# A new class of efficient and debiased two-step shrinkage estimators: method and application

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**ABSTRACT**

This paper introduces a new class of efficient and debiased two-step shrinkage estimators for a linear regression model in the presence of multicollinearity. We derive the proposed estimators' mean square error and define the necessary and sufficient conditions for superiority over the existing estimators. In addition, we develop an algorithm for selecting the shrinkage parameters for the proposed estimators. The comparison of the new estimators versus the traditional ordinary least squares, ridge regression, Liu, and the two-parameter estimators is done by a matrix mean square error criterion. The Monte Carlo simulation results show the superiority of the proposed estimators under certain conditions. In the presence of high but imperfect multicollinearity, the two-step shrinkage estimators' performance is relatively better. Finally, two real-world chemical data are analyzed to demonstrate the advantages and the empirical relevance of our newly proposed estimators. It is shown that the standard errors and the estimated mean square error decrease substantially for the proposed estimator. Hence, the precision of the estimated parameters is increased, which of course is one of the main objectives of the practitioners.

## 1. Introduction

To describe the problem, we consider the following classical linear regression model (LRM):

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

where $Y$ is a $(n \times 1)$ vector of observations on the response variable, $X$ is a $(n \times p)$ full ranked design matrix consisting of the explanatory variables, $\beta$ is a $(p \times 1)$ column vector of unknown regression coefficients and $\varepsilon$ is a $(n \times 1)$ vector of random errors assumed to be normally distributed with $E(\varepsilon) = 0$ and $E(\varepsilon\varepsilon^T) = \sigma^2 I_n$ where $I_n$ is a $(n \times n)$ identity matrix. The ordinary least square estimator (OLSE) of the unknown parameter vector $\beta$ is:

$$\hat{\beta}_{OLS} = (X^T X)^{-1} X^T Y. \tag{2}$$

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# When Are Two Step Estimators Efficient

**D Siedentop**

**When Are Two Step Estimators Efficient:**

**When are Two Step Estimators Efficient?** Michael McAleer,C. R. McKenzie,1991 **The Econometric Analysis of Time Series** Andrew C. Harvey,1990 The Econometric Analysis of Time Series focuses on the statistical aspects of model building with an emphasis on providing an understanding of the main ideas and concepts in econometrics rather than presenting a series of rigorous proofs *Advanced Econometric Methods* Thomas B. Fomby,R. Carter Hill,Stanley R. Johnson,2012-12-06 This book had its conception in 1975in a friendly tavern near the School of Businessand PublicAdministration at the UniversityofMissouri Columbia Two of the authors Fomby and Hill were graduate students of the third Johnson and were and are concerned about teaching econometrics effectively at the graduate level We decided then to write a book to serve as a comprehensive text for graduate econometrics Generally the material included in the bookand itsorganization have been governed by the question Howcould the subject be best presented in a graduate class For content this has meant that we have tried to cover all the bases and yet have not attempted to be encyclopedic The intended purpose has also affected the levelofmathematical rigor We have tended to prove only those results that are basic and or relatively straightforward Proofs that would demand inordinant amounts of class time have simply been referenced The book is intended for a two semester course and paced to admit more extensive treatment of areas of specific interest to the instructor and students We have great confidence in the ability industry and persistence of graduate students in ferreting out and understanding the omitted proofs and results In the end this is how one gains maturity and a fuller appreciation for the subject in any case It is assumed that the readers of the book will have had an econometric methods course using texts like J Johnston s Econometric Methods 2nd ed **Encyclopedia of Measurement and Statistics** Neil J. Salkind,2007 Publisher Description *Modelling the Efficiency of Family and Hired Labour* Prem Jung Thapa,2017-11-01 This title was first published in 2003 The principal economic units in most developing countries are family based farm households Empirical models that recognize the dual role of the farm household as producer and consumer in a theoretically consistent manner are essential tools for policy analyses This book provides an important extension of the conventional farm household model by developing an analytical framework that allows for efficiency differences between family and hired labour as inputs in farm production The model is estimated with survey data from the southern lowland region of Nepal The estimation strategy is a two step process The first step estimates a farm level production function in which is embedded a test for heterogeneity between family and hired labour The labour heterogeneity detected in the production function estimation is incorporated at the second step in the labour supply estimation in a theoretically consistent manner The methodological novelty is to relate the shadow wage rate for family labour to the observed market wage rate for hired labour adjusted for the differential productivity of family and hired labour detected in the production function estimation **Innovations in Multivariate Statistical Analysis** Risto D.H. Heijmans,D.S.G. Pollock,Albert Satorra,2012-12-06 The three decades which have followed

