

ISSN 0819-2642  
ISBN 0 7340 2475 4



THE UNIVERSITY OF MELBOURNE  
DEPARTMENT OF ECONOMICS

RESEARCH PAPER NUMBER 820

NOVEMBER 2001

**PRICES IN SEQUENTIAL AUCTIONS:  
PRELIMINARY EVIDENCE FROM  
AUSTRALIAN RARE BOOK AUCTIONS**

by

Stuart Kells

Department of Economics  
The University of Melbourne  
Melbourne Victoria 3010  
Australia.

**Prices in Sequential Auctions: Preliminary Evidence  
From Australian Rare Book Auctions\***

Stuart Kells

Department of Economics  
University of Melbourne

November 2001

*This paper examines price paths in sequential ascending auctions of identical rare books in Australia. Economic theory is inconclusive but suggests prices in sequential auctions of identical objects should follow flat or rising paths. The empirical literature is in several ways unsatisfactory, but points most commonly to falling price paths. Data from rare book auctions promise to overcome some of the problems in the empirical literature. A preliminary examination of rare book auction data from Australia indicates prices tended to be equal in sequential auctions of identical books in the 1980s and 1990s, and unequal in the 1970s. These results are consistent with the conjecture that more mature auction markets feature flatter price paths in sequential auctions of identical assets. Rare book auctions are a context in which further progress on sequential auctions is likely.*

\* The author is grateful to Professor John Creedy, and to Mrs Jill Burdon for her advice about interpreting the book auction records.

## 1. INTRODUCTION

The topic of this paper is the path taken by prices in sequential auctions of identical assets. In many settings, prices in sequential auctions have been found to follow a downward path. This is the so-called ‘afternoon effect’, also referred to as the declining price anomaly, because much of the relevant theory points to flat or rising price paths. The afternoon effect is interesting for several reasons. If it exists only in the presence of particular auction characteristics, it may influence decisions about how auctions are structured. In its presence, multiple sellers would care about who went first. The afternoon effect is also important for bidders’ strategies. If prices decline systematically, are there unexploited opportunities in later sales, or is something real—such as risk—being captured by the difference in prices?

The empirical work in the area is in several ways deficient. Most importantly, researchers have found it difficult to obtain data from large numbers of similar sequences of auctions of genuinely identical objects in contexts with wide empirical relevance. Against the shortcomings of the empirical literature, data from rare book auctions look promising. As most books are produced in runs of numerous copies, pairs of identical books are often put up for sale at the same auction event. Also, rare book auctions are institutionally similar to auctions in many other settings.

This paper uses data from *Australian Book Auction Records* to explore sequential auction price paths. This dataset has not been analysed formally before. It contains a large number of instances where two identical books were auctioned sequentially. Section 2 of the paper presents an overview of the theoretical literature on sequential auctions of identical objects. Section 3 introduces the relevant empirical evidence and draws out some directions for empirical work. Section 4 sketches the institutional setting in Australian book auctions and describes the data. Section 5 contains the preliminary analysis. Strategic ordering of non-identical books in sequences of auctions is considered, before sequences of identical lots are examined across three subgroups in the data. Results are presented from a statistical analysis of price paths across different time periods and across different book values. Section 6 presents some conclusions.

## 2. SEQUENTIAL AUCTIONS

Theoretical studies of auctions have tended to focus on sales of single objects. However, sellers may wish to dispose of two or more identical objects at once. The objects might be sold together

as one lot, or in separate simultaneous auctions. The present paper concerns another set of multiple-object auctions, sequential auctions. In these auctions, the goods are sold one by one. Information about the results of the first round is released before the commencement of the second round, and so on until all objects are sold.

The focus of this paper is the pattern of prices in sequential auctions of identical objects. To make predictions about price paths, it is necessary to make assumptions about how bidders behave, how the valuations of different bidders are related, how many objects bidders want and bidders' attitudes to risk.

### *The independent private values set-up*

The starting point in the theoretical literature is a simplified auction environment developed by Vickrey (1961) and Weber (1983).

It is assumed each bidder knows his or her own idiosyncratic valuation of an object, and this knowledge is private information. This is called the private values assumption. The valuations of different bidders are treated as independent draws of a non-negative random variable whose distribution is continuous and commonly known. A bidder's valuation is all that defines his or her type. The fact that each bidder cannot discern differences between the other bidders is referred to as symmetry. It is assumed that a bidder will attach identical valuations to objects that are themselves identical.

Bidders are assumed to be risk-neutral, and to desire only one object. Their utility from a second object is zero and bidders are referred to as having 'unit demand'. A bidder exits when he or she has won an item.<sup>1</sup> The seller chooses which asset is to be offered in each round. After each round, an announcement is made about the outcome. Weber showed that the outcome is the same whether the announcement is 'an object was sold' or whether it is, truthfully, 'an object was sold at price  $p$ '.

Given these assumptions, all prices in the sequence have the same expected value,  $p$ . They do not drift upward or downward over time. A sequence of prices with the same expected value is called a martingale. The proof of the martingale result rests on a backward-induction argument in which the assumption of independence in buyers' valuations is crucial. Suppose there are  $k$  identical objects and  $n$  bidders, and, without loss of generality,  $k < n$ . The best strategy

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<sup>1</sup> It is also assumed that bidders do not cooperate with each other. Collusion is beyond the scope of this paper, but is an important dimension of auctions. As yet, no theoretical work has linked price paths in sequential auctions with the effects of cooperative bidding.

for the  $k$  highest-valuation bidders is for each to estimate the valuation of the  $(k+1)$ th highest bidder, and to bid no more than this. So all bidders are expected to pay the same price, and the price path, on average, is flat.<sup>2</sup> This result applies equally to first price and second price sealed bid auctions, and to ascending (English) and descending (Dutch) auctions.

### *Affiliated values*

Instead of assuming independent private values, suppose bidders' valuations are affiliated. This is explored in detail by Milgrom and Weber (1982). The concept opens up a general framework in which common values, where bidders make independent estimates of an asset's objective value, and private values are special cases.<sup>3</sup>

With affiliation, bidders are not sure *ex ante* how much an object is worth to them. They base their valuations partly on information they are able to glean from the auction process. More formally, each bidder has a valuation function that depends on information revealed about the types of the other bidders, and on private estimates of the values of indirectly observable characteristics of the objects being sold. The concept of affiliation allows us to treat a bidder's valuation of an object as increasing in another's valuation.

In a sequence of first price, second price and descending auctions in which bidders' valuations are affiliated, the first auction reveals information about the value of the goods being sold in subsequent auctions. Later bidders are therefore less worried about the 'winner's curse'—the possibility that they have overestimated an object's value—and raise their bids. The result is a rising price profile.<sup>4</sup> In ascending auctions, the bidding process in the first round plays the same role of revealing information about values, so the expected profile is flat. (With affiliation, sellers' revenues will be highest with ascending auctions, and lowest with first price and descending auctions. The price path with second price auctions will on average be flatter than with first price and descending auctions, and not as flat as with ascending auctions.)

### *Risk aversion*

How robust is the martingale result to different attitudes to risk? In any series of auctions of identical objects, risk aversion should be important, as bidders are gambling over their expected

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<sup>2</sup> This result extends to the case where there is uncertainty about the number of bidders,  $n$ .

<sup>3</sup> The common values model is sometimes called the mineral rights model.

<sup>4</sup> This is one aspect of the 'linkage principle' of Milgrom and Weber (1982). The phenomenon of bidders reducing their bids in this way is referred to as 'shading'.

utilities in different stages. Risk-averse bidders care about the randomness of their payoffs in later rounds, and so might be willing to bid higher in early rounds.

It has been suggested that adding risk aversion to the independent private values and unit demand model would be sufficient to generate a falling price path (Ashenfelter, 1992). In fact this is only true of a particular set of utility functions, ones that feature non-decreasing absolute risk aversion (McAfee and Vincent, 1993).<sup>5</sup> Increasing absolute risk aversion has been criticised as a theoretically unsatisfactory characterisation of attitudes to risk (Stiglitz, 1991). It implies that as wealth increases, people are less willing to gamble. For this reason, the claim that observed declining price paths arise from non-decreasing absolute risk aversion is not compelling.

