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A statistical measure of the dispersion of data points around the mean. The coefficient of variation (relative standard deviation) is a statistical measure of the dispersion of data points around the mean. The metric is commonly used to compare the data dispersion between distinct series of data. Unlike the standard deviation that must always be considered in the context of the mean of the data, the coefficient of variation provides a relatively simple and quick tool to compare different data series. In finance, the coefficient of variation is important in investment selection. From a financial perspective, the financial metric represents the risk-to-reward ratio where the volatility shows the risk of an investment and the mean indicates the reward of an investment. By determining the coefficient of variation of different securities, an investor identifies the risk-to-reward ratio of each security and develops an investment decision. Generally, an investor seeks a security with a lower coefficient (of variation) because it provides the most optimal risk-to-reward ratio with low volatility but high returns. However, the low coefficient is not favorable when the average expected return is below zero. Formula for Coefficient of Variation Mathematically, the standard formula for the coefficient of variation is expressed in the following way: Where: σ = the standard deviation μ = the mean In the context of finance, we can re-write the above formula in the following way: Example of Coefficient of Variation Fred wants to find a new investment for his portfolio. He is looking for a safe investment that provides stable returns. He considers the following options for investment: Stocks: Fred was offered stock of ABC Corp. It is a mature company with strong operational and financial performance. The volatility of the stock is 10%, and the expected return is 14%. ETFs: Another option is an Exchange-Traded Fund (ETF) which tracks the performance of the S&P 500 index. The ETF offers an expected return of 13% with a volatility of 7%. Bonds: Bonds with excellent credit ratings offer an expected return of 3% with 2% volatility. In order to select the most suitable investment opportunity, Fred decided to calculate the coefficient of variation of each option. Using the formula above, he obtained the following results: Based on the calculations above, Fred wants to invest in the ETF because it offers the lowest coefficient (of variation) with the most optimal risk-to-reward ratio. Related Readings Thank you for reading CFI's guide to Coefficient of Variation. To keep learning and advancing your career, the following CFI resources will be helpful: The coefficient of variation (CV) is a statistical measure of the dispersion of data points in a data series around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another, even if the means are drastically different from one another. The coefficient of variation (CV) is a statistical measure of the relative dispersion of data points in a data series around the mean. It represents the ratio of the standard deviation to the mean. The CV is useful for comparing the degree of variation from one data series to another, even if the means are drastically different from one another. In finance, the coefficient of variation allows investors to determine how much volatility, or risk, is assumed in comparison to the amount of return expected from investments. Ideally, if the coefficient of variation formula should result in a lower ratio of the standard deviation to mean return, then the better the risk-return trade-off. While most often used to analyze dispersion around the mean, quartile, quintile, or decile CVs can also be used to understand variation around the median or 10th percentile, for example. The coefficient of variation formula or calculation can be used to determine the deviation between the historical mean price and the current price performance of a stock, commodity, or bond, relative to other assets. Below is the formula for how to calculate the coefficient of variation:
$$CV = \frac{\sigma}{\mu}$$
 where: σ = standard deviation μ = mean
$$CV = \frac{s}{\bar{x}} * 100$$
 where: s = sample standard deviation \bar{x} = mean for the population Multiplying the coefficient by 100 is an optional step to get a percentage rather than a decimal. The coefficient of variation formula can be performed in Excel by first using the standard deviation function for a data set. Next, calculate the mean using the Excel function provided. Since the coefficient of variation is the standard deviation divided by the mean, divide the cell containing the standard deviation by the cell containing the mean. The standard deviation is a statistic that measures the dispersion of a dataset relative to its mean. It is used to determine the spread of values in a single dataset rather than to compare different units. When we want to compare two or more datasets, the coefficient of variation is used. The CV is the ratio of the standard deviation to the mean. And because it's independent of the unit in which the measurement was taken, it can be used to compare datasets with different units or widely different means. In short, the standard deviation measures how far the average value lies from the mean whereas the coefficient of variation measures the ratio of the standard deviation to the mean. The coefficient of variation can be useful when comparing datasets with different units or widely different means. That includes when using the risk/reward ratio to select investments. For example, an investor who is risk-averse may want to consider assets with a historically low degree of volatility relative to the return, in relation to the overall market or its industry. Conversely, risk-seeking investors may look to invest in assets with a historically high degree of volatility. When the mean value is close to zero, the CV becomes very sensitive to small changes in the mean. Using the example above, a notable flaw would be if the expected return in the denominator is negative or zero. In this case, the coefficient of variation could be misleading. If the expected return in the denominator of the coefficient of variation formula is negative or zero, the result could be misleading. The coefficient of variation is used in many different fields, including chemistry, engineering, physics, economics, and neuroscience. Other than helping when using the risk/reward ratio to select investments, it is used by economists to measure economic inequality. Outside of finance, it is commonly applied to audit the precision of a particular process and arrive at a perfect balance. For example, consider a risk-averse investor who wishes to invest in an exchange-traded fund (ETF), which is a basket of securities that tracks a broad market index. The investor selects the SPDR S&P 500 ETF, Invesco QQQ ETF, and the iShares Russell 2000 ETF. Then, they analyze the ETFs' returns and volatility over the past 15 years and assumes the ETFs could have similar returns to their long-term averages. For illustrative purposes, the following 15-year historical information is used for the investor's decision: If the SPDR S&P 500 ETF has an average annual return of 5.47% and a standard deviation of 14.68%, the SPDR S&P 500 ETF's coefficient of variation is 2.68. If the Invesco QQQ ETF has an average annual return of 6.88% and a standard deviation of 21.31%, the QQQ's coefficient of variation is 3.10. If the iShares Russell 2000 ETF has an average annual return of 7.16% and a standard deviation of 19.46%, the IWM's coefficient of variation is 2.72. Based on the approximate figures, the investor could invest in either the SPDR S&P 500 ETF or the iShares Russell 2000 ETF, since the risk/reward ratios are approximately the same and indicate a better risk-return trade-off than the Invesco QQQ ETF. The coefficient of variation indicates the size of a standard deviation in relation to its mean. The higher the coefficient of variation, the greater the dispersion level around the mean. That depends on what you're looking at and comparing. There is no set value that can be considered universally "good." However, generally speaking, it is often the case that a lower coefficient of variation is more desirable as that would suggest a lower spread of data values relative to the mean. To calculate the coefficient of variation, first find the mean, then the sum of squares, and then work out the standard deviation. With that information at hand, it is possible to calculate the coefficient of variation by dividing the standard deviation by the mean. The coefficient of variation is a simple way to compare the degree of variation from one data series to another. It can be applied to pretty much anything, including the process of picking suitable investments. Generally speaking, a high CV indicates that the group is more variable whereas a low value would suggest the opposite.

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