

Nonparametric regression and measurement error

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Measurement error models are widely studied in statistics (see [3]). In this paper we shall study the SIMEX estimator. It uses simulation and extrapolation. First it adds artificial measurement errors to the independent variables, then calculates the estimator from the contaminated data, then extrapolates to the case of no measurement error. The SIMEX estimator was introduced in [2] for parametric measurement error models. The SIMEX estimator was introduced to nonparametric function estimation in [1].

In this paper we consider nonparametric regression when the variables are measured with error. Assume that we have a relationship between y and ξ of the form

$$y = f(\xi) + \varepsilon$$

where y , ξ , and ε are random, ε is the unobservable error term and f is a fixed but unknown deterministic function. Our aim is to estimate f . Assume that if y and ξ are observable then we can estimate f consistently. However, we can not observe the precise ξ . We observe it with error, that is we observe

$$x = \xi + \delta.$$

We propose the application of the SIMEX estimator introduced by [1]. We prove that if the original procedure offers an estimator with nice asymptotic properties, then its SIMEX modification produces an estimator with error magnitude σ^{2l+1} where σ^2 is the variance of the measurement error.

References

- [1] Carroll, R. J., Maca, J. D., and Ruppert, D. Nonparametric regression in the presence of measurement error. *Biometrika*, **86**, No.3, 541–554 (1999).
- [2] Cook, J.R. and Stefanski, L.A. Simulation-extrapolation estimation in parametric measurement error models. *J. Am. Stat. Assoc.* **89**, No.428, 1314–1328 (1994).
- [3] Fuller, W. A. *Measurement error models*. Wiley Series in Probability and Statistics; Wiley-Interscience. Hoboken, NJ: John Wiley & Sons, (2006).

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