### *Multi-unit demand*

In a series of sequential auctions, it is possible that the highest-valuation bidder's valuation for a second object is more than the *k*th-highest bidder's valuation for one object. The unit-demand restriction would therefore bind. This and more complex possibilities are relevant to auctions that feature wholesale buyers, such as wine and antique dealers, for whom the unit demand assumption is inappropriate.

What would the predicted pattern of prices be if the unit-demand assumption were dropped and bidders were allowed to desire more than one object? As yet there is no clear answer. The literature on auctions with wholesale buyers and multi-unit demand is early in its development, and there is no general model of how prices would behave. Bidders' optimal behaviours become more complex if multi-unit demand is allowed.

A special case of multi-unit demand, relevant to wine auctions, is where the winner of the first round has the option to buy the next item at the same price, without going through another auction. With independent private values, the value of the option has been shown to generate a falling price path (Black and de Meza, 1992). The great majority of auction markets lack such buyers' options, so this result does not have wide applicability. Another approach is to treat some bidders' values as 'superadditive'. A bidder of this type values a bundle of two objects in the sequence more than twice as much as his or her valuation of one of the objects.<sup>6</sup> Branco (1997) used this approach to generate a predicted declining price path. Values of this type are relevant to some real world auctions, but far from all. Menezes and Montiero (1999) extended this work to

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<sup>5</sup> This assumes bidders use pure strategies. If bidders randomise, a falling path is possible without non-decreasing absolute risk aversion, but the outcome is inefficient, and resale is likely.

<sup>6</sup> Budget and liquidity constraints would seem to operate in the opposite direction to complementarity between assets, with success in earlier auctions limiting bidders' aggressiveness later.

accommodate both positive and negative synergies between products. They found Branco's result breaks down if one player wants two objects and the others want only one.<sup>7</sup>

### *Agency bidding*

Buyers have been assumed in the previous subsections to be acting on their own behalf. What if instead they buy through agents? Under some assumptions about agents' behaviour, a falling price profile is plausible. Suppose an agent has a contract which tells the agent to bid up to a specified maximum price for an item. The agent is paid only if the item is obtained at or below this price, and the fee is a fixed amount. This agent does not care if he or she buys an object at a price less than the ceiling in the contract. The agent is ready to bid 'unstrategically' in the first round and pay more than the agent has to—more than the valuation of the  $(k+1)$ th highest valuation bidder. Milgrom and Weber (1982) discuss this type of agent. It is not a satisfactory characterisation, as a simple change to the contract—such as linking the agent's fee to the buyer's surplus—would better align their incentives.

### *Stochastically identical objects*

It is possible to relax the assumption that the assets in the sequence are identical. Suppose they are only stochastically identical: a bidder's valuations over two assets are identically distributed, but not perfectly correlated (Engelbrecht-Wiggans, 1992; Bernhardt and Scoones, 1994). Bidders are assumed to arrive at their valuation of an object just before it is offered for sale. In this set-up, the predicted price path depends on the distribution of the objects' values. If the number of objects is sufficiently large and if values are bounded and independent across the objects, the price path is on average a downward one.

This approach can be taken further by allowing each bidder's valuations to be dependent across the objects (but still independent across bidders), and assuming bidders know all their own valuations up front. Gale and Hausch (1994) followed this route and examined sequential auctions alongside 'right-to-choose' auctions, where the winner selects his or her most-preferred object from a pool. They found that with these assumptions, sequential auctions can lead to inefficient allocations, and that in the case of those sequential auctions that generate falling price paths, the seller would be better off holding a right-to-choose auction.<sup>8</sup>

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<sup>7</sup> This is because the bidders with unit-demand shade their bids in the first round, so bidding in that stage is less aggressive. This offsets the effect of the bidder who wants both objects trying harder in the first round.

<sup>8</sup> The assumption that a bidder's valuations of different assets in the sequence are drawn from identical distributions can also be relaxed. Bernhardt and Scoones (1994) show that if two objects have different distributions of bidders'

This branch of the literature is relevant to some auctions, such as of used business equipment, but is not applicable to auctions with genuinely identical objects and where bidders have the opportunity to inspect lots before the auction starts. (The same is true of work that assumes bidders face uncertainty about how many more identical assets will be offered in later rounds. Burguet and Sakovics, 1994, showed that such uncertainty about future opportunities to buy was sufficient to generate falling prices.) It is also a significant departure from the kinds of auctions envisaged in the standard independent private values and affiliated values models.

### *Participation costs*

It may be reasonable to assume that there is a time cost associated with waiting for later rounds in a sequential auction. In the construction with independent private values, unit demand and risk neutrality, it is plausible that bidders who face waiting costs are willing to pay more than the  $(k+1)$ th highest valuation in early rounds, if this higher amount is still below their own valuation. The result would be a falling price path.

An implicit assumption here is that bidders must arrive at the start of the sale; this is not realistic for some auctions. Also, the time cost would be low if the identical lots were offered consecutively, which is often the case.<sup>9</sup>

### *Scarcity*

In principle, the identity of buyers could be relevant to price paths in some sequential auctions. Consider auctions of antiques, art and other assets that depend for their value partly on the number of objects in private hands. When the first buyer in a sequence is an institution, an object has been taken out of circulation, and so the remaining objects will be more valuable than if the first buyer had been a private collector or dealer. With affiliated values, the result could be a rising price path in a sequence of ascending auctions, and more steeply rising paths in first price and second price sealed bid auctions and descending auctions.

This result depends on the identity of each buyer being revealed before the subsequent round. In reality, the buyer will often be unknown thanks to telephone, agency and order bidding. Moreover, the impact is likely to be significant only for the very rarest of objects, which by

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valuations, the auctioneer should sell the product with the most dispersed distribution first.

<sup>9</sup> Engelbrecht-Wiggans and Menezes (1993) have sought to express in a formula the time at which it is optimal for a bidder facing continuation costs to withdraw from a sequential auction.

definition are hardly ever auctioned sequentially. Also, the possibility cannot be ignored of deaccessioning—the sale of assets by public institutions.

### 3. EMPIRICAL EVIDENCE

This section is concerned with examining how prices behave in real sequential auctions. The theoretical literature is informative about how to proceed. An auction environment that is a good target for study should be well established: buyers and sellers should know the rules, and the market institutions should be organised and credible. The auctions should be of a common type, such as the ascending auction. Before a sequence of auctions commences, bidders should know how many of the identical assets are to be offered, and their own valuations of the assets. The auctioneer should choose which asset is offered in each round of each sequence, and the outcome of a round should be announced before the next round commences. Just as the auction environment should not be too specialised, so too the objects being sold should not be so unusual as to prevent the analysis from being applicable to other settings.

The objects in each sequence of auctions should be identical, not merely similar. This requirement is particularly important. When the objects are not identical, sellers' ordering strategies can affect the pattern of prices. Some auctioneers follow a policy of offering the best objects first in sequential sales of similar assets. This policy has been documented in print auctions (Pesando and Shum, 1996), dairy cattle auctions (Engelbrecht-Wiggans and Kahn, 1999) and in ancient Babylonian bride auctions.<sup>10</sup> All other things equal, such a policy will generate a falling price path, but for reasons other than bidders' strategies and the structure of auctions. Only when the objects being sold are identical can sellers' quality ordering strategies be ignored. Whether the objects are identical is also relevant to the behaviour of bidders. Without identical assets within each sequence, it is not appropriate to treat bidders as valuing the assets the same. Bidders' idiosyncratic preferences over particular asset characteristics will affect the prices realised. Because of the influence of sellers' and bidders' behaviours, auctions with non-identical assets pose a different set of empirical and theoretical issues to those posed by auctions with identical objects. Studies of how auctions work with multiple identical assets need data from auctions of multiple identical assets.

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<sup>10</sup> Some very preliminary work has been done to explore the ordering incentives faced by auctioneers. The *Australian Book Auction Records* data permit exploration of whether auctioneers systematically apply a quality ordering in sequential auctions of differing but nearly identical assets. This is the subject of section 5.1.

To study sequential auctions in an environment with these desirable features, data from a large number of sequences of auctions are needed, so that the results of the analysis are statistically robust. The sequences should be fairly homogenous: apart from the assets being identical within sequences, they should at least be similar across sequences, and the sequences should be similar in terms of where, when and how the auctions were held.

