

## Practice Quiz 10: Risk Diversification (Solutions)

1. An investor uses a discount rate of 5% to value riskless investments. He is considering making a \$15,000 equity investment in a new coffee shop in his neighborhood. Depending on the success of the coffee shop, the investor will either receive \$5,000 or \$50,000, each with a 50% probability, in five years. The investor requires a risk premium of 15% on such a risky investment. Calculate the net present value (NPV) of this investment.

**NPV: -\$3,948**

The expected value of the investment in five years is  $0.5 \times \$5,000 + 0.5 \times \$50,000 = \$27,500$ .

The discount rate is  $15\% + 5\% = 20\%$ .

The NPV is:

$$NPV = -\$15,000 + \frac{\$27,500}{1.20^5} = -\$3,948$$

2. Discuss the principle of risk diversification. Include both an intuitive and mathematical description of risk diversification.

**Ans.** The principle of risk diversification states that risk in an investment portfolio may be reduced by spreading one's assets across multiple investments. This is because different investments do not always move in the same direction, and so if one performs poorly, its performance may be offset by the better performance of another investment.

Mathematically, the more independent investments are held in a portfolio, the less likely it becomes that all the investments experience low (or, for that matter, high) returns in a given period. Therefore, the probability of extreme returns is reduced when a portfolio is composed of multiple, independent investments, and the standard deviation of returns is lower.

3. Discuss correlation and the limits of risk diversification.

**Ans.** Correlation is the tendency of investments to move in the same direction. If two investments are positively correlated then when one moves in a certain direction, the other is more likely to also move in that direction. Because risk diversification depends on assets moving in opposite directions to offset one another, correlation can limit the effect of diversification. Mathematically, if the assets in a portfolio are positively correlated, the standard deviation cannot be reduced below a certain level. It can only be further reduced by continuing to add assets that are uncorrelated with the existing assets in the portfolio.

4. Discuss the diversification benefits of investing in multiple asset classes.

**Ans.** Because securities within a given asset class tend to be influenced by common factors, they tend to be correlated with one another. Therefore, the diversification benefits of diversifying across securities within an asset class are limited. To further diversify, an investor must also diversify across asset classes.

For example, an investor may reduce the standard deviation of a portfolio by holding multiple stocks instead of a single stock. However, because the returns to individual stocks, though partially independent, tend to be correlated with one another, not all of the risk may be diversified away (the remaining risk is known as systematic risk or non-diversifiable risk). To further reduce the risk of such a portfolio, the investor must add other asset classes, such as corporate bonds.

5. Which of the following statements is **true** of risk diversification?

- A) An investor may reduce the standard deviation of the returns on his or her portfolio by buying several shares of the same company's stock.
- B) Risk diversification is desirable because it reduces the chance of an extreme loss without reducing the chance of an extreme gain.
- C) An investor may completely eliminate financial risk in a U.S. stock portfolio by diversifying across a sufficient number of stocks.
- D) Risk may be diversified even if two assets are positively correlated (i.e. have a correlation coefficient of greater than zero).

**Answer: D**

A is wrong because there is no diversification in buying shares of the same company. B is not a correct definition of risk diversification. C is wrong because it is not possible to completely eliminate financial risk, in a macro-economy there is non-diversifiable risk.