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ECONOMETRIC METHODS

by Jack Johnston and John DiNardo

McGraw Hill, 1997

Reviewed by
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1. BRIEF OVERVIEW

The fourth edition of *Econometric Methods* by Jack Johnston and John DiNardo, is a rewrite of the venerable third edition by Johnston that sustained several generations of economists. As stated by the authors themselves, the reason for undertaking this major revision is to provide a comprehensive and accessible account of currently available econometric methodology, and in my opinion they have been successful in achieving their objective. The book has 13 chapters and runs to 531 pages. Each chapter ends with a selection of problems, several of which are new to this edition. Answers are not provided, although a solutions manual is available. Two appendices, one on matrix algebra and the other on statistical preliminaries, are intended to make the book as self-contained as possible. Not unexpectedly, the appendices are somewhat tersely worded, and the reader may wish to supplement them with additional reference material. Conforming to current practice, the book is accompanied by a data diskette containing several data sets, allowing the reader to replicate the applications given in the text.

2. DESCRIPTION OF CONTENTS

The authors commence with a study of the bivariate linear model in Chapter 1. In this chapter the reader is guided through correlation coefficients and the bivariate normal distribution to the standard two variable normal linear regression model and the Gauss–Markov theorem. The authors even manage to introduce the concept of ancillarity, without ever using the term, when they emphasize on page 24 that in using the conditional distribution of $Y|X = x$ to obtain information about the parameters on interest an implicit assumption is that the marginal of X does not depend upon these parameters.

Chapter 2 continues with the bivariate model by introducing a family of transformations of the dependent and independent variables. Unlike in the previous edition however, the general Box–Cox transformation is not used as a motivation here. Certain types of stochastic convergence such as convergence in probability and

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convergence in distribution are also introduced in brief passages. This treatment, however, is too terse and may leave the reader looking for more. Moreover, the notation in equation (2.27) (on p. 55) that describes the convergence in distribution of the sample mean $\bar{x}_n$ as $n^{1/2}\bar{x}_n \xrightarrow{d} N(n^{1/2}\mu, \sigma^2)$ may confuse the reader as the limiting distribution is allowed to depend upon n. The usual way of denoting such convergence, namely, $n^{1/2}(\bar{x}_n - \mu) \xrightarrow{d} N(0, \sigma^2)$, leads to no such confusion.

Chapter 3 presents the k variable linear model $\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{u}$ using a matrix formulation. The chapter is very well written and has a nice treatment of testing linear hypotheses about $\boldsymbol{\beta}$. However, the near absence of any discussion on multicollinearity may distress those who have read the third edition.

Deviations from the assumptions of the classical linear regression model for the k variable case are the main theme of Chapter 4. Like the previous chapter, I found this one to be quite detailed and very clearly written. Various kinds of specification errors are described and several tests of parameter constancy discussed. Tests for structural change and dummy variables are also introduced in this chapter. As is the case throughout the book, each new concept is accompanied by at least one numerical example intended to familiarize the reader with the concept.

Chapter 5 has a nice description of maximum likelihood, generalized least squares (GLS), and IV estimation of the linear model. It is quite well written, but two things did catch my eye. First, in describing the invariance property of the maximum likelihood estimator (MLE) on p. 144, the authors mention that "if $\hat{\theta}$ is the MLE of θ and $g(\theta)$ is a continuous function of θ, then $g(\hat{\theta})$ is the MLE of $g(\theta)$." However, the invariance of the MLE continues to hold even when g may not be continuous. For instance, using the example due to Berk (1967), the MLE of $\text{sgn}(\theta)$ is $\text{sgn}(\hat{\theta})$, where $\text{sgn}(\cdot)$ denotes the sign function; i.e., $\text{sgn}(x) = 1$ if $x \geq 0$ and -1 otherwise. Second, In Section 5.3 on the "holy trinity" of likelihood ratio (LR), Wald, and Lagrange multiplier (LM) tests the authors have shown the inequality $W \geq LR \geq LM$ by using the first two terms in the Taylor expansion of $\log(1 + x)$. This may perturb some readers as no mention is made of remainder terms in this expansion. The same result may be obtained in a straightforward manner, and without involving any remainder terms, by using the inequality $\log x \leq x - 1$, which follows directly from the concavity of the logarithmic function.

