Empirical Rule

https://www.investopedia.com/terms/e/empirical-rule.asp

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The empirical rule, also referred to as the three-sigma rule or the 68-95-99.7 rule, is a statistical rule that states that for a normal distribution of data, almost all the data fall within three standard deviations (denoted by σ, sigma) of the mean (denoted by μ).

Remember, a *z*-score measures the number of standard deviations from the mean, and a z-score of 1.000 means the value is one standard deviation from the mean.

Therefore, the empirical rule predicts the following:

-- about 68% of the data in a normal distribution will fall within ± 1 standard deviation from the mean, which means that 68% of the data are likely to have a z-score that is no greater than +1.000 and no less than -1.000.

-- about 95% of the data in a normal distribution will fall with ± 2 standard deviations from the mean, which means that 95% of the data values are likely to have a z-score that is no greater than +2.000 and no less than -2.000; and

-- about 99.7% of the data in a normal distribution will fall within ± 3 standard deviations from the mean, which means that 99.7% of the data values are likely to have a z-score no greater than +3.000 and no less than -3.000.

Using the Empirical Rule

The empirical rule is used in statistics for forecasting final outcomes. The empirical rule is also used as a rough way to test a distribution's "normality". If too many data values fall outside three standard deviations (three *z*-scores), the distribution might not be normal.

Example of the Empirical Rule

Let's assume the lifespan of dogs is normally distributed, and that, on average, dogs live to be 13.1 years with a standard deviation of 1.5 years. If you want to know the probability that your dog will live longer than 14.6 years, you can use the empirical rule.

Knowing the distribution's mean is 13.1 years old with a standard deviation of 1.5, the following age ranges fall within each z-score:

- ± 1.000 *z*-score: 11.6 years to 14.6 years
- ± 2.000 *z*-scores: 10.1 years to 16.1 years
- ± 3.000 *z*-scores: 8.6 years to 17.6 years

The empirical rule predicts that 68% of the distribution will fall within ± one standard deviation (± a 1.000 z-score), which is 11.6 to 14.6 years.

Thus, the remaining 32% of the distribution lies outside this range. Half lies above 14.6, and half lies below 11.6. Therefore, the probability of your dog living for more than 14.6 is 16% (calculated as 32% divided by two).