Series Editor's Introduction

Over the last 25 years Structural Equation Modeling (SEM) has become one of the most important data analysis techniques in the social sciences. In fact, it has become much more than that. It has become a language to formulate social science theories, and a language to talk about the relationship between variables. A series of books on advanced techniques in the social sciences is incomplete without a book on SEM. We are consequently very pleased that we can present David Kaplan's excellent text in our AQT series.

SEM is not without its critics, and most researchers active in the area will admit that it can easily be misused and in fact has frequently been misused. Its routine application as a tool for theory formation and causal analysis has been criticized by well-known statisticians such as Freedman, Wermuth, Rogosa, Speed, Rubin, and Cox. One obvious problem is that SEM is a complicated technique, whose statistical properties are far from simple, and many of its users do not have enough statistical expertise to understand the various complications. Another problem is that using SEM allows one to search over an enormously large space of possible models, with a complicated combinatorial structure, and the task of choosing an appropriate model, [let alone the "best model"], is horrendously difficult. Unless one has very strong prior knowledge, which sets strict limitations on the choices of the model, it is easy to search until one has an acceptable fit. That fit will often convey more about the tenacity and good fortune of the investigator than about the world the model supposed to characterize. Finally, at a deeper level there is considerable disagreement about precisely what one can learn about cause and effect in the absence of experiments in which causal variables are actually manipulated. For the critics, SEM can never be a substitute for real experiments.

It is somewhat unfortunate that most of the books discussing SEM concentrate on the practical aspects of the technique, and are often ill-disguised extended manuals of specific SEM software packages. A notable exception is the book by Bollen (Structural Equations with Latent Variables, Wiley, 1989), but this book is by now more than 10 years old, and it does not discuss many of the recent developments. Kaplan's book provides a general overview of theoretical aspects of SEM, and it does include many of these more recent developments. He mentions multilevel SEM, non-normal SEM, missing data, latent growth curves. Thus it is an eminently useful addition to the literature, because it complements

the package and how-to books and it updates the more methodological ones.

Let us try to place the Kaplan book somewhat more precisely in its historical context. There is very little factual distortion if we attribute the creation of modern SEM to Karl Jøreskog's work undertaken in the early seventies. Because of the competitive structure of the field, due in part to the emphasis on commercial software packages, there have been many attempts to minimize his contributions. But it is clear from the record that Jøreskog managed, almost single-handedly, to integrate into a single framework the simultaneous equations theory from econometrics, the path analysis theory from genetics and sociology, and the factor analysis theory from psychometrics. And he implemented this synthesis in the LISREL program, which was so influential in its first twenty years of existence, that many people simply referred to SEM as "LISREL modeling" or "LISREL analysis." Kaplan's book takes the LISREL approach as its starting point, but it integrates the many subsequent fundamental contributions of Bentler, Brown, Satorra, McDonald, and (especially) Muthen.

In a sense, SEM is an extension of simultaneous equation modeling, a class of techniques that has been around in econometrics since the late thirties. The major contributors around that time were Tinbergen and Havelmoo. At the same time, SEM is in an active stage of development in quite a few different sciences, and it has a long history in each. Consequently, there inevitably are differences in the way scientists from different disciplines talk and think about the technique. Kaplan clearly comes from the psychometric tradition. This is apparent from the organization of the book, from the list of references, and from the choice of words and topics. Nevertheless he has taken a good look at the econometric tradition as well, and one of the most original contributions of his book is the discussion of Spanos's work on econometric modeling and the consequent alternative approach to SEM.

Thus, the main contributions of the book are a solid discussion of likelihood-based inference for SEM, with many of the modern extensions, and a new methodological perspective on the model-fitting cycle based on Spanos' work. We think this combination works, and it makes the book eminently suitable as a textbook on SEM for graduate level courses in social science methodology or social statistics programs.

—Jan de Leeuw
—Richard Berk
Series Editors