On the use of higher order bias approximations for 2SLS and k-class estimators with non-normal disturbances and many instruments

Gareth Liu-Evans, Garry D.A. Phillips

PII: S2452-3062(17)30044-8
DOI: 10.1016/j.ecosta.2017.06.002
Reference: ECOSTA 68

To appear in: *Econometrics and Statistics*

Received date: 3 May 2016
Revised date: 7 June 2017
Accepted date: 7 June 2017

Please cite this article as: Gareth Liu-Evans, Garry D.A. Phillips, On the use of higher order bias approximations for 2SLS and k-class estimators with non-normal disturbances and many instruments, *Econometrics and Statistics* (2017), doi: 10.1016/j.ecosta.2017.06.002

On the use of higher order bias approximations for 2SLS and k-class estimators with non-normal disturbances and many instruments

Gareth Liu-Evans[1,*], Garry D.A. Phillips[2]

Abstract

The first and second moment approximations for the k-class of estimators were originally obtained in a general static simultaneous equation model under the assumption that the structural disturbances were i.i.d. and normally distributed. Later, higher-order bias approximations were obtained and were shown to be important especially in highly overidentified cases. It is shown that the higher order bias approximation continues to be valid under symmetric, but not necessarily normal, disturbances with an arbitrary degree of kurtosis, but not when the disturbances are asymmetric. A modified higher-order approximation for the bias is then obtained which includes the case of asymmetric disturbances. The effect of asymmetry in the disturbances is explored in the context of a two equation model where it is shown that the bias of $2SLS$ may be substantially changed when the skewness factor increases. The use of the bias approximation is illustrated using empirical applications relating to the return to schooling, where a model with many instruments is employed, and to higher education wage premia.

Keywords:
bias approximation, 2SLS, k-class, simultaneous equation model, many instruments, weak instruments

1. Introduction

Moment approximations of estimators in simultaneous equation models have a long history. The seminal paper was Nagar (1959) who derived approximations to the first and second moments of the consistent k-*class* of estimators in a general simultaneous equation model with exogenous regressors. In obtaining the results, it was assumed that the structural disturbances were independently and normally distributed. Later Mikhail (1972) extended Nagar's $O(T^{-1})$ bias approximation for the $2SLS$ case to a higher order, viz. $O(T^{-2})$, and under the same assumptions while Iglesias and Phillips (2010) give the higher

*Corresponding author
[1]Management School, University of Liverpool, Liverpool, UK L69 7ZH
[2]School of Business and Economics, University of Exeter, Exeter, UK EX4 4PU