Are Extreme Bids Inevitable? The Tale of Three Distributions

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Abstract:

This paper proposes a simple statistical explanation for the phenomenon of extreme bids observed during house market booms. During a boom period the house market regime switches from a single bidder to a multiple bidder environment. The sale price in a multiple bidder auction is the maximum bid, and the distribution of maximum bids contains a much higher proportion of extreme bids compared with the distribution of single bidder valuations. The inevitability and simplicity of this statistical explanation of extreme bids in a rising house market justifies its claim to be the default explanation under the principle of Occam's razor. This statistical explanation of extreme bids during a house market boom is consistent with the observed phenomenon of estate agents lowering their offers over price during a boom.

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Non Technical Summary:

Is there a simple statistical explanation for the phenomenon of extreme bids observed during house market booms? We argue here that the origin of this phenomenon is the absence of any market-making mechanism to identify bid and ask prices that would instantly clear the market, because each house is unique with respect to characteristics and location. In this environment the seller posts a list price and waits for a potential buyer to make a bid for the house. During periods of price stability the professional valuer identifies the likely selling price from past experience. The professional valuer's valuation at the mean buyer's valuation enables building societies to lend, confident that it is possible to recoup the loan by a fast resale in the event of default. This same valuation also guides buyers in a single bidder market concerning the likely sale price.

During a boom period, however, the market regime switches from a single bidder to a multiple bidder environment. The sale price in a multiple bidder auction is the maximum bid, and the distribution of maximum bids contains a much higher proportion of extreme bids compared with the distribution of single bidder valuations. The inevitability and simplicity of this statistical explanation of extreme bids in a rising house market justifies its claim to be the default explanation under the principle of Occam's razor. This explanation is consistent with professional valuer confusion about the correct valuation during the boom. It becomes impossible to distinguish gaps between the sale price and the mean potential buyer valuation caused by multiple bids, and the shifting distribution of potential buyer valuations associated the excess demand of a booming house market. This in turn provides an innocent explanation for estate agents exhortations to buyers to "just offer as much as you can afford".

The statistical explanation for extreme bids is also consistent with the asymmetrical behaviour of estate agents in boom compared with quiet house markets. During the house market boom they lower the "offers over" price in order to increase the number of bidders. However they do not lower the "offers over" price during quiet house markets when there is still likely only one bidder and the main effect would be to signal a low seller reservation price. Our analysis does not preclude attempts by market intermediaries to rig the market but the phenomena that have been used as evidence that the political and legal framework of market making contributes to price instability are consistent with perfectly innocent behaviour together with the statistical explanation for extreme bids.

Introduction

Extreme bids become commonplace during house market booms and various explanations of this phenomenon have been proposed in the context of particular housing market upswings. In the popular press, for example, the extreme bids offered in some housing auctions have been characterised as the consequence of buyer desperation:

> In Edinburgh city centre, where demand easily outstrips supply and many properties are attracting more than a dozen notes of interest, the [difference between asking and selling price] exceeds 30 per cent. Similar high bids have been experienced in parts of Glasgow such as Merchant City, and in nearby Bearsden. The same is being seen in increasingly desirable pockets of east Fife and Aberdeenshire… Last month, a flat in the High Street, Edinburgh, which was advertised at offers over £53,000, sold for £108,500 - 105 per cent over the asking price. A second floor flat in the Merchiston area, on the market at offers over £49,000, sold for £101,000 - 106 per cent over… Simon Fairclough, of the Edinburgh Solicitors Property Centre, said: "You can understand buyers who have missed out a couple of times and who are offering 30-40 per cent over to make sure they are successful the next time round." ("House hunters trapped in bidding war", Frank O'Donnell and Shona Darroch, *The Scotsman*, Mon 22 Sep 2003)

Others have suggested the existence of market manipulation by estate agents (Smith, Munro and Christie, 2005), or the emergence of local housing market conventions regarding bidding behaviour (Pryce 2004). However, there may be another less elaborate explanation that rests entirely on the laws of probability. The argument put forward in this paper is that we should not be surprised either at the occurrence of extreme bids in a booming market or at the divergence of selling prices from surveyor valuations. These phenomena are, in fact, an inevitable consequence of the interplay of three distributions: the distribution of potential bids, the distribution of mean actual bids and the distribution of successful (maximum) actual bids.

