Vol 5 Issue 1 July 2015 ISSN No :2231-5063

International Multidisciplinary Research Journal

Golden Research Thoughts

Welcome to GRT

RNI MAHMUL/2011/38595 **ISSN No.2231-5063**

Golden Research Thoughts Journal is a multidisciplinary research journal, published monthly in English, Hindi & Marathi Language. All research papers submitted to the journal will be double - blind peer reviewed referred by members of the editorial board.Readers will include investigator in universities, research institutes government and industry with research interest in the general subjects.

International Advisory Board

Editorial Board

Address:-Ashok Yakkaldevi 258/34, Raviwar Peth, Solapur - 413 005 Maharashtra, India
Cell : 9595 359 435, Ph No: 02172372010 Email: ayisrj@yahoo.in Website: www.aygrt.isrj.in

Golden Research Thoughts
ISSN 2231-5063
Impact Factor : 3.4052(UIF)
Volume - 5 | Issue - 1 | July - 2015

ESTIMATION IN THE PRESENCE OF ERRORS IN VARIABLES AND AUTOCORRELATED DISTURBANCES

V. Kodandarami Reddy[1] and V. Balakrishnama Naidu[2]

Abstract

Errors in variables and errors in equations, particularly autocorrelated disturbances, are two major problems in general linear model. In the presence of both the problems a linear transformation of the Generalized Least Squares estimator is proposed as an estimator of the parameter vector of the original model and it is shown that this estimator is unbiased and consistent under certain assumptions.

Keywords :*Linear Model, Errors in Variables, Autocorrelation, Generalized Least Squares.*

Short Profile

V. Kodandarami Reddy is working as an Assistant Professor at Department of Econometrics in S. V. University, Tirupati. He Has Completed M.Sc. and Ph.D. He Has Professional Experience 35 Years and Research Experience 40 Years.

INTRODUCTION

The general linear model is a widely used tool both in experimental and behavioural sciences to draw some valid conclusions and to make certain predictions with the help of data. Errors in variables and errors in equations are two basic problems in the general linear regression model.

It is well known that errors in variables play a crucial role in Econometrics. The presence of observational errors in the data violates the basic assumption implicit in the methodology adopted to analyse data. The classical as well as recent estimators of parameters of a linear model, in the presence of observational errors, have their theoretical and practical limitations and there in no satisfactory breakthrough.

Errors in equations, particularly autocorrelation, have been paid a lot of attention by researchers and there is a satisfactory solution when it is treated alone. In the standard linear regression model, autocorrelated disturbances lead to inefficient, but still unbiased estimates of the coefficients. When the autocorrelation parameter of the disturbances is known, one can use the Generalised Least Squares method directly. In the absence of its knowledge several two stage estimation procedures have been suggested in the literature.

The presence of both the problems of errors in variables and autocorrelated disturbances in the general linear regression model pose serious problems to the researchers. With this vital problem as focus the present study is an attempt to provide a method of estimation of the parameters of a general linear model with measuremental errors and serially correlated disturbances.

PRELIMINARIES

Consider the familiar linear model

$$Y = X\beta + U \qquad (1)$$

where

Y is a $n \times 1$ vector of outcomes,

X is a $n \times k$ matrix of stochastic regressors, and

β is a $k \times 1$ vector of parameters.

The $n \times 1$ random vector U, is assumed to

[1]Professor, Department of Econometrics, S. V. University, Tirupati.
[2] Professor & Head, Department of Econometrics, S.V. University,Tirupati.

be normally distributed with zero mean and variance covariance matrix

$E(UU') = \sigma^2 R$ (2)

where (i, j)th element of R is $\rho^{|i-j|}$ and $|\rho| < 1$ for stationarity.

