

The Joy of Data: *Wait a Moment!*
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"Statistics is the grammar of science."
---Karl Pearson (1857-1936)

Introduction:

In everyday language we use the word “moment” as a measure of time. We might say “Wait a moment, please” before responding to a restaurant server about our menu choice. In statistics and therefore business analytics, however, we use the word “moment” to discuss the various parts of variable, or more precisely, the parts of the distribution of a variable. Moments matter not just because the math is interesting but because it affects our business decision-making on important issues. There are four principal moments: that is, parts of a variable’s distribution.

Sample *Mean*

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

Sample *Standard Deviation*

$$s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

Sample *Skewness*

$$skew(x) = \frac{n}{(n - 1)(n - 2)} \sum_{i=1}^n \left(\frac{x_i - \bar{x}}{s} \right)^3$$

Sample *Kurtosis*

$$kurt(x) = \frac{\frac{\sum_{i=1}^n (x_i - \bar{x})^4}{n}}{\left(\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n} \right)^2} - 3$$

All four moments of a variable can be visualized by generating and inspecting a histogram. Because the first two moments are easier to interpret for most individuals, we often represent them with their computed values (numbers) as well. However, because the second two moments are harder to interpret for most individuals, we often just discuss them in the visual context of a histogram.

Notice that each equation is fraction, that is a ratio. Notice also that each moment involves increasing an exponent by the number one (1).