To set the scene for our hypothesis and consider its status among the existing list of alternative explanations, consider Unwin's (2003, p.24-25) *Shopping Mall Vignette* as a possible metaphor of the debate:

THE SHOPPING MALL VIGNETTE

Scene: A shopping mall.
Characters: Two teenage boys – Anaxagoras (The Axe) and Chad.

THE AXE: We're lost.
CHAD: I know. I think society has let us down by failing to instil in us a sense of those values that…
THE AXE: No, you idiot. I mean it literally. I've no idea where the Body-Part Piercing Parlor is.
CHAD: Oh. There's a mall guide over there.

[*CHAD walks over to the mall guide, which is a wall map showing the locations of the mall stores. He inspects it for a while.*]

CHAD: Oh, my god. [CHAD is unnerved.] This is totally incredible. I just don't believe it.
THE AXE: What is it? Speak to me, Chad.
CHAD: Come and look. You won't believe this.

[THE AXE *joins* CHAD *and looks at the mall guide.*]

THE AXE: Well?
CHAD: Don't you see it? It took me a while to notice it too.
THE AXE: Notice what?

[*CHAD points to an arrow on the map beside which is written "You Are Here."*]

CHAD: We *are* exactly where the arrow ways we are. How could they have known that?

[THE AXE *ponders the situation.*]

CHAD: I knew that these shopping mall people were clever, but this is miraculous. [CHAD *looks up suspiciously for cameras.*] [*Whispering.*] How do they do that? How did they know where we are? Axe, I'm scared.

The genuine surprise expressed by CHAD at the mall guide arises from an epistemological fallacy. The "You Are Here" arrow had not followed them around the shopping mall, nor was it evidence that they were predestined to be there at that moment in time. It was always there on the same notice board offering the same mundane message to each passer by. In truth, the arrow was identifying the position notice board – the location of the reader was coincidental. No mystery. No conspiracy. No need for an additional cause. The preferred logical interpretation was the simplest one – the one that required the fewest assumptions.

Similarly, we argue here that, as the market booms, there tend to be more bids per house auction (for prices to rise, demand must exceed supply – which is another way of saying that the number of properties for sale is less than the number of buyers chasing them) and this alone is sufficient to induce the phenomenon of extreme bids. This is because, when the number of bids per auction rises, the distribution of successful (i.e. maximum) bids shifts to the right and alters in shape. Even if the distribution of *potential* bids remains unchanged, the metamorphosis of the distribution of *maximum* bids makes the increased likelihood of extreme bids not only possible, but inevitable. While this does not preclude other explanations, one has to ask whether *additional more convoluted theories are necessary when a simple explanation exists?* In other words, the burden of proof rests on purveyors of more elaborate theories to demonstrate that their more complex theories are required to explain phenomena that cannot be explained by the simpler theory. The challenge is all the greater if it can be shown that the simpler theory is not only feasible, but inevitable.

The remainder of the paper is structured as follows. In section 1 we offer a brief review of the literature. Then we present our theory of extreme bids (section 2) and discuss the main assumptions (section 3). In section 4 we attempt to test the validity of our hypothesis using a simulated data set before discussing the implications of our findings for the meaning of surveyor valuations (section 5) and the divergence between asking and selling prices (section 6). Section 7 offers a discussion of our findings in the context of Occam's razor and we ask whether some of the arguments presented by developers of 'anti-razors' are in fact still required to explain residual phenomena that are not adequately accounted for by our theory of unexplained bids.

Before proceeding we should also note that our analysis is based on the Scottish sealed-bid system, though we believe it to be extendable to other selling structures. We do not provide a detailed description of the Scottish system here because there are two recent papers that do this in full (Smith, Munro and Christie (2005); Pryce and Gibb (2006)).

1. Literature Review

There is widespread agreement on the sequence of events associated with the sale of a house. The seller chooses a list price with the help of an estate agent, prospective buyers use this information to decide whether or not to inspect the house, and eventually one or more potential buyers makes a bid. There is, however, less agreement about the microstructure of housing markets and the nature of the relationship between valuation, the "usual" list price, the actual list price, time on the market and the final selling price.

