



Semi-parametric transformation boundary regression models

Natalie Neumeyer¹ · Leonie Selk¹ · Charles Tillier¹

Received: 4 December 2018 / Revised: 13 June 2019 / Published online: 21 September 2019
© The Institute of Statistical Mathematics, Tokyo 2019

Abstract

In the context of nonparametric regression models with one-sided errors, we consider parametric transformations of the response variable in order to obtain independence between the errors and the covariates. In view of estimating the transformation parameter, we use a minimum distance approach and show the uniform consistency of the estimator under mild conditions. The boundary curve, i.e., the regression function, is estimated applying a smoothed version of a local constant approximation for which we also prove the uniform consistency. We deal with both cases of random covariates and deterministic (fixed) design points. To highlight the applicability of the procedures and to demonstrate their performance, the small sample behavior is investigated in a simulation study using the so-called Yeo–Johnson transformations.

Keywords Box–Cox transformations · Frontier estimation · Minimum distance estimation · Local constant approximation · Boundary models · Nonparametric regression · Yeo–Johnson transformations

Financial support by the DFG (Research Unit FOR 1735 *Structural Inference in Statistics: Adaptation and Efficiency*) is gratefully acknowledged.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s10463-019-00731-5>) contains supplementary material, which is available to authorized users.

✉ Charles Tillier
charles.tillier@gmail.com

Natalie Neumeyer
neumeyer@math.uni-hamburg.de

Leonie Selk
leonie.selk@math.uni-hamburg.de

¹ Department of Mathematics, University of Hamburg, Bundesstrasse 55, 20146 Hamburg, Germany