The prices used in the analysis should be the total prices paid by buyers. Buyers' premia, consumption taxes and other imposts on buyers should be added to the hammer prices. The prices should be genuine prices rather than highest bids on items that were 'passed in' for failing to reach the reserve price. For these items, no transaction has taken place, so the 'prices' are not prices at all.

To understand what might be driving the observed price paths, it would be desirable to know how different bidders' valuations were related, whether bidders faced complementarities between objects, how many objects bidders wanted in each sequence and bidders' attitudes to risk. Unfortunately, data of this kind are nearly impossible to get. Auctions in which bidders' valuations, demands and risk preferences are a known input can be simulated, but simulations fail to capture how auctions work in the real world, where individuals' wealth, prestige and jobs are at risk. Experimental auctions also fail to meet the criterion of an established and credible market environment. It would also be useful to know whether bidders were acting as agents, and if so the nature of their agency agreements. Again, this information is very hard to obtain. Fortunately, the absence of data on individual bidders' valuations, demands and agency arrangements is not a decisive barrier to studying price paths in sequential auctions.

The key empirical studies in the sequential auctions literature are by Ashenfelter (1989, examining wine auctions), Ashenfelter and Genesove (1992, condominiums), McAfee and Vincent (1993, wine), Lusht (1994, commercial real estate), Chanel et al., (1996, jewellery), Pesando and Shum (1996, prints), Jones, Menezes and Vella (1996, wool), Gandal (1995, cable television licences) and Engelbrecht-Wiggans and Kahn (1999, dairy cattle). Table 1 gives summary details of these studies. How well do they meet the criteria for analysing sequential auctions?

**Table 1: Previous empirical work on sequential auctions**

	<b>Asset</b>	<b>Type of auction</b>	<b>Data</b>	<b>Identical assets in each sequence</b>	<b>Method</b>	<b>Pattern of prices on average</b>
Ashenfelter (1989)	Wine	ascending	4615 pairs, sold in London, Chicago and San Francisco 1985 to 1987	yes	took price ratios for each of four auctioneer subgroups and tested for equality with one	declining
Ashenfelter and Genesove (1992)	Apartments	pooled	one auction of 83 apartments (51 actually sold)	no	regressed price on sale order	declining
McAfee and Vincent (1993)	Wine	ascending	234 pairs and 177 triples, sold in Chicago in 1987	yes	took price ratios, tested for equality with one; regressed second price on quadratic function of first price	declining; afternoon effect increasing and concave in the data range
Jones, Menezes and Vella (1996)	Wool	ascending	951 lots sold at 6 auctions in Australia, July 1991 to June 1994	no	hedonic regression (prices included highest bids on passed in items)	increasing
Lusht (1994)	Commercial real estate	ascending	one auction with 44 lots sold	no	regressed price on reserve and sale order; no formal accommodation of quality differences	declining
Gandal (1995)	Cable television licences	sealed tender	one auction with 17 lots sold	no	regressed price on sale order, number of bidders in each round, and variables to capture licence area features	increasing
Pesando and Shum (1996)	Prints	ascending	25 pairs sold in the US, 24 in London, 48 in Europe 1977 to 1993	no	ratio of mean difference to mean price	declining
Chanel et al. (1996)	Jewellery	ascending	351 pairs, sold by CMP in Paris, June 1993 to May 1994	no	hedonic regressions for each jewellery type	declining for gold, rising for rings and watches, flat for others
Engelbrecht-Wiggans and Kahn (1999)	Dairy cattle	ascending	1943 lots at 18 US sales, Oct. 1987 to April 1988	no	regressed price on independent appraisal value and sale order	declining

The table shows that researchers have struggled to find data from large numbers of sequential auctions of identical assets. The studies of wine auctions by Ashenfelter (1989) and McAfee and Vincent (1993) are the only ones to have met this criterion. As was noted above, differences between the assets in the sequences expose auction outcomes to the influence of sellers' quality ordering strategies and bidders' idiosyncratic preferences over asset characteristics.

Studies by Lusht (1994) and Pesando and Shum (1996) are examples of sequential auctions studies in which the assets within sequences were not identical, and in which no formal attempt was made to address this. Other authors have tried to extract the influence of quality differences. One method is to compare the profile of prices in the auction to a set of benchmark prices. Benchmarks used by researchers have included resales in subsequent private negotiations (Ashenfelter and Genesove, 1992) and independent expert appraisals (Engelbrecht-Wiggans and Kahn, 1999). The rationale is to see how much of the change in prices through the sequences of auctions is attributable to the auction process, and how much to quality differences. Another approach is to standardise non-identical goods using hedonic regression (Gandal, 1995; Jones, Menezes and Vella, 1996; Chanel et al., 1996). A regression equation is estimated with coefficients that capture the influence of specific asset characteristics on the price. Sale order is included in the regression equation to see if it has a separate effect. The key problem with these approaches is that the underlying assets are not identical, and the results are therefore fundamentally estranged from how auctions work with identical assets. Studies with non-identical assets might provide useful indirect evidence of how auctions work with identical assets, but it is impossible to say how useful.

Another area of shortcomings in the empirical literature is the type of auction studied. Some of the empirical studies are in specialised contexts whose results are not readily applicable to other settings. Ashenfelter's (1989) seminal study of wine auctions is an example. Wine is a specialised product, and wine auctions have some unusual features, including the buyers' option that was mentioned above. Ashenfelter and Genesove's (1992) apartment study does not fit well in the sequential auctions literature because the apartment auction was a *pooled* auction, in which the highest bidder at each stage won the right to choose his or her most favoured unsold apartment. Pooled auctions are not strategically equivalent to sequential sealed bid auctions and sequential ascending auctions, and are uncommon. They also fail to meet the criterion that sellers choose which lot is offered in each round. The jewellery auctions studied by Chanel et al. (1996) were also of a special type. They were held by Crédit Municipal de Paris, a body with a legal monopoly to undertake auctions of goods left with pawnshops. That the auctions were judicial

pawnshop auctions had a number of implications. Reserves were set equal to the outstanding loan amounts for each asset. The surplus of the price over the reserve was distributed to the pawner of the good. The ultimate sellers were captive and had no discretion over the reserve prices or how the sales were organised. Gandal's (1995) cable television environment was unusual for the strong complementarities between the neighbouring licences, an example of superadditive values.

Data problems figure in some of the empirical studies. Some of the studies did not exclude highest prices on passed-in items from the price data that were used. Jones, Menezes and Vella (1996), for example, included highest prices on passed-in items in their analysis of wool auctions. Several of the studies had too few data. Lusht (1994) analysed just one sequence of ascending auctions of forty-four lots of commercial real estate in Melbourne. Gandal (1995) looked at one sealed bid auction of seventeen television licences. In contrast, Ashenfelter (1989) used data from 4615 sequential auctions.

It was emphasised above that the sequences of auctions studied should be somewhat homogenous. This extends to the auctions being close together in time, space and style. Pesando and Shum (1996) analysed a small sample of pairs of prints sold over a sixteen year period, a period long enough for potential determinants of price paths—including market institutions and the profile of bidder types—to have changed substantially. Ashenfelter's (1989) sample was very homogenous in time, but less so in space and by auctioneer. He addressed this by dividing the sample into four auctioneer groups, two in London and one in each of Chicago and San Francisco. The sample used by Chanel et al. (1996) was very homogenous in terms of where, when and how the assets were sold.

Several lessons can be drawn from these studies. To analyse sequential auctions, an environment must be found in which there is a large number of sequences of identical assets. The environment must not be too unusual, the sequences studied must be fairly homogenous, and the price data should be the prices actually paid by successful bidders.

#### **4. AUSTRALIAN RARE BOOK AUCTIONS**

With observations about the existing empirical literature in mind, the rare book market looks to be a promising environment for studying price paths in sequential auctions.<sup>11</sup> Books are

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<sup>11</sup> Book auctions have been neglected in the auctions literature, and in the economic literature more broadly, despite the fact that books are an important category of collectible. An exception is Cutler et al. (1991), who studied

published in runs, and so identical books are often sold at the same auction. It is reasonable to expect that rare book auction data will contain a large number of sequences of genuinely identical assets.

