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ON THE TREATMENT OF A MEASUREMENT ERROR REGRESSION MODEL

Abstract:

The treatment of the measurement error regression model has been a focus of various studies, in particular, in the analysis of economic time series data. The ordinary least squares (OLS) estimator of the measurement error model is known to be asymptotically biased (inconsistent). In the present paper, we propose a new approach to the problem. Namely, it elaborates the effects of temporal aggregation, i.e. aggregation over time, on the OLS estimator.

In the present paper, we consider a simple regression model whose explanatory variable consists of a latent variable and an measurement error. As the key assumption, we assume that the latent explanatory variable is positively autocorrelated. Since most economic time series data are positively autocorrelated, this assumption is satisfied in many situations and is not restrictive. Further, the measurement error is assumed to be serially independent

We firstly analytically show that the non-overlapping temporal aggregation of the model decreases the bias and the mean squared error (MSE) of the OLS estimator when the sample size is large. This result comes from the fact that temporal aggregation of the positively autocorrelated latent variable increases their variability faster than the non-autocorrelated measurement error. That is, the noise-signal ratio becomes smaller in the temporally aggregated model. We may note that the aggregation scheme can be easily generalized to the overlapping one.

It should be noted, however, that the temporal aggregation does not completely eliminate the bias (inconsistency). Thus, we secondly propose a consistent estimator by suitably combining the original disaggregated estimator and the aggregated estimator. Thirdly, we conduct appropriate simulation experiments which exhibit that the above analytical results are valid even in the small sample.

Finally, we apply the proposed consistent method to an empirical application of Japanese data and the result appears to be effective in decreasing the inconsistency caused by the measurement error.

Keywords:

Regression Model, Measurement Error, Temporal Aggregation, Cosistent Estimator

JEL Classification: C01, C13, C26