MACROECONOMETRIC SYSTEMS

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CONSTRUCTION, VALIDATION AND APPLICATIONS

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Macmillan Education

Softcover reprint of the hardcover 1st edition 1983

First published in the United States of America in 1983

ISBN 978-0-333-31084-7 ISBN 978-1-349-27931-9 (eBook)
DOI 10.1007/978-1-349-27931-9

Library of Congress Cataloging in Publication Data

Challen, D. W.
Macro-econometric systems.

Includes index.
1. Econometrics. 2. Economics—Mathematical models. I. Hagger, A. J. II. Title.
HB141.C44 1983 339'.0724 83–2856
ISBN 978-0-312-50315-4

To Anne and Rona

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PREFACE

Our object in writing this book was not to produce yet another textbook on econometrics but rather to remedy a major deficiency which all existing books appear to share. We refer to their highly unsatisfactory treatment of 'systems'.

Our quarrel with the standard textbook treatment of systems is that it has the appearance of being (and, in fact, is) almost totally divorced from what actually goes on in 'the systems world'. This was more or less inevitable in the 1950s and early 1960s when working macroeconometric systems were comparatively rare and when, therefore, there was very little going on in the systems world. It is no longer inevitable (and is certainly undesirable) now that the USA alone has some eight major working systems, the UK and Canada have four and almost every country, large or small, developed or undeveloped, has at least one.

Two examples will help to amplify our statement that the standard textbook treatment of systems is almost totally divorced from what goes on in the systems world. The first relates to estimation.

The standard way of approaching the topic of systems estimation is to show that equation-by-equation estimation of OLS and/or its derivatives – Almon, non-linear least squares, ARMAX and the like – is unacceptable and then to proceed with a very detailed treatment, complete with proofs, of system estimators such as 2SLS, 3SLS and FIML. One or other of these is supposed to constitute the alternative. However, when authors face up to the question of what estimators are actually used in working systems, as at some point they must, they are forced to admit, usually rather lamely and without explanation, that for all practical purposes the estimators most commonly used in working systems are OLS and its derivatives! Why, then, the reader is bound to ask, was so much time spent on the others?

The second example concerns applications. Invariably the discussion which leads up to the chapters on applications of systems is couched in terms of *linear* systems. Thus it is natural that the discussion of applications, when it comes, should focus on the various multipliers that can be calculated from linear systems and on forecasting from linear systems. However, the author is unable to draw on actual econometric studies in which these techniques can be seen in action because effectively they are never used, the reason being that modern macroeconometric systems are invariably non-linear.

In the present book the main focus, right from the beginning, is on practice; it is a book about how modern macroeconometric systems are actually built, which estimation techniques are available in practice, as distinct from in principle, and which are chosen, how systems are assessed in practice and how they actually are, as distinct from how they might be, put to work.

This does not mean that the theoretical material which forms the essential ingredient of the systems chapters of most texts is ignored, only that it is put in what we believe to be its proper place. For example, Chapter 4 presents a comprehensive discussion of available estimators. The emphasis, however, is on how they work and on what we know about them because the ultimate purpose of the discussion is to show (in Chapter 6) that, in practice, most of them, have, for one reason or another, to be ruled out. No proofs are presented, though references to where the proofs can be found are given. Again, the various linear multipliers – impact, delay, intermediate-run and long-run – are discussed in detail, and in a rigorous way, in Chapter 7. As is made clear at the outset of the chapter, however, the reason for discussing these multipliers is not that they are now used but that they provide a natural entry-point to certain evaluation procedures – discussed in Chapter 8 – which *are* in widespread use.

In our opinion, the practical focus we have adopted has two great advantages. One is that it facilitates the introduction of certain important material which does not sit easily in the standard textbook framework and which is, therefore, either omitted altogether or given very brief treatment in the typical text. Examples are the material on the solution of non-linear systems (nowadays all working systems are non-linear) presented in Chapter 2 and the Monte Carlo and other finite-sample material presented in Chapter 5. The second advantage is that it facilitates the discussion of studies in which an estimated system is used to attack some policy or other economic problem of obvious practical significance and so helps to convince the readers that they are being asked to master difficult material because it is useful, and not, as they must feel when working through the typical text, because of its intellectual challenge *per se*.

The book assumes that readers have completed an introductory course in econometrics at the level of such texts as Johnston's *Econometric Methods,* Kmenta's *Elements of Econometrics* or Intriligator's *Econometric Models, Techniques and Applications*. Thus, for example, one should be familiar with the mechanics of OLS estimation, with the 'classical' assumptions under which OLS is the BLUE estimator of a linear stochastic relationship, with concepts such as consistency and efficiency and, in general, with the basic econometric tools and concepts. Some familiarity with elementary macroeconomics is also desirable, though by no means indispensable.

The main use of the book will be in follow-up courses in econometrics, at the third- and fourth-year undergraduate and postgraduate levels. In addition, the book should be suitable for use in advanced courses in macroeconomics and possibly in related courses in such areas as operations research and decision-making. With its emphasis on the practical side of systems it should also be found helpful by practising economists in the civil service and in business.

Many people have made significant contributions to the writing of the book and to these we extend our sincere thanks. We owe a particular debt to Professor D. E. A. Giles of Monash University who read through an earlier draft with great care and made numerous detailed suggestions for improvement. The book is much better than it would have been without his help. Another painstaking reader to whom we are greatly indebted is Dr G. M. Wells of the Victoria University, Wellington. He, too, made many helpful and penetrating comments. We must also express our thanks to two of our colleagues in the University of Tasmania, Mr J. R. Madden and Mr M. L. Kerslake, both of whom scrutinised the manuscript with great care. Finally we owe yet another great debt to Mrs Patricia Combes, who typed the manuscript in her customary impeccable fashion.

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December 1982

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LIST OF ABBREVIATIONS

ACF	AutoCorrelation Function
ARMAX	AutoRegressive Moving Average eXogenous
BLUE	Best Linear Unbiased Estimator
CA	Constant-term Adjustment
CO	Cochrane–Orcutt
D-W	Durbin–Watson statistic
FIIV	Full information Iterated Instrumental Variables
FIML	Full Information Maximum Likelihood
FISE	Full Information relating to the whole-System Estimator
FP	Fixed Point
h	Durbin's *h* statistic
IIV	Iterative Instrumental variables
IV	Instrumental Variables
KK	Keynes–Klein
LIIV	Limited information Iterated Instrumental Variables
LIML	Limited Information Maximum Likelihood
LISE	Limited Information relating to the whole-System Estimator
MAE	Mean Absolute Error
MS	Muth–Sargent
MSE	Mean Square Error
NLLS	Non-Linear Least Squares
NL2SLS	Non-Linear Two-Stage Least Squares
NL3SLS	Non-Linear Three-Stage Least Squares
OLS	Ordinary Least Squares
PB	Phillips–Bergstrom
PDL	Polynomial Distributed Lag
RMSE	Root Mean Squared Error
RMSPE	Root Mean Squared Percentage Error
RRF2SLS	Restricted Reduced-Form Two-Stage Least Squares
SIE	Single-equation Information Estimators
2SLS	Two-Stage Least Squares
2SPC	Two-Stage Principal Components
3SLS	Three-Stage Least Squares
WJ	Walras–Johansen
WL	Walras–Leontief