In Australia, results from rare book auctions are published every two years in *Australian Book Auction Records*.<sup>12</sup> The series covers the period 1969 to 1999 inclusive, except for a gap from 1979 to 1982. The issues from 1969 to 1978 were compiled by Mrs Margaret Woodhouse. The current series, so far covering the period 1983 to 1999, is compiled by Mrs Jill Burdon. To date, 413 auctions and 42,511 transactions have been documented.<sup>13</sup> A book is only included if it was sold as one lot, it or another copy exceeded a minimum price at auction at least once in a given two-year period, and the book is of 'Australasian interest'.<sup>14</sup> This is defined as books and periodicals written by Australians, or published in Australia, or written about Australia or Australians, or about Antarctica or the South Pacific. For each book, information about its condition (taken from the auction catalogue) and bibliographic information (author, title, edition, date and place of publication, and special associations between the book and the author) are given. This allows sequential auctions of identical books to be identified.

In section 3, it was argued that a good auction environment to study would not be so unusual as to preclude application of the results to other settings. While the rare book market is fairly small, rare book auctions are organised in a way that is very similar to auctions of fine art, jewellery, furniture and many other products, so the results are of wide empirical relevance.<sup>15</sup> The English or ascending auction, perhaps the most common type of auction throughout the world, is universal in Australian book auctions.<sup>16</sup> For all the auctions in *Australian Book Auction Records*, a catalogue of lots was issued before the sale, and all the lots were available for inspection before

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financial returns to a variety of assets, including a small sample of rare books.

<sup>12</sup> *Australian Book Auction Records* is published in printed volumes, in which entries are listed alphabetically. To study the data, each title in each volume was assigned a number, and the sale results published over the duration of the series were entered into a database. The ABAR volumes are offered for sale by the publishers (Australian Book Auction Records) and copies are in the National and State libraries and other major reference collections. The latest volume, 1998–99, was published in May 2000.

<sup>13</sup> More information about *Australian Book Auction Records*, including the profile of prices in these transactions, will be provided in a separate paper.

<sup>14</sup> The nominal minimum price has risen over time. Currently, books must have realised at least \$45 in the two years covered by the particular volume to be eligible for inclusion. In the first year of *ABAR* the cut-off was five dollars. The cut-off is not applied religiously: if two copies of a book are sold in a given year and only one satisfies the price cut-off, the other will still be included.

<sup>15</sup> In the larger book auctions in Australia, particularly those by multinational auctioneers, books, prints and paintings are frequently offered in different sections of the one sale, so the book auction sessions are institutionally *identical* to the art sessions.

<sup>16</sup> In Australia, the ascending auction is widespread in the markets for real estate, second hand cars, antiques and used business equipment.

bidding started. Pre-sale display is also the norm in auctions of wine, paintings, prints, jewellery and furniture.<sup>17</sup> Other basic features of book auctions are common to many other markets. There are secret reserves. The auctioneer acts on behalf of sellers in return for a commission. Sometimes buyers are also charged a fee—the buyer's premium. The auctions are held in salerooms, galleries, hotels and public venues like town halls. They are advertised in the press and through direct mail. There are no attendance fees.<sup>18</sup> Bids are made at increments decreed by the auctioneer.

The criteria in section 3 for studying auctions also referred to price data. The prices in *Australian Book Auction Records* are all winning bids; passed-in items are not recorded. The prices are the total Australian dollar prices paid by buyers; they include the hammer price and any buyers' premia charged by the auction houses.<sup>19</sup>

As is typically the case in real world auction studies, information about bidders' valuations and other characteristics is not available. But some general facts are known about participants in Australian book auctions. The bidders include 'wholesale' bidders such as dealers and booksellers, and 'retail' bidders such as individuals, public libraries, public galleries, universities and corporate buyers. Another way to classify the bidders is into 'amateurs'—private individuals—and 'professionals'—those who buy for firms or institutions.<sup>20</sup>

The independent private values and common values concepts both fail to characterise bidders' values in the rare book market. The independent private values model requires that each bidder knows his or her own valuation and that bidders' valuations are independent. In reality, the value to a bidder will depend in part on others' valuations. For example, the value of the object may be in doubt, or there may be a prestige value to owning it (Milgrom and Weber, 1982). Also, bidders of all kinds will have an eye to future resale prices. Assuming bidders have common values, on the other hand, does not accommodate differences in tastes, yet bidders of all kinds will make idiosyncratic judgements about values. The concept of affiliated values is therefore most likely to best capture bidders' values in the rare book market.

Bidders in the rare book market are heterogenous with respect to how many identical books they want to buy. Private buyers rarely desire more than one copy of a particular title, but the same is not true of dealers. Bidders are also heterogenous in their attitudes to risk. It is likely

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<sup>17</sup> In the wool auctions studied by Jones, Menezes and Vella (1996), core samples from 60 per cent of wool lots were displayed

<sup>18</sup> Bookfair auctions are a minor exception.

<sup>19</sup> The period under study ended in 1999. In 2000 a ten per cent Goods and Services Tax was introduced in Australia. The tax applies to books sold at auction.

that private buyers' attitudes to risk differ from wholesale buyers', for example. Also, bidders for low value books might think about risk differently from bidders for high value books. Bidders also differ in their expertise, with some buyers well informed about previous prices, and others less so.

Some bidders act as agents: booksellers frequently represent their clients at auctions, and institutional and corporate buyers also bid through intermediaries. Unfortunately, it is impossible to say which books were bought by agents. For some sales, the identity of the buyer is published after the sale, but this is not helpful precisely because the named buyer might have acted on another's behalf.

Despite a number of drawbacks, the data from sequential rare book auctions have several advantages over the data used in the main empirical studies in the literature. There are a large number of sequences, and the sequences themselves contain identical assets, not merely similar ones. The book auctions are institutionally similar to many other auctions, and are of a type—ascending auctions—that is relevant to the theoretical literature.

## 5. ANALYSIS

In section 4, a case was made for treating bidders' valuations at book auctions as affiliated. This is not enough to give a strong prediction about the likely pattern of prices. The presence of multi-unit demand, for example, means that the reality of sequential book auctions is more complex than the situation envisaged in the standard model with affiliated values. Nevertheless, there is no strong reason *a priori* why price paths in sequences of auctions of rare books will not be flat on average. Non-decreasing absolute risk aversion is unlikely to characterise book buyers' risk preferences; buyers' options are not a feature of Australian book auctions; scarcity effects are unlikely to be large; participation costs and superadditive values are unlikely to play a significant part; and there was no uncertainty about future buying opportunities in any of the auctions, as a catalogue of lots was issued for each sale and the lots were available for inspection. It is not known how the presence of bidders with multi-unit demand will affect price paths on average, nor is the precise extent of such bidders' participation known.

Accordingly, in this section the hypothesis is explored, that prices in sequences of identical rare books are on average equal. The analysis takes in all the instances in *Australian*

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<sup>20</sup> Chanel et al. (1996) used this distinction between amateurs and professionals.

*Book Auction Records* in which two titles of a book were offered in the same auction event. After a look at doubles whose books were not equivalent in quality, to show the influence of ordering strategies by auctioneers, the analysis focuses on sequences of books matched in quality. The analysis of matched books begins with a visual and statistical analysis of price profiles in the sequences of auctions. The data are divided into relatively homogenous groups, and most importantly into different time periods. The profiles of prices in different time periods are then examined using regression and other data analysis techniques. Regression techniques are also used to analyse price profiles at different asset value levels.

### 5.1 Sequential auctions of books of differing quality

There are 1744 instances in *Australian Book Auction Records* where two copies of a book were sold sequentially.<sup>21</sup> In some of these pairs, the second book was sold immediately after the first, while in others the books were separated by other lots. Not all the 1744 pairs comprise books of equivalent condition. The importance of studying sequential auctions of identical assets was stressed above. To separate out quality effects, the sample was divided into identical and non-identical pairs. Of the 1744 pairs, there are 1032 ‘matched’ pairs and 712 ‘unmatched’ pairs.

