2 On the Specification and Estimation of Large Scale Simultaneous Structural Models

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Summary. This paper surveys the state of the art of the analysis and application of large scale structural simultaneous econometric models (SSEM). First, the importance of such models in empirical economics and especially for economic policy analysis is emphasized. We then focus on the methodological issues in the application of these models like questions about identification, nonstationarity of variables, adequate estimation of the parameters, and the inclusion of identities.

In the light of the latest development in econometrics, we identify the main unsolved problems in this area, recommend a combined data-theory-driven procedure for the specification of such models, and give suggestions how one could overcome some of the indicated problems.

2.1 Introduction

Simultaneity and structure are two key concepts in econometrics that help the econometricians to look at a statistical model from an economic point of view and to go beyond the analysis of statistical parameters to estimating and analyzing economic structural relations.

Simultaneous structural econometric models (SSEMs) - the implementation of these concepts - became the most important research object of econometrics in its early

time. The Cowles Commission methodology became the main paradigm of empirical research in macroeconomics. Simultaneous structural models, especially large scale simultaneous structural models, became very popular in the 1960s and the 1970s. During the 1970s, however, the scientific community became sceptic against these models due to its methodological deficits. Lucas (1976) questioned the constancy of parameters of SSEM in case of policy changes and thus the suitability of the SSEM for policy simulation. Naylor *et al.* (1972) and Nelson (1972) doubted the predictive ability of SSEMs in comparison with alternative simple time series models. Granger and Newbold (1976) pointed out the improper treatment of the time series properties in SSEMs. Sims (1980) and Sims (1982) finally criticized the 'incredible' identification restrictions in the specification of SSEMs[1]. Since then simultaneous structural models stepped back from the forefront of econometric research.

Despite of this serious and justified criticism towards simultaneous structural models, large scale SSEMs are still widely used among practitioners and policy consultants. In Germany, for instance, large scale econometric models were applied in the late 1990s at Deutsche Bundesbank, RWI, DIW, HWWA, Ifo-Institute and IWH, and some models are still applied today. For more information about these models see 'www.macromodels.de'.

Why are SSEMs still in use? There are several reasons, and all have to do with the 'economic' appeal of these models: (1) Policy makers often want to find out the impact of certain policies in different areas of economic life. An SSEM seems to be capable of taking into account various related aspects of the policy, while its scientific competitors VAR and VECM are much too small to answer the question asked. (2) Furthermore, *structural* models are more revealing of the manner in which an economy is operating[2], contrary to *reduced* form models.

The main purpose of this paper is to survey relevant new developments in econometrics concerning the methodology of SSEMs and to identify the leftover problems.

Applying an approach by Spanos (1990) (see also Chen, 2001)[3] we reinterpret simultaneous structural equations as an economic theory motivated representation of a general statistical model that describes the probability law of the observed data. In this way we provide a coherent framework for integrating the concept of statistical adequacy in the concept of simultaneity and structural modeling.

The paper is organized as follows: In Section 2 we summarize the main methodological deficits of the simultaneous structural approach from the perspective of statistical inadequacy. In Section 3 we survey the relevant new developments in econometrics and address the open problems[4]. Then we provide a general statistical framework to encompass simultaneous structural models. We also discuss the issues of statistical inference in simultaneous structural models. In Section 4 we conclude with an outlook for further research.

[1] See Granger (1990) for an overview of the methodological debate.
[2] See Dhrymes (1993) for more discussions.
[3] Similar ideas can be found in Hendry and Mizon (1990) and Hendry and Mizon (1993).
[4] See Frohn (1999) for more discussion.