The housing market literature identifies a number of different ways in which the seller's choice of the list price influences the actual sale price of a house. For example, Anglin et al (2003) emphasise the importance of the seller's choice of list price on the time taken to sell the house and also the likely selling price received. Allen and Dare (2004) discuss the psychological effects of using "charm prices" that set the list price just below round number price points. Miller and Sklarz (1987), Northcraft and Neale (1987) consider how the list price affects the perceived valuation as well as conveying information to potential buyers. Haurin (1988) shows how greater variance in the distribution of buyer valuations of an atypical house lengthens time on the market because it is profitable to wait for more offers. Horowitz (1992) and Knight, Sirmans and Turnbull (1994) suggest that a lower list price attracts more bids but also lowers the perceived valuation. Yavas and Yang (1995) examine the disincentive effect of overpricing on the estate agent acting on behalf of the seller. Arnold (1999) models the optimal list price strategy that trades off extra bids against a lower ceiling price, taking account of the cost associated with time on the market. Merlo and Otralo-Magne (2004) incorporate strategic interactions between buyer and seller when the seller can revise the list price as time goes by.

More generally, Smith, Munro and Christie (2005) suggest that the institutional procedures adopted by market-making intermediaries contribute to house price instability. The authors interviewed solicitors, surveyors, valuers, estate agents, property developers and property managers in order to understand how the house market-making process might have contributed to the extraordinary Edinburgh house price boom between 1996 and 2003. These interviews appear to support the authors' view that the operation of the house market exacerbates house price instability. During periods of relative price stability buyers paid 5 per cent to 10 per cent above the *offers over* price, the *offers over* price was set at a constant margin below the anticipated sale price, and all those involved understood roughly what the outcome would be. However, during the boom one in three buyers in the Edinburgh study paid at least 10 per cent and sometimes 25 per cent over valuation.

Smith et al explain the increase in the sale price to valuation ratio in terms of the institutional nature of the market process. For example, they maintain that professional valuers should provide a powerful anchor for price negotiations, but "hadn't a clue" what potential buyers should offer when prices were rising fast. Estate agents started dropping "offers over" list prices when the market started to take off in order to attract buyers. This created a disjunction between "professional" pricing and pragmatic "offers over" selling prices. This in turn encouraged buyers' agent to advise buyers to "offer as much as you can afford". The authors maintain that their interviews support the hypothesis that the political and legal framework of market making contributes to price instability.

We agree that the evidence provided by the interviews does not contradict the conjecture that institutional features of the house market contribute to house price instability, and in particular to an unwarranted Edinburgh house price boom. However, Occam's Razor dictates acceptance of the simplest explanation and we contend that there is a straightforward, more general, explanation for the apparently extraordinary bidding behaviour that has characterised the house price booms in Edinburgh, Glasgow and elsewhere.

2. The Tale of Three Distributions

Consider now an explanation of extreme bids in terms of the interplay of probability distributions. This explanation, it should be said, is not a general theory of market cycles. We do not attempt to explain why the market booms, only that there are certain inevitable consequences when it does. Indeed, there is nothing in the Scottish experience that presents a prerogative to re-write the textbooks with regard to the cause of business cycles, which arise when there are structural factors that cause unanticipated fluctuations in aggregate demand or supply. There is no great mystery to why the Edinburgh housing market formed a leading edge of Britain's house price boom between 1996 and 2003. The 1997 referendum on a Scottish Parliament and the subsequent establishment of The Scottish Executive in 1999, combined with the constraints on new supply (particularly of the particular type and location of properties in greatest demand) and the perpetuating effects of accumulated equity gains over time, led to a prolonged housing market boom, resulting in relatively steep house price-rises in Edinburgh. This is consistent with economic theory.

Our primary goal in this paper is to explain the increased propensity of extreme bids during booms – bids that appear to be a long way from the average value potential bidders would place on the property. We present our explanation as the story of how three distributions change and interact during boom conditions and cause the final selling price to diverge from the mean valuation. This process is not contingent on conspiracies, collusions, bargaining behaviour, psychological effects, agency incentive distortions, information "conventions", sunspots or acts of God. We suggest that the laws of probability lead to a fundamental relationship between the number of bidders and the final sale price.

Our hypothesis can be summarised as follows. In an auction system of house sales, the distribution of final sales prices is defined by the distribution of the *maximum* bid in each auction, not the distribution of the *mean* bid. This is important because the distribution of the mean bid responds differently to increases in the number of bids than the distribution of the maximum bid. The distribution of the mean bid will tend towards the bell-curve (normal distribution) as the number of bidders increases (a widely celebrated result known as the Central Limit Theorem that underpins much of modern statistics*). Not so for the distribution of the maximum bid*. The distribution of the maximum bid systematically *deviates* from normality as the number of bids in each auction rises. This gives rise to the observed phenomenon of extreme bids. An increased proportion of successful bids (i.e. final sales prices) are drawn from the extreme upper tail of the underlying distribution of potential bids. This occurs without any change to the distribution of potential bids. This, we argue, is an inevitable statistical process. The story of extreme prices during booms is, in fact, the tale of three distributions.