It was pointed out in section 3 that price paths in sequences of auctions of assets not matched in quality can be influenced by auctioneers’ ordering strategies. Did the auctioneers in the 712 unmatched sequences tend to follow a quality ordering strategy? Of the unmatched pairs, 440 pairs (61.8 per cent) had the best book offered first, so there is some evidence that auctioneers tended to put the best item first. There were differences across auction houses in the extent to which this strategy was followed. Table 2 gives the number of non-identical pairs for six auction firm groups, and the proportion of pairs in which the best book was offered first.

**Table 2: Ordering of non-identical pairs at various auction firms**

	Christie’s	Sotheby’s	Lawsons	Leonard Joel	Kenneth Hince	Other	All
Number of pairs	173	21	190	183	98	47	712
Best first (%)	57.8	95.2	52.1	74.3	62.2	51.1	61.8

In every category, better books were offered first more often than second, but there were large

<sup>21</sup> It is likely there were other sequences in which the first or second item or both items were passed in for failing to reach the reserve price. These sequences are not included in the analysis because passed in items are not documented in *Australian Book Auction Records*.

differences between the firms. Of the twenty-one Sotheby's pairs, twenty had the best lot offered first. In contrast, Lawsons and the 'other' auction firms did not show such a strong tendency to offer better books first.

### *5.2 Sequential auctions of identical books*

In the remainder of the analysis, the unmatched pairs are put to one side and only the matched pairs are examined. There are 1032 instances where two identical books were offered sequentially in the same auction. In identifying the 1032 pairs, books were judged to be identical if they could not be separated on the grounds of condition or anything else, such as edition, binding or unique features like inscriptions. Some of the 1032 pairs comprise books that are both 'fine'—equivalent to 'mint condition' in stamps. Some comprise books that share the same defect or defects. Common defects include discolouration of paper, broken bindings and missing illustrations.

This matching exercise is expected to remove the effect of deliberate ordering by auctioneers. It is unlikely that auctioneers apply a systematic ordering based on differences that are not sufficiently important to document in auction catalogues, when even minor differences in condition are disclosed. The influence of any remaining undocumented quality differences in the book auction data should be random.

Let us look more closely at the structure of the dataset. The dataset comprises two sets of prices: 1032 first prices ( $p_{1,i}$ ) and 1032 second prices ( $p_{2,i}$ ). Every  $p_{1,i}$  is the first price realised in a sequence of two auctions, and every  $p_{2,i}$  is the second price realised in a sequence of two auctions. Every  $p_{1,i}$  therefore has a corresponding  $p_{2,i}$ . That the  $p_{1,i}$  and  $p_{2,i}$  are tied in pairs is important. The price pairs resemble a repeated measures experimental design, in which the data comprise two sets of observations for a single group of subjects, the first set of observations taken before a treatment is applied, the second set afterward. There is variation across the subjects, but the variation within pairs is attributable only to the influence of the treatment, and random changes. (The treatment is 'being second' in a sequential auction of two identical assets.) This property will be exploited later.

To make the price results comparable over time, the prices were adjusted to 1999 prices using the Australian consumer price index.<sup>22</sup> Four outlying pairs were removed from the analysis. In all these four pairs, one price was more than four times the other. This left 1028 pairs.

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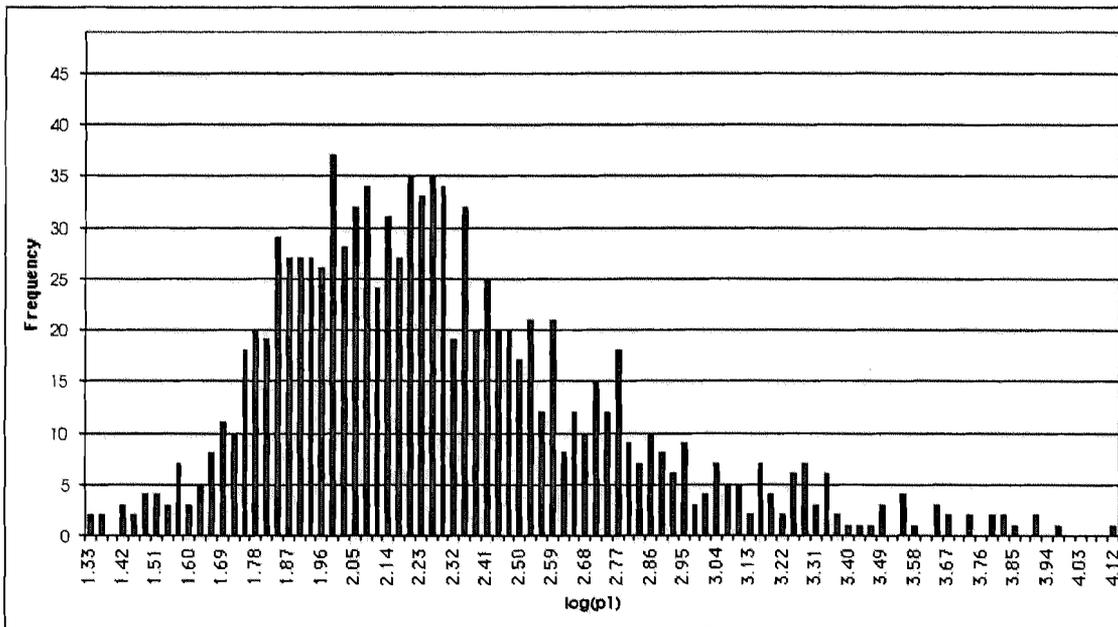
<sup>22</sup> The figures were adjusted using the consumer price index figures in Australian Bureau of Statistics catalogue no.

### 5.3 Grouping the sequences into more homogenous sets

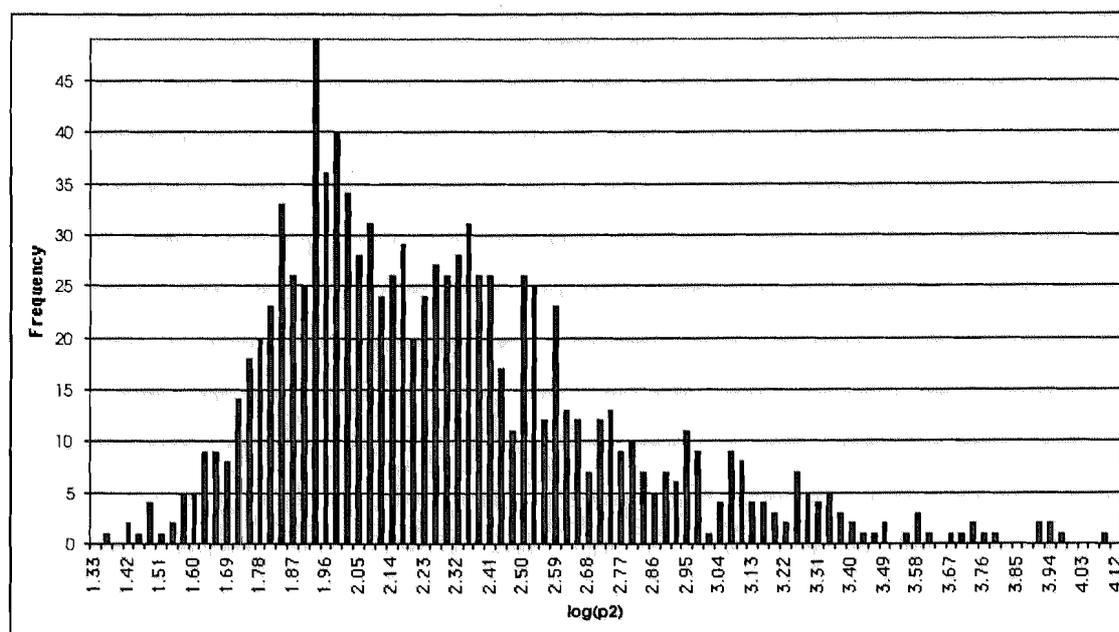
It was argued above that to analyse price paths in sequential auctions, the set of sequences studied must be fairly homogenous, in terms of the structure of the auctions, when and where they were held, and the nature of the assets sold. The 1028 sequences are geographically homogenous. The great majority (97 per cent) are from auctions that were held in Melbourne and Sydney, and all the books in the pairs were sold in Australia. The sequences are also reasonably homogenous in the types of books sold. All of them are rare books 'of Australasian interest' (all of them were published after 1787). There are large differences in the *value* of the books. In a typical book auction there will be a small number of high value lots and a large number of lower value lots. This profile is also seen in auctions of wine, art and other collectables. Whether price paths differ according to the value of the books being sold is explored in section 5.6 below.

