

Book review

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An Introduction to the Structural Econometrics of Auction Data

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Extracting meaningful information from auction data to guide policy decisions presents many challenges. This book provides a very useful reference to those econometric techniques that can be applied to empirical analysis of auction data. What the book essentially tries to do is to explain how one can go about estimating bidder values (demand or cost) from auction data. As the authors make clear, this can be difficult as the available data may include only the winning bids, and even when all bid data are available, those data reflect strategic participation and bidding decisions of the bidders.

My review is mainly from the perspective of a practitioner or policy analyst, who is informed about auction theory, and is seeking expositions of econometric techniques for analysing auction data. The introduction states that the target audience is *graduate students* and *professionals*. The level of the exposition assumes a strong background in modern econometrics.

Chapter 2, the first main chapter, provides an introduction to auction theory. Auction theory is not the main subject of the book, and this material is presented elsewhere perhaps more clearly and concisely (Krishna, 2002; Klemperer, 2004; Milgrom, 2004). This chapter mainly focuses on classic results about single-object auctions. Much of the subsequent analysis concerns repeated auctions, each for a single object. The relevance of this chapter applies where each auction is just a different trial from exactly the same stochastic and strategic environment.

This limitation is addressed, in part, starting in Chapter 3. That chapter studies Vickrey (or second price, sealed-bid) and English (oral ascending price) auctions. Chapter 3 and most of the subsequent analysis are restricted to the Independent Private Values Paradigm (IPVP). Perhaps, the most glaring omission from this book is its very limited treatment of affiliated or common value models. This lacuna is addressed in Hendricks and Porter's (2007) survey article in the *Handbook of Industrial Organization*. Chapter 3 provides a useful exposition of semi-parametric estimation techniques when there is a sequence of single-object auctions in which there is some heterogeneity that can be captured by some co-variates.

This chapter's exposition of the estimation techniques developed for situations in which there are reserve prices can be very useful. Reserve prices are commonly found in auctions. Moreover, an auctioneer seeking to maximise revenues or minimise costs will want to know how the reserve price affects expected auction revenues. As a reserve price truncates the distributions of the valuations of the participants, the estimation approach must make some adjustments in order to be able to estimate the underlying distribution of valuations. Like much of the book, the analysis in this section is restricted to the IPVP paradigm; in this case, this can significantly limit the applicability of the analysis as in many real-world auctions bidders have affiliated values. Even in the timber auction case presented in this chapter, it would be of interest to investigate the extent to which bidder valuations were affiliated.

Chapter 4 investigates first-price, sealed-bid and Dutch auctions. First-price auctions differ strategically from second-price auctions in that it is no longer a dominant strategy to bid valuations. In second-price auctions, bidders will usually find it a dominant strategy to bid their values, whereas this is not the case in the first-price auctions. Paarsch *et al.* provide four approaches to estimating valuations. Essentially, they derive optimal bidding strategies, and describe how to back out valuations. One set of techniques relies on inverting the first-order conditions that define a bidder's optimal bid strategy. Another rests on using the revenue equivalence theorem to estimate valuations. Both maintain the IPVP assumptions. Interestingly, in laboratory experiments, bidders do not always bid values; this suggests that the assumption that bidders are maximising surplus, which is implicit in both these estimation approaches, is inconsistent with observed behaviour (Kagel and Levin, 1993). This chapter also discusses the situation where there are reserve prices, and where bidders are risk averse.

Chapter 5 examines multi-unit auctions. Multi-unit auctions, those in which identical units of a single product are auctioned, are fairly common. This is distinct from multi-object auctions, such as spectrum auctions run by the US Federal Communications and other national regulatory agencies, in which the licenses can differ by location in the radio-spectrum and geographic area of coverage. This chapter is primarily a review of the large, and still developing, literature on multi-unit auctions, and provides a review of a few of the standard results in this area.

Most of the attention is focused on the case in which there is a sequence of auctions, each auction contains one unit, and the units are all identical. There are a variety of other types of multi-unit auctions, including simultaneous independent auctions, simultaneous sealed-bid auctions and sequential auctions with multiple units in each auction. One of the most striking results in this area, which is described in this chapter, is Weber's Martingale Theorem, which states that in a sequence of auctions of identical objects, the expected price in the n th auction is the actual price in the $(n - 1)$ st auction. The chapter also provides a useful description of multi-unit

Vickrey–Clark–Groves auctions, and Ausubel’s English auction-based *clinching* procedure.

Much of the analysis applies only to the case in which bidders are interested in only a single unit. However, the section does review demand-withholding incentives when bidders may be interested in multiple units. The chapter very briefly explains that bidders can have strategic incentives to withhold demand in one auction in anticipation of being able to get a better price in the next. However, except for the Martingale theorem, and some development of necessary bid optimisation conditions in some specific situations, this chapter does not further develop this theme, and provides only very limited citations to the numerous papers in this area.

What is probably most useful in Chapter 5 is the discussion of estimation procedures in multi-unit Vickrey–Clarke–Groves auctions, and environments in which strategic interdependence across auctions has little or no impact on bidding. More specifically, what is actually derived are estimation approaches to the final stage of a sequence of auctions. However, this approach should apply to sequential auctions in which bidders have little incentive to withhold demand.

Finally, Chapter 6 provides a very brief discussion of directions for future research. Two topics of particular interest to practitioners and policy makers are multi-object auction and collusion. Indeed, there is now a fair amount of empirical literature on multi-object auctions, which includes analysis of the US Federal Communications Commission spectrum auctions (see Milgrom, 2004), energy auctions (Wolfram, 1998) and oil lease auctions (Hendricks and Porter, 2007). However, perhaps the most challenging task for empirical analysis of multiple unit and multiple object auctions is that of identifying strategic behaviour, both collusion and strategic withholding, about which there is some prior literature. If this book has one large gap, it is in this area.

In summary, this book provides a very useful review of estimation techniques for auction data. The reader should be warned that the reader is assumed to start with a good understanding of graduate level econometrics. Readers with limited econometric background could find the book very challenging. Paarsch *et al.* clearly explain the motivation behind the different estimation approaches that can be applied to a wide variety of auction data. The book’s title and introduction promise to provide graduate students and researchers with a useful guide to the literature on structural econometrics of auction data, and the book delivers as promised.

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