. You have 10,000. Put 6,000 in stocks (volatility 20%) and \$4,000 in bonds (volatility 8%). Stocks and bonds have -0.3 correlation. Find portfolio risk.

6. Compare 1 stock (20% risk) vs portfolio of 10 uncorrelated stocks. Roughly how much does risk drop?

7. Your portfolio: 50% US stocks, 30% international, 20% bonds. If US market drops 15% but others rise 5%, net portfolio change?

8. Define: What is diversification?

9. Define: How does correlation affect diversification?

10. Define: Can diversification eliminate all risk?

Answer Key

1. B) Unsystematic risk — Diversification eliminates company/sector-specific (unsystematic) risk, not market-wide (systematic) risk.
2. B) 11% — $\sqrt{(0.36 \times 0.04 + 0.16 \times 0.0064 - 2 \times 0.24 \times 0.16)} \approx 11.4\%$
3. B) Poor diversification — High correlation means they move together — diversification benefit is minimal.
4. B) Lower correlation = diversification benefit — International and US stocks often move independently, reducing portfolio volatility.
5. Portfolio Risk = $\sqrt{(0.6^2 \times 0.2^2 + 0.4^2 \times 0.08^2 + 2 \times 0.6 \times 0.4 \times (-0.3) \times 0.2 \times 0.08)} = \sqrt{(0.0144 + 0.001024 - 0.002304)} = \sqrt{0.01312} = 11.45\%$
6. 1 stock: 20% risk 10 uncorrelated stocks (equal weight 10% each): portfolio risk $\approx 20\%/\sqrt{10} \approx 6.3\%$ Risk reduced by $\sim 68\%$
7. Change = $0.5 \times (-15\%) + 0.3 \times (+5\%) + 0.2 \times 0\% = -7.5\% + 1.5\% = -6\%$ Diversification cushions the blow
8. Spreading investments across multiple assets to reduce risk without sacrificing return.
9. Lower correlation = better diversification. Negative correlation is ideal (inverse moves).
10. No. Systematic risk (market risk) remains; diversification removes unsystematic risk only.

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