Our hypothesis is illustrated in the stylised distributions of Figures 1 and 2. In Figure 1, panel A represents the distribution of all potential bids for property of type *k*. The shape of the distribution will be determined by the values that buyers put on a property which in turn will be determined by the pattern of consumer preferences and budget constraints at a given point in time. The shaded area in the right tail represents the proportion of buyers that would offer at least *x*. Not all potential buyers bid in a particular auction. In fact, in this initial diagram (panels B and C of Figure 1), we assume in each auction that only one person puts in a bid. This one bidder is randomly drawn from the distribution of potential bids depicted in panel A. Panel B shows the average value of the bid in each auction if there were many auctions of this type (i.e. with only one bidder). Panel C plots the distribution of the maximum bid in each auction. Because there is only one bidder, distributions B and C are identical because the maximum bid will inevitably equal the minimum bid. In both cases, the area to the right of *x* is very small indeed – the chances of either the mean bid or the maximum bid in an auction being greater or equal to *x* is negligible.

Figure 2 tells a very different story. Here we have the same exercise but with multiple bids in each auction. Although the bids are drawn from the same distribution of potential bids, the distribution of the maximum bid now has a different shape (fatter right hand tail) and position (further to the right) compared with the distribution of the mean bid. So the area to the right of *x* in Panel C is now considerably greater than in either panel A or panel B, or indeed of any of the panels in the diagrams representing single bid auctions (Figure 1). The spectacular increase in the probability of the successful bid (i.e. maximum bid) representing an extremely large value (greater than *x*) arises entirely from the increase in number of bids per auction for property type *k*. As the number of bids increases, the distribution of the *mean* bid tends towards the normal distribution (whatever the underlying distribution of potential bids) but the distribution of the *maximum* bid tends towards an extreme value distribution (such as the Poisson distribution or Gumbel distribution). We have assumed that the distribution of the population of potential bids is normal, but our basic hypothesis would also hold for a range of distributions for the population because of the laws governing sampling probabilities.

