Representation and Structure in Economics. The methodology of econometric models of the consumption function, Hsiang-Ke Chao, Routledge, 2009, xiv +161pages.

Federica Russo
Philosophy – Kent
f.russo@kent.ac.uk
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In the last decades, concepts such as 'representation' or 'structure' have been widely debated by philosophers of science, notably in the quarrels between scientific realists and antirealists. Chao's book *Representation and Structure in Economics* adds to this literature. His contribution at once fits well into the philosophy of economics and into general philosophy of science. This is because Chao specifically deals with the methodology of econometric models, and within this context he raises epistemological questions that have been debated in other fields such as the natural sciences. This work is therefore an interesting and valuable attempt to bridge the scientific literature in economics and econometrics with the philosophical literature on scientific realism, which, as a matter of fact, dealt mainly with physics and the natural sciences, rather than the special sciences.

The title announces precisely what to expect in the book: a thorough analysis of the notions of representation and structure in economics. Even more precisely, the subtitle specifies that the particular area of interest will be the methodology of econometric models of the consumption function. As a general rule, it is better to analyse a particular domain systematically and then try to draw general lessons out of it. Chao scrupulously follows this precept, narrowing down the focus to the consumption function. Yet, having reached the end of the book, the reader is left wondering to what extent the results achieved can be extended to economics and econometrics more generally—the case for the analysis of consumption function as being paradigmatic of econometric methodology is understated.

The book is not just about representation and structure—Chao investigates a *triplet* of concepts: representation, structure, and model. Following the well-know work of Morgan and Morrison, Chao suggests that *models* mediate between theory and data, but also between representation and structure: the possibility to successfully represent a structure (of either a theory or of the data), lies in the (theoretical or empirical) model used. The author does a remarkable job in explaining and singling out the similarities and dissimilarities of those concepts as they are used in the philosophical literature and in the literature in economics. Let me focus on the concept of

'structure'. On the one hand, philosophers of science supporting the syntactic (or received) view take the structure of a theory to be a set of axioms, sentences, and the logical consequences that can be drawn from them; philosophers of science supporting the semantic view, instead, usually take structure to be related to models, in the sense that a scientific theory is constituted by its models, which in turn are meant to represent phenomena. On the other hand, Chao distinguishes two trends in defining structure in economics: the 'theory view' and the 'invariance view'. Simply put, the theory view states that structure is the relationships between variables *as specified by economic theory* or a priori information—a view championed by the Cowles Commission and its predecessors (in particular Frisch and Tinbergen). The invariance view, instead, stresses the autonomy or invariance of relationships between variables and the main goal becomes *testing (testing and testing) for invariant properties* (to echo Hendry's motto). This is an important distinction indeed. Nevertheless, it would have been interesting to relate the two views of economists with the contemporary literature on 'structural approaches' to causality (notably, Pearl's and Woodward's). In those accounts the sense in which causality is related to 'structurality' is in fact not clear, except for the mention of *structural* equations. It would have been of much help for the current debate to discuss whether this use of 'structural' is meant in the sense of the 'theory view', the 'invariance view', some combination of both, or in an altogether different sense.

The author alternates descriptive parts where the main accounts and variants of scientific realism on the one hand, and of models of the consumption function on the other hand, are presented, with more argumentative parts where he tries to bridge the two literatures. The pillars of such a bridge are the concepts of representation and structure.

The book is divided into nine chapters. It opens (chapter 1 and 2) with a discussion of why the notion of 'structure' ought to be taken seriously and with a presentation of the major views in the econometric literature. We learn two important lessons. *First*, two different questions ought to be distinguished: one is the ontological question about structure (econometricians debate on whether or not there *is* a structure) and the other is the epistemological question (econometricians debate on whether the structure is *knowable* and if so how). *Second*, as mentioned above, there are two main views of 'structure' in econometrics: the 'theory view', and the 'invariance view'. Chapter 3 gives instead an overview of the leading contenders in philosophy of science for structure and representation: the syntactic view and the semantic view also mentioned above. Suppes' theory of measurement is then presented by Chao as a heir of the

semantic view and it will be shown, later in the book, to be relevant because measurement is the *trait d'union* between representation and structure, via invariance. Chapter 4 to chapter 8 discuss different models of consumption put forward in the econometric literature: Haavelmo's, Friedman's and Hendry's. Chao shows that some approaches (for instance Koopmans' and Friedman's) are more akin to the received view, whilst others (Haavelmo's and Hendry's) are more akin to the semantic view. The final chapter winds up recalling the key steps of the arguments of the previous chapters and the main claim of the book, namely that the semantic view is more useful in understanding economic methodology, especially concerning the notions of structure and representation.