There is no reason to think that the  $p_{1,i}$ 's and  $p_{2,i}$ 's are normally distributed. The reality is far from it. Figures 1 and 2 show the distributions of the logs of  $p_{1,i}$  and  $p_{2,i}$ .

**Figure 1: Frequency distribution of first prices (logs)**



**Figure 2: Frequency distribution of second prices (logs)**



The figures show that the price distributions are somewhat skewed in logs. In the analysis that follows, the data are studied in logs.

The sequences are not very homogenous with respect to when they were held. The dataset covers a long period: 1969 to 1999. It is likely that the rare book market institutions and participants changed over this time. To achieve greater homogeneity, the 1028 pairs were divided into three time periods: 1969 to 1978, 1983 to 1990, and 1991 to 1999. The border between the first two periods is the break in the data from 1979 to 1982. The border between the second and third periods is more arbitrary, but divides the 1983 to 1999 period approximately in half in terms of years and observations. The result of this division is three groups of pairs, roughly corresponding to the 1970s, 1980s and 1990s.

The pairs are also not very homogenous in terms of auctioneers. The dataset includes results from international auction houses that operate in Australia, as well as from large Australian auction houses, and small Australian auction houses. There may be important 'house style' and other differences between these groups of auction firms. To increase homogeneity across firms, the pairs were classified into three groups: those from international auction firms operating in Australia (Christie's and Sotheby's); those from large Australian auction firms (Leonard Joel, Kenneth Hince and Lawson's); and those from smaller Australian auctioneers. This gave nine groups altogether: SMALL 1970s (136 pairs), SMALL 1980s (11), SMALL 1990s (13), LARGE 1970s (166), LARGE 1980s (233), LARGE 1990s (179), INTERNATIONAL 1970s (169), INTERNATIONAL 1980s (64), and INTERNATIONAL 1990s (57).

#### *5.4 Graphical analysis of sequences with identical books*

To begin the analysis of the pairs, the logs of all the first prices were plotted against the logs of all the second prices, for each of the nine groups. The scatter plots showed a strong tendency for the prices in each pair to be equal. Differences among the nine groups were evident in the distribution of values between low and high value books—reflecting the fact that different auction houses tend over-proportionately to service particular segments of the rare book market—and in the degree of deviation of points from the forty-five degree line. But the plots all showed the same general pattern: the points clustered around the forty-five degree line. The correlations between the first and second prices are imperfect, but high, ranging between 0.73 and 0.99 for the nine groups.<sup>23</sup> (This highlights a basic difference between auctions and sales with posted prices. In auctions, identical assets will not necessarily realise identical prices even on the same day at the same place.)

It is not easy to tell from scatter plots whether points below the forty-five degree line (representing declining price paths) or points above the line (rising price paths) predominate. To give a clearer picture of the price paths, frequency distributions were prepared for the differences in logs of  $p_{1,i}$  and  $p_{2,i}$  for each of the nine groups. This graphical analysis exploits the paired structure of the data and promises to reveal features that are hidden when price ratios are used (c/f. Ashenfelter, 1989, and McAfee and Vincent, 1993). Within each decade, the distributions of price differences were similar across the auctioneer groups, indicating that the division of the dataset into auctioneer groups was inappropriate. The observations for each auctioneer group were therefore combined, and distributions were prepared for each of the three decades. Figures 3, 4 and 5 show the three distributions. (Distributions of ratios of  $p_{1,i}$  to  $p_{2,i}$  were also prepared. There were no differences between those and the figures here that had implications for the analysis.)

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<sup>23</sup> Correlations between real prices: SMALL 1970s 0.86, SMALL 1980s 0.99, SMALL 1990s 0.73, LARGE 1970s 0.92, LARGE 1980s 0.98, LARGE 1990s 0.99, INTERNATIONAL 1970s 0.91, INT. 1980s 0.96, INT. 1990s 0.84, all 1970s 0.90, all 1980s 0.97, all 1990s 0.94. Log prices: SMALL 1970s 0.90, SMALL 1980s 0.97, SMALL 1990s 0.86, LARGE 1970s 0.93, LARGE 1980s 0.95, LARGE 1990s 0.93, INT. 1970s 0.93, INT. 1980s 0.98, INT. 1990s 0.93, all 1970s 0.93, all 1980s 0.97, all 1990s 0.94.

Figure 3: Differences in log prices, 1970s

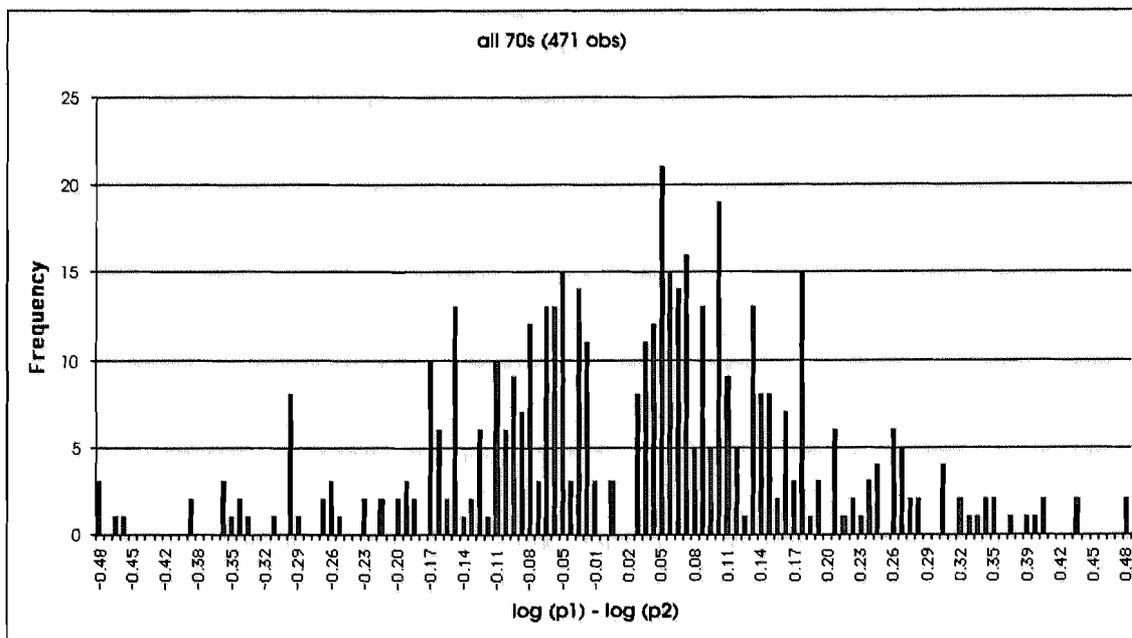
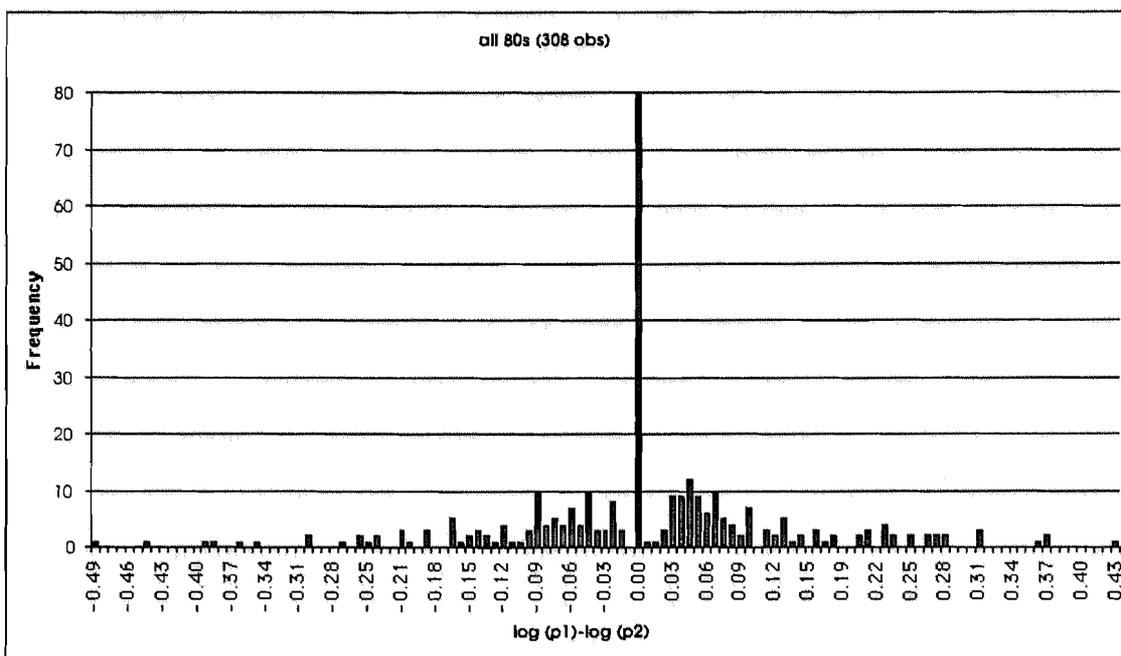
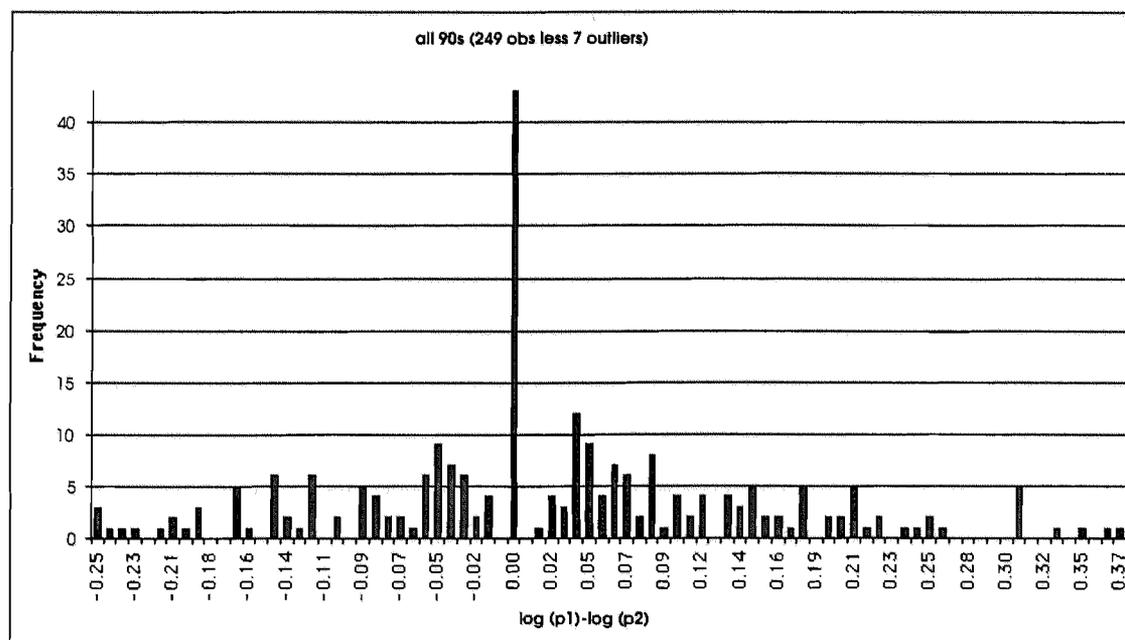