Figure 1 Tale of Three Distributions: Single-Bid Auctions

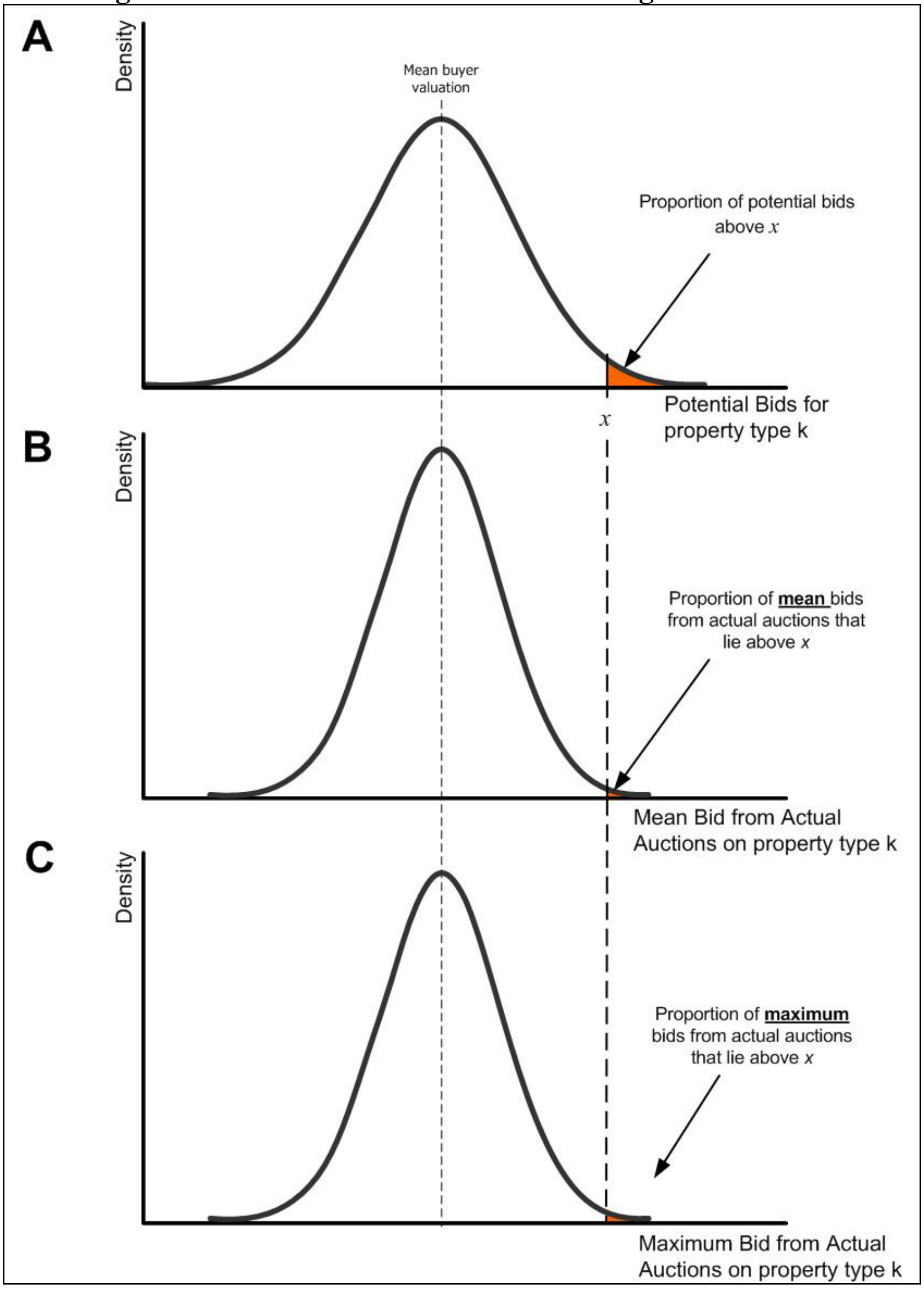
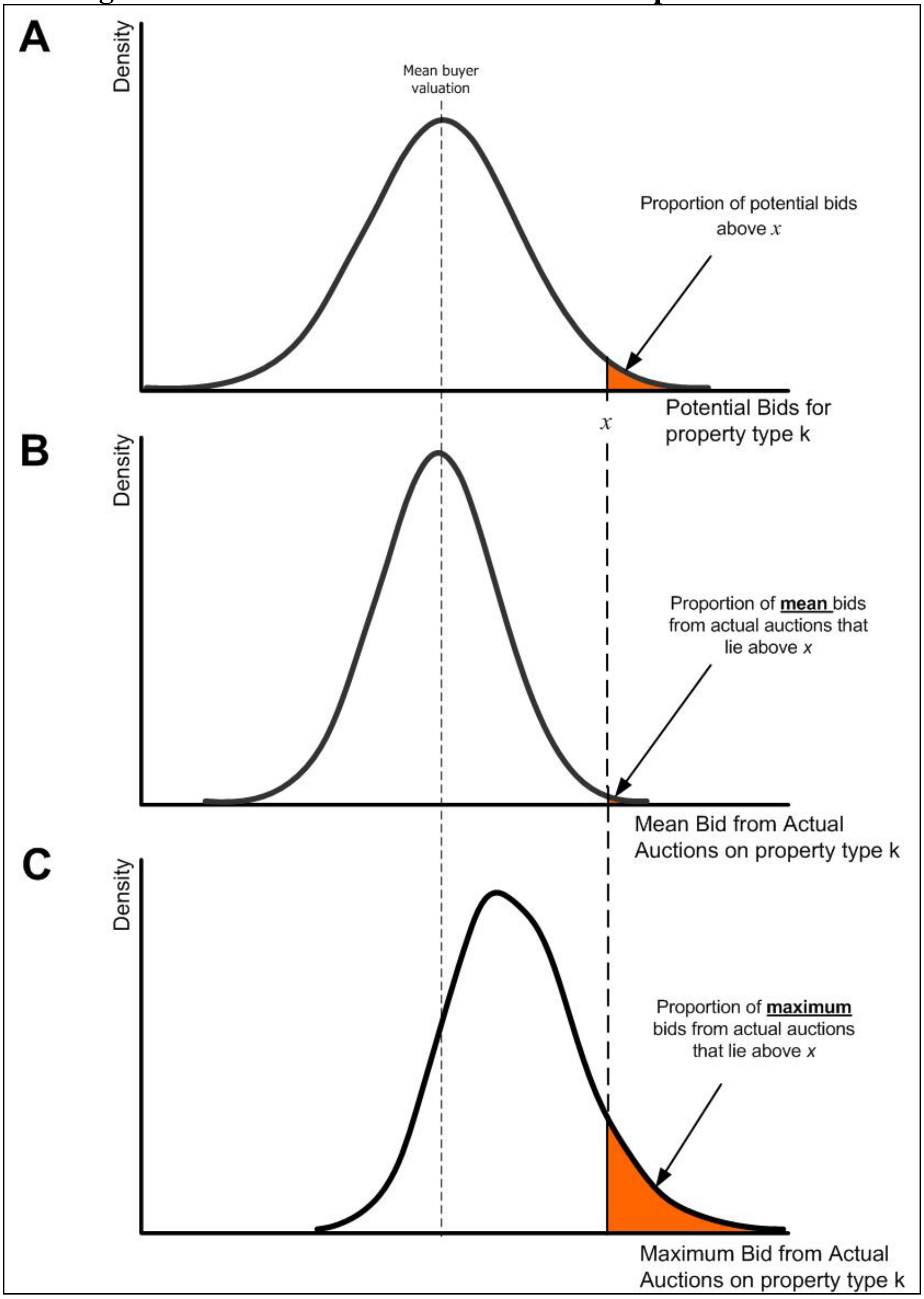


