Uniform confidence bands in deconvolution with unknown error distribution

Kengo Kato, Yuya Sasaki

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UNIFORM CONFIDENCE BANDS IN DECONVOLUTION WITH UNKNOWN ERROR DISTRIBUTION

KENGO KATO AND YUYA SASAKI

Abstract. This paper develops a method to construct uniform confidence bands in deconvolution when the error distribution is unknown. Simulation studies demonstrate the performance of the multiplier bootstrap confidence band in the finite sample. We apply our method to the Outer Continental Shelf (OCS) Auction Data and draw confidence bands for the density of common values of mineral rights on oil and gas tracts. We also present an application of our main theoretical result specifically to additive fixed-effect panel data models, and we draw confidence bands for the density of the total factor productivity in a manufacturing industry in Chile.

Keywords: deconvolution, measurement error, multiplier bootstrap, uniform confidence bands
JEL Code: C14

1. Introduction

In this paper, we propose a method of uniform inference on the density function of a latent signal X in the measurement error model

$$Y = X + \varepsilon, \tag{1}$$

where X and ε are independent real-valued random variables with unknown densities f_X and f_ε, respectively. An econometrician observes Y in data, but does not observe X or ε. The variable ε represents a measurement error. In this model, the density f_Y of Y can be written by the convolution of f_X and f_ε:

$$f_Y(y) = (f_X * f_\varepsilon)(y) = \int_{\mathbb{R}} f_X(x) f_\varepsilon(y - x) dx. \tag{2}$$

Deconvolution refers to solving the convolution integral equation (2) for f_X, and the deconvolution problem in econometrics and statistics has concerned with identifying, estimating and making inference on f_X from available data.

The goal of this paper is to develop a multiplier-bootstrap method to construct uniform confidence bands for f_X when the error density f_ε is unknown. Bissantz et al. (2007) provide a condition

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K. Kato: Graduate School of Economics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan. Email: kkato@e.u-tokyo.ac.jp.

Y. Sasaki: Department of Economics, Vanderbilt University, VU Station B #351819, 2301 Vanderbilt Place, Nashville, TN 37235-1819, U.S.A. Email: yuya.sasaki@vanderbilt.edu.