I found Chapter 6 to be quite informative in its detailed examination of the properties of the least squares estimator, when disturbances exhibit heteroskedasticity and/or autocorrelation. A battery of tests for heteroskedasticity and serial correlation is also described in great detail. ARCH processes, and estimation under ARCH, are also introduced.

Chapter 7 marks the major point of departure of this book from the previous edition. It is devoted to univariate time series and covers the properties of autoregressive (AR), moving average (MA), and autoregressive moving average (ARMA) processes. New topics such as testing for stationarity and unit root tests have also been included.

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Chapter 8 extends univariate time series regression by allowing explanatory variables that may include the lagged values of the dependent variable along with the current and lagged values of some other covariates. Spurious regressions and cointegrating relations, along with a nice discussion on specification testing, are introduced in this chapter.

Unlike the previous edition where simultaneous equations had a separate chapter to themselves, in this edition they share the glory with vector autoregressions in Chapter 9. In a nice balancing act the authors seem to have done justice to both these topics, though 3SLS and FIML barely find a mention in this edition.

Generalized method of moments (GMM) estimators are introduced in Chapter 10, where the generality of the GMM technique is demonstrated by showing various classical estimators to be special cases of certain (unconditional) moment problems. The usefulness of GMM in testing overidentifying restrictions, including an application to estimating Euler equations, is also discussed. However, the role of GMM in estimating conditional moment restrictions, and the importance of such restrictions in econometrics, is not described (see, e.g., Powell, 1994, and the references therein).

Chapter 11 is on computational methods and contains a fairly nontechnical introduction to Monte Carlo methods, bootstrapping, and nonparametric density/regression estimation. Readers wanting to learn more about these sophisticated statistical techniques will surely appreciate this accessible presentation. Most of the illustrative examples in this chapter (and in subsequent chapters) are drawn from labor economics. In Section 11.5.1 (on the partially linear model) I would suggest adding a reference to the now classic paper by Robinson (1988).

Chapter 12 is devoted to the study of panel data. In a very lucid exposition, random and fixed effects models are introduced and the perils of fixed effects estimation illustrated for the case when the explanatory variables are either mismeasured or endogenous. A brief introduction to Chamberlain's (1982) approach of estimating panel data models is also provided. Apart from two typographical errors—the first on p. 390 (y should be in boldface in equation (12.4)) and the second on p. 396 ($\mathbf{X}i2$ should read $\mathbf{X}_{i2}$)—and the authors' insistence on using unconditional expectations to denote conditional expectations (in equation (12.9)), the chapter appeared to me to be blemish free.

Finally, Chapter 13, the last chapter in the book, is concerned with limited dependent variable models. Beginning with the linear probability model the reader is skillfully guided through a tour of the probit and logit formulations of the binary choice model, including a section on the effects of misspecification in these models. There is a brief discussion of the ordered probit model, but multinomial probit and logit do not find a mention. Censored and truncated regression models are introduced via a discussion of the type 1 tobit model, and the sensitivity of the tobit model to heteroskedasticity is highlighted. Symmetrically trimmed least squares and censored least absolute deviations are discussed as a means of obtaining consistent estimates in tobit models in the presence of heteroskedasticity. Sample selection models also find a place with a description of the famous "Heckman two step" estimator, and the technique is illustrated by applying it to the tobit model.

3. CONCLUSION

As the reader may have inferred from this review, I liked this book very much. Incorporating some of the most recent advances in econometric methodology, it is broad enough to serve as a textbook and detailed enough to serve as a useful reference. It is well written and contains several numerical examples and problem sets. Some readers of the previous edition may not like the omission of a few time-tested topics from this edition, but this is easily rectified. In any case the abundance of the references provided by the authors, even for the topics that have been omitted, more than makes up for these omissions. Johnston and DiNardo are to be congratulated for writing an excellent multipurpose econometrics text.

REFERENCES

Berk, R. (1967) Review of Zehna (1966). *Mathematical Reviews* 33 (1922), 342–343.
Chamberlain, G. (1982) Multivariate regression models for panel data. *Journal of Econometrics* 18, 5–46.
Powell, J.L. (1994) Estimation of semiparametric models. In R. Engle & D. McFadden (eds.), *Handbook of Econometrics*, vol. IV, pp. 2443–2521. Amsterdam: Elsevier Science B.V.
Robinson, P. (1988) Root-*N*-consistent semiparametric regression. *Econometrica* 56, 931–954.

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