The Box-Cox Transformation: Review and Extensions with Economic Applications

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May 11, 2021

Abstract

The Box-Cox power transformation family for non-negative responses in linear models has a long and interesting history in both statistical practice and theory. The Yeo-Johnson transformation extends the family to observations that can be positive or negative. The paper describes an extended Yeo-Johnson transformation that allows positive and negative responses to have different power transformations.

As an illustration of the suggested procedure we analyse data on the performance of investment funds, 99 out of 309 of which report a loss. The problem is to use regression to predict medium term performance from two short term indicators. It is clear from scatterplots of the data that the negative responses have a lower variance than the positive ones and a different relationship with the explanatory variables. Tests and graphical methods from

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our robust analysis allow the detection of outliers, the testing of the values of transformation parameters and the building of a simple regression model.

These procedures are used to compare parametric power transformations with the non-parametric transformations produced by ACE and AVAS. We suggest further directions for this kind of research.

The talk is based on the following two papers

ATKINSON A.C., RIANI M., CORBELLINI A. (2020). The analysis of transformations for profit-and-loss data, *Journal of the Royal Statistical Society, Series C, Applied Statistics*, https://doi.org/10.1111/rssc.12389

ATKINSON A.C., RIANI M., CORBELLINI A. (2021). The Box-Cox Transformation: Review and Extensions, *Statistical Science*, 36, 2, 239-255, DOI: 10.1214/20-STS778