Volatility\(^1\) most frequently refers to the standard deviation of the continuously compounded returns of a financial instrument with a specific time horizon. It is often used to quantify the risk of the instrument over that time period. Volatility is typically expressed in annualized terms, and it may either be an absolute number (50) or a fraction of the mean (5%). Volatility can be traded directly in today’s markets through options and variance swaps.

For a financial instrument whose price follows a Gaussian random walk or Wiener process, the volatility increases as time increases. Conceptually, this is because there is an increasing probability that the instrument’s price will be farther away from the initial price as time increases. However, rather than increase broadly, the volatility increases with the square-root of time as time increases, because some fluctuations are expected to cancel each other out, so the most likely deviation after twice the time will not be twice the distance from zero.

More broadly, volatility refers to the degree of typically short-term unpredictable change over time of a certain variable. It may be measured via the standard deviation of a sample, as mentioned above. However, price changes actually do not follow Gaussian distributions. Better distributions used to describe them actually have “fat tails”, although their variance remains finite. Therefore, other metrics may be used to describe the degree of spread of the variable. As such, volatility reflects the degree of risk faced by someone with exposure to that variable.

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