Figure 2 Tale of Three Distributions: Multiple-Bid Auctions



3. Assumptions and Diversions

We have assumed that the number of bids per auction rises during a boom because rising prices in an area reflects the fact that there are more buyers than sellers (demand is greater than supply). Indeed, it is likely that the steeper the rate of price increase, the greater the number of buyers for every house offered for sale. We have, however, also assumed that the distribution of the population of potential bids (panel A in Figures 1 and 2) also remains constant. This, of course, is unrealistic and we have imposed it only to simplify the statement of our hypothesis without loss of generality by isolating the effect of increasing the number of bids from other forces at play. In reality, the distribution of potential bids will shift in dynamic perpetuity as people constantly adjust their preferences and expectations. All this means in terms of our hypothesis is that, for every new distribution of potential bids, there will be separate sibling distributions for the mean bid in each auction and the maximum bid in each auction. So we can state more generally that, for any given distribution of potential bids, the chances of an extreme bid occurring in any one auction will tend to rise with the number of bids.

A second point to clarify here is our stance on the role of "market-makers". Gibb (1992) has argued that house purchase is primarily a process wherein market-makers have a pivotal role. However, we make a distinction between market-makers and market intermediaries that addresses the central issue that there are no market-makers in the housing market in terms of the conventional definition of a market maker. Market-makers in financial markets guarantee to stand ready to act as counter-party principals for anyone wishing to buy or sell named stocks at any time during trading hours. That is, market-makers provide immediacy to stockholders and therefore liquidity to the stock market by sacrificing discretion over when and what quantity to buy or sell in return for the bid-ask spread. Competition between market-makers for each quoted share narrows the bid-ask spread, ensuring that market-makers make a normal profit in return for providing this service.

Market-makers carry inventories of stocks for which they act in the capacity of market-makers. Market-makers interpret unexpected inventory movements for a given stock as "excess demand" i.e. a signal that the demand and/or supply curve has shifted and that the market is not clearing at the current price. They adjust their buying and selling prices accordingly in response to unanticipated movements in their inventories. If the inventory of stock x falls and the inventory of stock y rises, the market-maker will raise both bid and ask prices for stock x and lower both bid and ask prices for stock y until the desired inventory levels are re-established at the new market-clearing equilibrium prices.

In financial markets, market-makers exist as intermediaries to provide immediacy for buyers and sellers, and they adjust bid and ask prices in response to changes in excess demand observed as unexpected movements in inventory. It is important to note that these market-makers acting as principals have no influence on the market buying and selling prices. Their price adjustments only reflect changes in supply or demand at prevailing prices. It is true that market-makers occasionally take a position on their own account, but this is not relevant. When they do this they are acting as investors/speculators and not in the capacity as market-makers.

The mechanism of the housing market is very different. There are no market-makers in the house market because, unlike the shares of a given company, every house differs with respect to characteristics and location. It would be virtually impossible for a market maker to translate inventory movements into excess demand and thereby identify bid and ask prices that would clear the market because each unit is unique and has a different value. That is, there is no mechanism by which market-clearing house prices can be established. In this house market environment the seller posts a list price and waits for a potential buyer to make a bid for the house. The professional valuer is able to identify the likely selling price from past experience during periods of relative price stability. The professional valuer's valuation at the mean buyer's valuation enables building societies to lend, confident that it is possible to recoup the loan by a fast resale in the event of default. This same valuation also provides a guide to buyers in a single bidder market concerning the likely sale price. The sale price may be above the mean valuation because there is a distribution of buyers' valuations. That is, a single bidder may offer a five to ten percent premium over the mean potential buyer valuation in order to secure the sale.