the publication of Heinz Neudecker s seminal paper Some Theorems on Matrix Differentiation with Special Reference to Kronecker Products in the Journal of the American Statistical Association 1969 have witnessed the growing influence of matrix analysis in many scientific disciplines Amongst these are the disciplines to which Neudecker has contributed directly namely econometrics economics psychometrics and multivariate analysis This book aims to illustrate how powerful the tools of matrix analysis have become as weapons in the statistician s armoury The majority of its chapters are concerned primarily with theoretical innovations but all of them have applications in view and some of them contain extensive illustrations of the applied techniques This book will provide research workers and graduate students with a cross section of innovative work in the fields of matrix methods and multivariate statistical analysis It should be of interest to students and practitioners in a wide range of subjects which rely upon modern methods of statistical analysis The contributors to the book are themselves practitioners of a wide range of subjects including econometrics psychometrics educational statistics computation methods and electrical engineering but they find a common ground in the methods which are represented in the book It is envisaged that the book will serve as an important work of reference and as a source of inspiration for some years to come **Analysis of Panel Data** Cheng Hsiao,2003-02-13 This book reviews the basic econometric methods that have been used to analyze panel data in other words data collected by observing a number of individuals over time Copyright Libri GmbH All rights reserved **Working Papers in Economics and Econometrics** Australian National University. Research School of Social Sciences. Department of Economics,1990 **Performance Analysis of the Indian Pharmaceutical Industry** Chandrima Chakraborty,Dipyaman Pal,2025-02-03 Chakraborty and Pal examine the import and export of Indian medicines to understand the place of the industry on a global scale and assess what can be done to become more competitive The international comparison of this study will appeal and be useful for researchers industry professionals and policy makers **Measurement Error and Latent Variables in Econometrics** T. Wansbeek,E. Meijer,2000-12-08 The book first discusses in depth various aspects of the well known inconsistency that arises when explanatory variables in a linear regression model are measured with error Despite this inconsistency the region where the true regression coeffecients lies can sometimes be characterized in a useful way especially when bounds are known on the measurement error variance but also when such information is absent Wage discrimination with imperfect productivity measurement is discussed as an important special case Next it is shown that the inconsistency is not accidental but fundamental Due to an identification problem no consistent estimators may exist at all Additional information is desirable This information can be of various types One type is exact prior knowledge about functions of the parameters This leads to the CALS estimator Another major type is in the form of instrumental variables Many aspects of this are discussed including heteroskedasticity combination of data from different sources construction of instruments from the available data and the LIML estimator which is especially relevant when the instruments are weak The scope is then widened to an embedding of the regression equation with

measurement error in a multiple equations setting leading to the exploratory factor analysis EFA model This marks the step from measurement error to latent variables Estimation of the EFA model leads to an eigenvalue problem A variety of models is reviewed that involve eignevalue problems as their common characteristic EFA is extended to confirmatory factor analysis CFA by including restrictions on the parameters of the factor analysis model and next by relating the factors to background variables These models are all structural equation models SEMs a very general and important class of models with the LISREL model as its best known representation encompassing almost all linear equation systems with latent variables Estimation of SEMs can be viewed as an application of the generalized method of moments GMM GMM in general and for SEM in particular is discussed at great length including the generality of GMM optimal weighting conditional moments continuous updating simulation estimation the link with the method of maximum likelihood and in particular testing and model evaluation for GMM The discussion concludes with nonlinear models The emphasis is on polynomial models and models that are nonlinear due to a filter on the dependent variables like discrete choice models or models with ordered categorical variables       **The American Economic Review** ,2005-03 Includes annual List of doctoral dissertations in political economy in progress in American universities and colleges and the Hand book of the American Economic Association

   **Theoretical and Applied Econometrics** Phoebus J. Dhrymes,1995 This selection of Professor Dhrymes s major papers combines important contributions to econometric theory with a series of well thought out skilfully executed empirical studies The theoretical papers focus on such issues as the general linear model simultaneous equations models distributed lags and ancillary topics Most of these papers originated with problems encountered in empirical research The applied studies deal with production function and productivity topics demand for labour arbitrage pricing theory demand for housing and related issues Featuring careful exposition of key techniques combined with relevant theory and illustrations of possible applications this book will be welcomed by academic and professional economists concerned with the use of econometric techniques and their underlying theory       **Studies in Econometric Theory** Takeshi Amemiya,1994 Takeshi Amemiya has made a significant contribution to econometric theory over the past 30 years This volume brings together 34 of his key articles and papers on areas such as limited dependent variables non linear simultaneous equations models time series analysis and error components models Many of the articles reprinted in this volume are indispensable references for researchers in the relevant fields The specially written preface outlines the influences and motivations behind Professor Amemiya s work Studies in Econometric Theorypresents in a single volume the most significant work of one of the most important influential econometricians of our time       **Survey Methodology** ,2002       **The Supervision of Instruction** Hubert Wilbur Nutt,1920 The following discussion and analysis of the elements of the supervisory process and statement of the technique and professional standards for the supervision of instruction will be read with interest by those who are concerned with the work of school supervision The fundamental purpose of all school supervision is to increase the efficiency of the classroom teacher

For a supervisor to be constructively critical and helpful requires a good understanding of both the purposes and the technique of supervision and the fundamental principles and methods underlying such helpful and constructive service the author of the present volume has here set forth    *Hungarian Statistical Review* ,2012    **The Fix-point Approach to Interdependent Systems** Herman O. A. Wold,1981 The Fix Point Approach to Interdependent Systems    *Journal of the American Statistical Association* ,2003 A scientific and educational journal not only for professional statisticians but also for economists business executives research directors government officials university professors and others who are seriously interested in the application of statistical methods to practical problems in the development of more useful methods and in the improvement of basic statistical data    Current Index to Statistics, Applications, Methods and Theory ,1997 The Current Index to Statistics CIS is a bibliographic index of publications in statistics probability and related fields    Frontiers of Quantitative Economics ,1974

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    - Chapter 5: Conclusion

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