Sometimes the exposition is a bit scholarly, but this is not necessarily a flaw: in order to make a sound comparison between so many different areas we need to smooth the way first. Indeed, the book offers a valuable mapping of the relevant literature in philosophy and economics. The book is written with expertise, especially in the methodology of economics and econometrics. The writing is simple and fluid. The bibliography and the index are rich and thus useful to both groups of potential readers (philosophers and economists). Therefore Chao's work certainly is an excellent starting point for those in either area aiming to snooping into the other one. Yet, at times the argumentation structure is not entirely clear and it becomes difficult to disentangle the author's thoughts from his reports of the positions of the philosophers and econometricians he discusses. The reader might wish more boldness with respect to the conclusions of the comparisons between the philosophers' and economists' accounts of representation and structure. In fact, most of the time Chao's conclusions are in the form of 'compatibility' claims. For instance, the notion of congruence in Hendry's approach is said to be compatible with van Fraassen's notion of empirical adequacy. But the reader is not told what we really gain (or lose) by shifting from one view to the other.

Consider again the notion of structure. Chao lucidly identifies and explores the two views of econometricians, i.e. the theory view and the invariance view. Yet, the reader might want to know more, namely which one is preferable or whether we need to develop an altogether different account of 'structure'. For instance, here is a suggestion of a third possible meaning of structure, relatively left unexplored so far. Structure means 'mechanism' and the mechanism is represented in the (structural) model by a recursive decomposition over an initial joint probability distribution of all the variables. Such a view would be different from both the theory and the invariance view. On the one hand, in the 'mechanist view' theory does not dictate what

the structure is, but helps or guides constructing the decomposition representing the mechanistic structure. On the other hand, the data generating process (DGP) is not left as a 'black box'—in the 'mechanism view' it is exactly the DGP that we aim to (mechanistically) model; on the contrary, the DGP in Hendry's methodology is the joint distribution over all the sample data, including both endogenous and exogenous factors (see p. 103) and this is the (unknown, perhaps unknowable) mechanism.

More importantly, the reader may feel that the main thesis of the book is somehow weak. Chao says that he takes side with semantic approaches, rather than syntactic approaches—he makes such a claim in the Introduction and in the Conclusion:

> "It will be argued in this book that, when economists or econometricians try to model structure, or to involve structure in their models, they usually want to represent structures, or use structures as heuristic devices for representation. In this sense, the themes that the semantic view sets out—*structure* and *representation*—are crucial to our analysis. (p. 10)

> "In econometrics, especially in the cases discussed in this book: models are representations, more importantly, models aim to represent structures. This book concludes that the semantic view or the model-based approach is useful to understand econometric methodology" (p. 134).

I would have liked to know more about this preference for the semantic view. Being 'useful' is too weak a conclusion to bring economic methodology forward. Because, as the author discusses, some econometricians are indeed closer to the received view than to the semantic view in philosophy of science, the reader is left with the question of who's right and who's wrong. Furthermore, Chao argues for the semantic view on the grounds that "a theory is conceived as a set of models, and we aim to construct models so that they represent theory" (p.57). However, the reader might then worry that the received view enters from the back door because if we construct models to represent theory, where does the theory come from in the first place? The proponents of the semantic view may rebut that theory is the set of models, but then, when the econometrician builds a model, what does she base it on? A circularity issue looms here, and, moreover, one is left with no account at all about theory building, perhaps as a consequence of being too focused on downplaying the very strong role of economic theory that is typical of classical economists and of the Cowles Commission.

None the less, Chao's work has opened a path of research worth pursuing further. Not only in bridging literatures that have been so far running on parallel tracks, but also in setting the framework for further clarifications about ontological claims of economists. In fact, based on Chao's work, further research can be planned to clarify what econometricians mean (or what they ought to mean) when they make claims about the reality of economic structures or of the DGP. That is to say, the next item on the research agenda may be to investigate the implications for social ontology. Thus, Chao's work is a valuable preparatory study for a metaphysics of economics, but a metaphysics that start from methodology and epistemology, rather than a priori assumptions.

Federica Russo
Institut supérieur de philosophie, Université catholique de Louvain
and Centre for Reasoning, University of Kent

Biographical note:
Federica Russo is Chargé de Recherche du FNRS at the Université catholique de Louvain and honorary research fellow at the University of Kent. She is the author of *Causality and Causal Modelling in the Social Sciences. Measuring Variations* (Springer, 2009) and of various articles (single and co-authored) exploring methodological and epistemological issues in causal analysis in social and biomedical contexts. (60 words)