Figure 4: Differences in log prices, 1980s



**Figure 5: Differences in log prices, 1990s**



The figure for the 1970s group is strikingly different to the figures for the other decades. It shows a distribution with peaks on either side of zero. The number of flat paths (representing equal prices) is very small: there are only three perfectly flat paths out of 471 pairs. In the 1980s and 1990s, in contrast, there was a strong tendency for price paths to be perfectly flat. In these two decades, zero was the mode and the median difference; in the 1970s, the mode and median were above zero. In section 5.5, the dissimilarity of the 1970s distribution with the other two figures is explored further.

Table 3 gives summary statistics for the three decades: the proportion of rising, flat and falling price paths, the standard deviation of the differences in log prices, and the average ratio of  $p_{1,i}$  to  $p_{2,i}$  (real prices, not logs).

**Table 3: Summary statistics for price pairs in three decade groups**

	n	pr(rising)	pr(flat)	pr(falling)	std deviation of differences in log prices	average ratio of p1 to p2
all 70s	471	.427	.006	.567	.163	1.11
all 80s	308	.344	.256	.399	.130	1.05
all 90s	249	.349	.173	.478	.146	1.12

Ashenfelter (1989) found in wine auctions that, while it was ‘most common for the price to remain constant, prices are at least twice as likely to decline as to increase’. This is not the case

in Australian rare book auctions. In the 1980s and 1990s, Figures 4 and 5 show that flat paths were the most common, but Table 3 shows that the number of falling paths was less than twice the number of rising paths. In the 1970s, flat paths were not the most common, and again the number of falling paths was less than twice the number of rising paths.

Table 3 shows that the differences in the 1970s were marginally more dispersed than in the other decades, and that in all decades prices were usually not flat. In every period, there were more declining paths than any other type, and flat paths were never more common than rising paths or falling paths taken as a group. In the 1990s, almost half of all pairs had declining prices.

There were similarities across the three decades in the slopes of price paths that were not flat. In the 1970s, prices that rose did so on average by 39.9 per cent; prices that fell did so on average by 23.9 per cent. The corresponding figures for the 1980s are 36.5 per cent and 21.0 per cent respectively. For the 1990s, 31.6 per cent and 22.3 per cent respectively. In all cases, therefore, there were fewer rising price paths than flat paths, but rising paths were on average steeper than falling paths. This is consistent with Weber's (1983) prediction of flat paths on average. Excluding the flat paths, the distributions of differences in log prices were similar across the three decades.

To formally analyse price paths, Ashenfelter (1989) took ratios of first and second prices and compared them with one. On its own, this is a poor method because it conceals features in the data that are revealed by visual analysis of distributions of price differences such as in Figures 3–5. For example, suppose the 1970s distribution of differences had a bimodal shape but one that was symmetric around zero. The average price difference would be zero, but the average would conceal an underlying process that never generated paths at the average. Price ratios also conceal potential differences in price paths at different asset values. Nevertheless, for the sake of comparison with Ashenfelter, analogous ratios were prepared for the three decades (Table 3). None of the ratios was statistically different from one. This is evidence that unique features of wine auctions, such as the buyer's option described in section 2, played a part in the prevalence of declining paths that was observed by Ashenfelter, and by McAfee and Vincent (1993).

Using Ashenfelter's ratio method, the hypothesis that prices in sequential auctions of Australian books are on average flat would be accepted for all three decades. But the distributions of price differences and the statistical analysis presented in this section suggest the hypothesis warrants supplementation. It has been shown that the finding of increasing price paths on average can be associated with more than one underlying profile of price differences. The processes generating the data are more complex than the hypothesis can accommodate.

A supplementary hypothesis is that flat price paths are usual, and that deviations from a

flat path are random. This hypothesis is accepted for the 1980s and 1990s, but not for 1970s.

### *5.5 Explaining the differences between the time periods*

How might the large difference between the distributions for the 1970s and those for the 1980s and 1990s be accounted for?

The data were searched to see if particular flat, rising or falling paths tended to come over-proportionately from a particular auction, a particular auctioneer, or a particular time period. No such bunching was found.

The 1970s group was split into two halves (1969–1973, 250 pairs, and 1974–1978, 221 pairs) to see if the same profile of price differences was evident in the subgroups. The profiles for the two subgroups were very similar to each other and to the distribution for the whole 1970s group.

