The Structural Econometric Time Series Analysis Approach

Bringing together a collection of previously published work, this book provides a timely discussion of major considerations relating to the construction of econometric models that work well to explain economic phenomena, predict future outcomes, and be useful for policy-making. Analytical relations between dynamic econometric structural models and empirical time series MVARMA, VAR, transfer function, and univariate ARIMA models are established with important application for model-checking and model construction. The theory and applications of these procedures to a variety of econometric modeling and forecasting problems as well as Bayesian and non-Bayesian testing, shrinkage estimation, and forecasting procedures are also presented and applied. Finally, attention is focused on the effects of disaggregation on forecasting precision and the new Marshallian macroeconomic model (MMM) that features demand, supply, and entry equations for major sectors of economies is analyzed and described. This volume will prove invaluable to professionals, academics and students alike.

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Introduction

In the early 1970s we were concerned about the relationships between multivariate and univariate time series models, such as those brilliantly analyzed by Quenouille (1957) and Box and Jenkins (1970) and multivariate dynamic structural econometric models that had been and are widely employed in explanation, prediction and policy-making. Fortunately, we discovered the relationships and reported them in our paper, Zellner and Palm (1974) that is included in part I of this volume (chapter 1). See also the other general chapters in part I discussing general features of our approach, the reactions of leading researchers, and many useful references to the literature.

Having discovered the algebraic relations connecting statistical time series and structural econometric models, we next considered how this discovery might be used to produce improved models. In this connection, we thought it important not only to emphasize a philosophical preference for sophisticatedly simple models that is discussed in several chapters in part I and Zellner, Keuzenkamp, and McAleer (2001), but also operational techniques that would help researchers actually produce improved models. As illustrated in the chapters included in this volume, our approach involves (1) deducing algebraically the implied marginal processes and transfer functions for individual variables in a multi-equation model, e.g. a vector autoregression (VAR) or a structural econometric model (SEM), and (2) comparing these derived equations' forms and properties with those derived from the data by use of empirical model identification and testing techniques. See Palm and Zellner (1980), included in part I (chapter 5) for some early estimation and testing procedures that have been improved over the years. If the information in the data is compatible with the empirically determined, simple time series models and not with those implied by a VAR or SEM, then we conclude that the VAR or SEM needs reformulation and improvement. See, for example our (1975) paper in part II (chapter 6) analyzing monetary models of the US economy and other papers for applications of this approach to many other problems including Trivedi (1975) on modeling inventory behavior (chapter 7), Evans (1978) on the German hyperinflation (chapter 8), Plosser (1976) on seasonality (Chapter 9), Webb (1985) on behavior of speculative prices (chapter 10), Ahking and Miller (1987) on exchange rate models (chapter 11), and Maravall and Mathis (1994) on diagnosis of VAR models using French macroeconomic data (chapter 12). These studies demonstrate well the usefulness of our SEMTSA approach in analyzing, comparing, and improving models.

Since there is often no satisfactory model available, in part III we illustrate how relatively simple forecasting equations have been developed, studied, and tested in point and turning point forecasting experiments using modern estimation and forecasting techniques. Here the objective is to get forecasting equations that work well in point and turning point forecasting and have reasonable dynamic properties. Then the objective is to produce reasonable economic models to rationalize the good empirical performance of these empirical forecasting equations. Thus we do not in the present instance go from theory to the data but reverse the process by going from what works well empirically to theory that explains this unusual empirical finding. As mentioned in several chapters in part III, the empirical forecasting equations for countries' annual GDP growth rates have been rationalized by Hong (1989) in terms of a Hicksian [IS-LM macroeconomic model, by Min (1992) in terms of a generalized real business cycle model that he formulated and by Zellner and Anton (1986) in terms of an aggregate demand and supply model. Thus the empirical relations studied intensively in the chapters included in part III have some theoretical as well as empirical support. Note, too, that many methodological tools were developed and tested in the chapters on empirical forecasting work in part III – namely, Bayesian shrinkage estimation and prediction, optimal turning point forecasting techniques, optimal Bayesian model-combining or pooling methods, etc. Also, comparisons of forecasting root mean-squared errors (RMSEs) and mean absolute errors (MAEs) indicate that various simple forecasting equations' performance is competitive with that of certain large-scale macroeconometric models for many economies. See, for example some comparisons reported in Garcia-Ferrer *et al.* (1987) and Hoogstrate, Palm, and Pfann (2000) (chapter 13 and 18) for some improved results that utilize various pooling techniques in analysis and forecasting of panel data for eighteen countries.

While the studies in part III provide useful, improved macroeconomic results, it is the case that aggregation of output and other kinds of data, say over sectors of an economy, can involve a loss of valuable information, as has been discussed many times in the past. Thus part IV presents chapters dealing with disaggregation, forecasting, and modeling. A simple experiment, reported in Zellner and Tobias (2000) (chapter 22) shows empirically how disaggregation can result in improved forecasting precision in connection with forecasting the annual medians of eighteen countries' growth rates. In chapters 20 and 21 by LeSage and Magura (1990) and LeSage (1990), it is shown how shrinkage point and turning point forecasting procedures perform using regional data. Then in Zellner (2000) and in Zellner and Chen (2000) (chapters 23 and 24), Marshallian sector models of industrial sectors are formulated, building on the earlier work of Veloce and Zellner (1985), and tested in forecasting experiments using annual data for eleven sectors of the US economy. The annual output forecasts of the sectors are added to get a forecast of total GDP and its growth rate year by year. Such forecasts are compared with forecasts derived from models implemented with aggregate data. In this instance, it was found that it pays to disaggregate. Further work to improve and expand the Marshallian sector model in line with the SEMTSA approach is described in these chapters.

In summary, pursuing the SEMTSA approach over the years has been an exciting experience that has led to new empirical findings, improved and novel methodological tools, and improved models. We thank all those who have contributed to these positive developments and hope that future developments will be even better. Also, thanks to the US National Science Foundation and the H. G. B. Alexander Endowment Fund, University of Chicago, for financial support. Ashwin Rattan at Cambridge University Press, provided much help in arranging for the publication of our book, for which we are most grateful.

EDITORS´ NOTE

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