Further assuming that the observational errors are presents both in explained and explanatory variables, the actual values of Y and X cannot be observed. On the assumption that the measuremental errors are random and additive in nature, the observed values are

$Y^* = Y + Z$ (3)

$Xj^* = Xj + Wj \quad j = 1, 2, \ldots, k$

where Y and X_j are the true values, Z and W_j are errors of measurement. Under certain conditions, the model in errors affected variables corresponding to the model (1) is

$Y^* = X^* \beta^* + U^*$ (4)

where

$U_t^* = U^*_{t-1} + V_t^*, \quad |\rho| < 1$

$E(V_t^*) = 0$

$E(V_t^*)2 = \sigma^*2$

such that $E(U^* U^{*\prime}) = \sigma^{*2} R$

The entire analysis is to be based on the observed variables Y* and X*. Under usual assumptions the generalized least square estimator of β*, viz.,

$b^* = (X^{*\prime} R^{-1} X)^{-1} X^{*\prime} R^{-1} Y^*$ (5)

is consistent and unbiased for β*

Using these preliminaries the new estimator proposed for β, the parameter vector of the true model (1), is as follows:

RESULTS PROPOSED

Suppose $\text{Plim}\, n^{-1} (X^{*\prime} R^{-1} X) = \Sigma_x^*$

ie., $\text{Plim}\, n^{-1} [(X+W)' R^{-1} (X+W)] = \Sigma_x^*$

ie., $\text{Plim}\, n^{-1} [(X' R^{-1} X + W' R^{-1} X + X' R^{-1} W + W' R^{-1} W)] = \Sigma_x^*$

ie., $\Sigma_x + Q = \Sigma_x^*$ exists (6)

where

$\Sigma_x = \text{Plim}\, n^{-1} (X' R^{-1} X)$ and

$Q = \Sigma_{wx} + \Sigma_{xw} + \Sigma_{ww},$

then the following results are obtained:

1.Assuming that Σ_x^*, Q and ρ known, a linear transformation of GLS estimator of β * is proposed as an estimator of β, that is

$b = L b^*$ (7)

where $L = \Sigma_x^{-1} \Sigma_x^*$.

2.It is proved that b is consistent and unbiased for β. The asymptotic variance of b is given by

$\text{Asy. variance}(b) = n^{-1} \sigma^{*2} \Sigma X^{-1} \Sigma^{X*} \Sigma_x^{-1}$ (8)

3.b follows multivariate normal distribution with mean vector β and asymptotic variance as given in equation (8).

4.Assuming that ρ and Q alone are known, the new estimator proposed is

$b\hat{} = (\Sigma\hat{}_{X^*} - Q)^{-1} \Sigma\hat{}_{X^* Y^*}$ (9)

where

$\Sigma\hat{}_{X^*} = n^{-1} (X^{*\prime} R^{-1} X^*)$ and

$\Sigma\hat{}_{X^*Y^*} = n\text{-}1 (X^{*\prime} R^{-1} Y^*)$

5.It is shown that b^ is consistent and asymptotically unbiased for β.

In the absence of autocorrelated

disturbances the above estimators reduces to the estimators proposed by Reddy, V.K. (1983) in the presence of errors in variables only.

In practice ρ and Q are not generally known. Usually ρ is replaced by its estimate. In the absence of its knowledge many different estimators of ρ are possible. In the presence of errors in variables the OLS estimator of ρ is inconsistent (Greather and Maddala, 1973). Hence a 'Monte Carlo' study is undertaken to examine the bias and mean square error (MSE) of the different estimators of ρ. An estimate of ρ is chosen with minimum bias and MSE. Replacing ρ by its estimate in R, Q is estimated by the 'Extended Ridge Method' developed by Lankipalli, K.N. (1984).

When ρ and Q are estimated, it is difficult to establish the properties of the estimator of $\hat{b}$. Therefore an extensive Monte Carlo study is undertaken to examine the behaviour of the estimator, $\hat{b}$, both in small and large samples and its efficiency is compared with the generalized least squares (GLS) estimator and ordinary least square (OLS) estimator.

REFERENCES

1.Lankipalli, K.N, V.K. Reddy and V.B. Naidu, "The Adjusted Linear Estimator-Non normal case", presented at the 23rd Indian Econometric Society Conference held at Hyderabad, 1985.
2.Greather and Maddala, "Errors in Variables and Serially Correlated Disturbances in Distributed Lags", Econometrica, 41, pp 255-262, 1973.
3.Reddy, V.K, "Estimation of Parameters in Errors in Variables Linear Model", Unpublished Ph.D. Thesis, 1983.

V. Kodandarami Reddy
Professor, Department of Econometrics,
S. V. University, Tirupati.