Buoyant house markets are very different. Multiple bid sealed auctions occur far more frequently in a buoyant house market. The seller sets a closing date at which the sealed-bids submitted by potential buyers are opened and the house is sold at the highest bidder’s price. The house market resembles the stock market insofar as non-zero excess demand likely precedes change in the distribution of buyer and seller valuations, and perception of this excess demand raises the distribution of buyer valuations. However, the mechanism by which the initial increase in demand alters the price differs in the house market because there are no market-makers.

The problem is that rising demand in the house market creates two separate effects that are difficult to disentangle. First, holding the distribution of buyer valuations constant, the sale price rises with the number of bidders. The more bidders there are, the higher is the expected winning bid for any given distribution of buyer valuations, and the larger is the gap between the mean buyer valuation and the sale price. Second,.a rise in the number of bidders heralds a shift in the distribution of buyer valuations and a corresponding rise in the mean buyer valuation, as well as a growing gap between the current mean valuations and mean sale prices. Consequently the professional valuer becomes uncertain about the correct mean buyer valuation when a rising number of bidders signals excess demand. The estate agent is therefore correct to advise potential buyers to bid far in excess of the valuer's valuation in order to secure a purchase. The reason being that both the potential buyers’mean valuation and the gap between the sale price and the potential buyers' mean valuation (the valuer's valuation) are likely to rise above historic levels in a multiple bid sealed price auction.

4. Simulated Effect of Increased Numbers of Bidders

We now present the results of our simulation model based on a hypothetical database of 30,000 house valuations with a mean of £100,000 (sd = £11,962) which represents the population of potential bids for a particular type of house, *k*. This distribution of potential bids reflects the range of preferences and budgets over all possible bidders. In reality, this distribution is also likely to reflect the distribution of income in the wider population due to the effect of budget constraints on actual bids. The amount people are willing to offer on a particular house is governed not only by tastes – which we might reasonably assume to be approximately bell-shaped – but also by the ability to pay which may not be normally distributed. For sake of simplicity we assume in the results reported here that the distribution of potential bids is normal. We also ran our simulations on a variety of alternative population distributions and found that the results remain essentially the same. (Because the distribution of income in the wider population is positively skewed, for example, one might argue that the distribution of potential bids should be of a similar shape – such as a log-normal distribution).

We then randomly draw each sample representing a particular auction from this population distribution of potential bids samples of size *n*. We draw many samples (20,000), representing many auctions of size *n* for the sale of property type *k* in order to see how the effect of varying *n* pans out in the long-run.

The next step is to define what we mean by an extreme bid:

Definition: *An extreme bid is one that is drawn from the section of the upper tail of the distribution of potential bids that lies above the 95th centile, that is, one that is in the top five percent of bids that the population of potential buyers would offer for a given property.*

The relationship between the number of bidders and the selling price in a sealed-bid auction for a given distribution of buyer valuations can be demonstrated by observing what happens to the maximum bid price as the number of bidders rises. Figure 3 depicts our attempt to replicate the three stylised panels of Figure 1 using the simulation methods described above assuming $n = 1$. Figure 4 depicts our attempt to replicate the three panels of Figure 2 using the simulation methods described above assuming $n = 4$. Just from eye-balling the graphs it can be seen that our hypothesis appears to be confirmed: the chances of the successful bid exceeding £119,681 in an auction increases from 5% to 18% when the number of bids rises from 1 to 4. However, this is not true of the mean bid: the chances of the mean bid in an auction exceeding £119,681 actually falls to less than half a percent as the number of bids per auction rises from 1 to 4.

