International Statistical Review (2003), **71,** 1, 131–150, Printed in The Netherlands

Covariate Measurement Error in Quadratic Regression

Jouni Kuha[1] and Jonathan Temple[2]

[1]Department of Statistics, London School of Economics and Political Science, Houghton St, London WC2A 2AE, UK. Email: j.kuha@lse.ac.uk. [2]Department of Economics, University of Bristol, 8 Woodland Road, Bristol BS8 1TN, UK. Email: jon.temple@bristol.ac.uk

Summary

We consider quadratic regression models where the explanatory variable is measured with error. The effect of classical measurement error is to flatten the curvature of the estimated function. The effect on the observed turning point depends on the location of the true turning point relative to the population mean of the true predictor. Two methods for adjusting parameter estimates for the measurement error are compared. First, two versions of regression calibration estimation are considered. This approximates the model between the observed variables using the moments of the true explanatory variable given its surrogate measurement. For certain models an expanded regression calibration approximation is exact. The second approach uses moment-based methods which require no assumptions about the distribution of the covariates measured with error. The estimates are compared in a simulation study, and used to examine the sensitivity to measurement error in models relating income inequality to the level of economic development. The simulations indicate that the expanded regression calibration estimator dominates the other estimators when its distributional assumptions are satisfied. When they fail, a small-sample modification of the method-of-moments estimator performs best. Both estimators are sensitive to misspecification of the measurement error model.

Key words: Corrected score; Errors-in-variables; Income inequality; Kuznets curve; Method of moments; Regression calibration.