It was noted in section 4 that the book auction data from 1969 to 1978 were not compiled by the same person as those for the other decades. Could this explain the difference? The present author checked the *Australian Book Auction Records* entries against the source catalogues to check their reliability, and confirmed that the condition information and the prices are accurate. A way to test formally for the influence of data collection is to look at the proportion of all doubles that were coded 'identical' in each year. The number of doubles is independent of condition coding by the compiler (as are the price data). If a structural break in the share of identical doubles coincided with the break in the data, that would be evidence condition was coded differently, and specifically that a different test was applied to determine identity. The share of identical doubles in all doubles in each year was regressed on time and on a dummy variable that took a value of zero before the data break, and one after the break. The share of identical doubles declined significantly over time ( $t = -2.86$ ), but the dummy variable was not significant ( $t = -0.47$ ). This indicates that condition coding was not the source of the difference between the 1970s and the other decades.<sup>24</sup> (The decline in the share of identical doubles makes sense, as the overall quality of rare books declines over time, and in random ways due to accidents and differences in storage. At the same time, the scarcity of individual titles increases due to the loss and destruction

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<sup>24</sup> It is conceivable that the 1970s books differed from those sold in other periods. For example, they could have been more valuable on average. To test whether this difference caused the observed profiles of prices, the average (log) price (ie. the average of each pair of prices) was regressed on time to see if there was a time trend in the value of the books. The time variable was not significant. The regression was repeated with a dummy variable equal to one before the gap, and zero after. Again, the time variable was insignificant, as was the dummy variable.

of copies, and purchases by institutions.)

Another set of arguments concern changes in the way book auctions worked. It is possible that the number of participants reached a critical level in the late 1970s or early 1980s, and that this extra liquidity tended to flatten price paths in sequential auctions of identical books. The extra liquidity may have been associated with a maturing of the rare book auction circuit in Australia, when the market institutions became more established, bidders developed more confidence in the institutions, and participants in general had better information about sale processes and values.<sup>25</sup> If this conjecture were true, it might suggest evidence from other markets of systematically declining prices reflected an immaturity in those markets, and that declining prices were only a temporary feature. This deserves further exploration.<sup>26</sup>

### *5.6 Book values and price paths*

It was noted in section 5.3 that the book auction data are not very homogenous with respect to the value of the books being sold. Do price paths in the sequential auctions differ according to the value of the books? There are reasons to expect they might. Bidders' behaviours at auctions plausibly depend on the size of the outlay they are called on to make. Bidders making small financial commitments may be less worried about risk—such as the risk of overpaying—than bidders making large purchases. Expertise may also play different roles at different price levels. Bidders making larger purchases may be more willing to seek out information about historical prices, for example.

To test if price paths are influenced by the average sale price in a sequence, the difference in the logs of the prices was regressed on the average value of the books, and a constant term, for each of the three decade groups, and for the whole sample. In none of the regressions was the coefficient on the average value variable significant at the 5 per cent level of significance. In the 1990s regression only, the coefficient was significant at the 10 per cent level ( $t = 1.73$ ), indicating a small positive relationship between the degree of the price decline and the value of the books sold.

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<sup>25</sup> Also, with more bidders, collusion is less likely to be viable.

<sup>26</sup> The only instance in the empirical literature of researchers returning to a previously studied auction setting is the work by McAfee and Vincent (1993) on wine auctions, in the footsteps of Ashenfelter (1989). But the data studied in these two papers overlaps in time—Ashenfelter looked at results from 1985–87, McAfee and Vincent from 1987—so they do not shed light on the evolution of wine auctions.

## 6. CONCLUDING COMMENTS

This paper presented the results from a preliminary analysis of a set of sequential auctions of rare books. Sequential auctions are interesting because they offer insights into how auctions work, insights that are not available when non-identical lots are sold.

Rare book auctions offer a promising environment in which to examine price paths in sequential auctions. *Australian Book Auction Records* contains a large number of identical pairs of books that were auctioned sequentially on the same day at the same place. The book auction records permit the analysis of price results across different groups of auctioneers, and across a range of values, from very low value books to very expensive ones.

A preliminary examination of every sequential pair of auctions in *Australian Book Auction Records* indicated that auctioneers tend to put better books first in sequences of auctions of non-identical books. The analysis then focused on sequences of auctions of identical books. While in every decade falling paths were more numerous than flat paths and rising paths, the preponderance of falling paths was not as strong as that found by Ashenfelter (1989) and McAfee and Vincent (1993) using data from wine auctions. The hypothesis of declining price paths on average was rejected for all three decades. The revised hypothesis, that flat paths were usual and that deviations from flat paths were random, was accepted for the 1980s and 1990s, but rejected for the 1970s. This preliminary finding of different price paths over time is new in the sequential auctions literature. The pattern of prices was found not to depend on the value of the books being sold, though there was some evidence of a small positive relationship between book values and the average extent of price declines in the 1990s. The analysis provides some support for the conjecture that auction markets with a paucity of flat price paths are immature. This is an issue warranting further study.

## REFERENCES

- Ashenfelter, O. (1989) 'How Auctions Work for Wine and Art', *Journal of Economic Perspectives*, 3, pp. 23-26.
- Ashenfelter, O. and D. Genesove (1992) 'Testing for Price Anomalies in Real-Estate Auctions', *American Economic Review*, 82, pp. 501-505.
- Bernhardt, D. and D. Scoones (1994) 'A Note on Sequential Auctions', *American Economic Review*, 84, pp. 653-657.
- Black, J. and D. de Meza (1992) 'Systematic price differences between successive auctions are no anomaly', *Journal of Economics and Management Strategy*, 1, pp. 607-628.
- Branco, F. (1997) 'Sequential auctions with synergies: An example', *Economics Letters*, 54, pp. 159-163.
- Burguet, and J. Sakovics (1994) 'Sequential auctions with supply or demand uncertainty', working paper, Instituto de Análisis Económico, Barcelona.
- Chanel, O., L.-A. Gerard-Varet and S. Vincent (1996) 'Auction theory and practice: evidence from the market for jewellery,' In: V. Ginsburgh and P. Menger (eds) *Economics of the Arts: Selected Essays*, Elsevier Science.
- Cutler, D., J. Poterba and L. Summers (1991) 'Speculative dynamics', *Review of Economic Studies*, 58:3, pp. 529-46.
- Engelbrecht-Wiggans, R. (1994) 'Sequential auctions of stochastically equivalent objects', *Economics Letters*, 44, pp. 87-90.
- Engelbrecht-Wiggans, R. and C. Kahn (1999) 'Calibration of a model of declining prices in cattle auctions', *Quarterly Review of Economics and Finance*, 39(1), pp. 113-128.
- Engelbrecht-Wiggans, R. and F. Menezes (1993) 'Sequential auctions with continuation costs', Australian National University Economics Working Paper no. 255.
- Gale, I. and D. Hausch (1994) 'Bottom-fishing and declining prices in sequential auctions', *Games and Economic Behaviour*, 7, pp. 318-331.

- Gandal, N. (1995) 'Sequential Auctions of Israeli Cable Television Licenses: The Morning Effect', mimeo, Tel Aviv University.
- Jones, C., F. Menezes and F. Vella (1996) 'Auction price anomalies: evidence from wool auctions in Australia', Australian National University Economics Working Paper no. 303.
- Lusht, K. (1994) 'Order and price in a sequential auction', *Journal of Real Estate Finance and Economics*, 8, pp. 259-266.
- McAfee, R. Preston and D. Vincent (1993) 'The Declining Price Anomaly', *Journal of Economic Theory*, 60, pp. 191-212.
- Menezes, F. and P. Montiero (1999) 'Synergies and price trends in sequential auctions', Australian National University Economics Working paper no. 366.
- Milgrom, P. and R. Weber (1982) 'A Theory of Auctions and Competitive Bidding', *Econometrica*, 50, 5, pp. 1089-1122.
- Pesando, J. and P. Shum (1996) 'Price anomalies at auction: evidence from the market for modern prints', in V. Ginsburgh and P. Menger (eds) *Economics of the Arts: Selected Essays*, Elsevier Science, pp. 113-134.
- Stiglitz, J. (1991) 'Symposium on organizations and economics', *Journal of Economic Perspectives*, 5, pp. 15-24.
- Vickrey, W. (1961) 'Counterspeculation, auctions, and competitive sealed tenders', *Journal of Finance*, 16, pp. 8-37.
- Weber, R. J. (1983) 'Multi-Object Auctions', in R. Engelbrecht-Wiggans, M. Shubik and R. M. Stark (eds) *Auctions, Bidding, and Contracting: Uses and Theory*, New York University Press, New York, pp. 165-194.

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