Pearson Type III Distribution

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A skewed distribution which is similar to the binomial distribution when $p \neq q$ (Abramowitz and Stegun 1972, p. 930).

$$y = k\,(t + A)^{A^2-1}\, e^{-A\,t},$$

for $t \in [0, \infty)$ where

$$A \equiv 2/\gamma$$

$$K \equiv \frac{A^{A^2}\, e^{-A^2}}{\Gamma(A^2)},$$

$\Gamma(z)$ is the gamma function, and T is a standardized variate. Another form is

$$P(x) = \frac{1}{\beta\Gamma(p)}\left(\frac{x-\alpha}{\beta}\right)^{p-1} \exp\left(-\frac{x-\alpha}{\beta}\right).$$

$p \sim n$

$\beta \sim \frac{1}{a}$

For this distribution, the characteristic function is

$$\phi(t) = e^{i\,\alpha\,t}\,(1 - i\,\beta\,t)^{-p},$$

$\alpha \sim b$

and the mean, variance, skewness, and kurtosis excess are

$$\mu = \alpha + p\,\beta \longrightarrow = b + n/a = \text{mu (mean)}$$

$$\sigma^2 = p\,\beta^2 \longrightarrow = n/a^2 \rightarrow \sigma = \sqrt{n}/a = \text{sigma (standard deviation)}$$

$$\gamma_1 = \frac{2}{\sqrt{p}} \longrightarrow = 2/\sqrt{n} = \text{gamma (skew)}$$

$$\gamma_2 = \frac{6}{p}.$$