

On Empirical Power of Univariate Normality Tests under Symmetric, Asymmetric, and Scaled Distributions.

**Lukman Abiodun Nafiu, Ph.D.1; Lanlege David Ibitayo, Ph.D.2;
and Solomon Matovu Muyombya, M.Sc.3**

1Department of Mathematics and Statistics, Islamic University In Uganda, Mbale, Uganda.

2Department of Mathematical Sciences, Federal University Lokoja, Kogi State, Nigeria.

3Department of Economics and Statistics, Kampala International University, Kampala, Uganda.

E-mail: lanafiu@iuiu.ac.ug¹

loislanlege@yahoo.com²

solomonmmatovu@gmail.com³

ABSTRACT

The study aims at conducting an empirical comparison of powers of the univariate normality tests under different distributions to obtain their ranking using a Monte-Carlo simulation for large sample sizes. A total of six normality tests were selected. From the Empirical Distribution Function (EDF), the Kolmogorov-Smirnov (Lilliefors correction) and Anderson-Darling normality tests were chosen. From the regression and correlation family of distributions, the Shapiro-Wilk and Shapiro-Francia normality tests were chosen. The Jaque-Bera and D'Agostino Pearson normality tests were chosen from the moment family. The empirical powers of these normality tests were studied using distributions that are symmetric, asymmetric and scale contaminated normal distributions.

Findings show that for symmetric distributions, Kolmogorov-Smirnov normality test is the most powerful test, followed by Anderson-Darling, Shapiro-Wilk, Shapiro-Francia, D'Agostino-Pearson and lastly Jaque-Bera. For asymmetric distributions, the Anderson-Darling normality test was best, followed by Shapiro-Wilk, Kolmogorov-Smirnov, Jaque-Bera, Shapiro-Francia and lastly D'Agostino. For scale contaminated distributions, Kolmogorov-Smirnov is the most powerful test, followed by Anderson-Darling, Shapiro-Francia, Shapiro-Wilk, D'Agostino-Pearson and lastly Jaque-Bera. Thus, regardless of the nature of the distribution given a large sample size, Kolmogorov-Smirnov is the most powerful normality test, followed by Shapiro-Wilk, Shapiro-Francia, Anderson-Darling, Jaque-Bera and lastly D'Agostino-Pearson.

The study recommends that for distributions that have short tails like symmetric distributions, correlation/regression-based tests should be used. For long tailed distributions like symmetric distributions, Empirical-based normality tests should be used and moment-based tests should be used if interest is in kurtosis and skewness of the data.