Figure 3 Simulated Distributions: Single-Bid Auctions

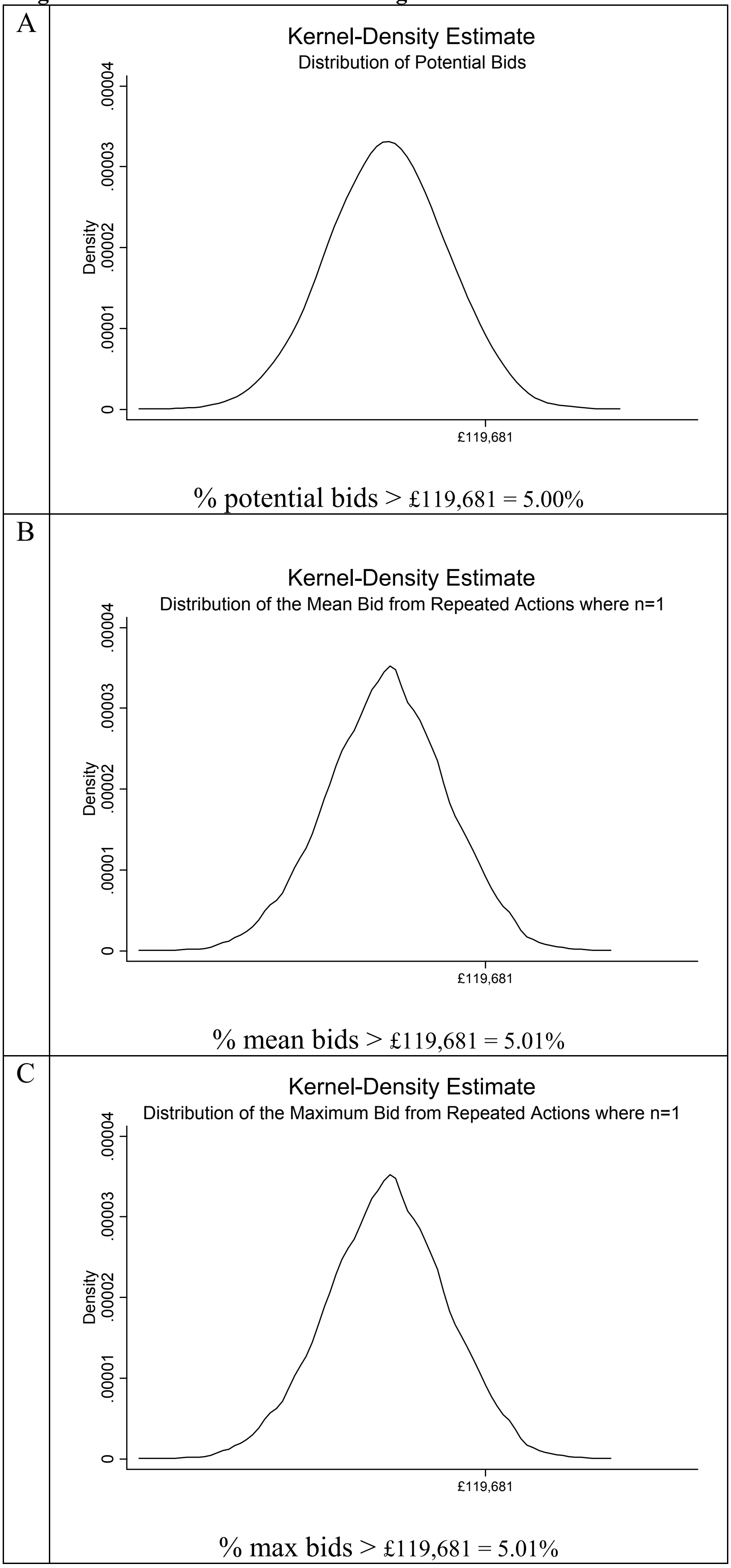
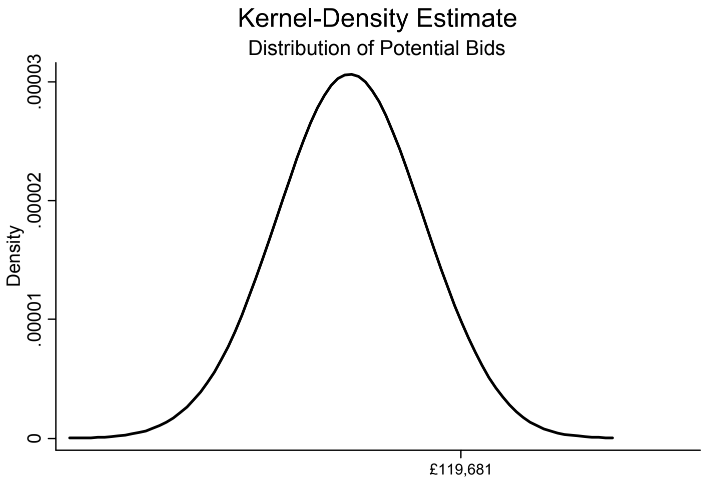


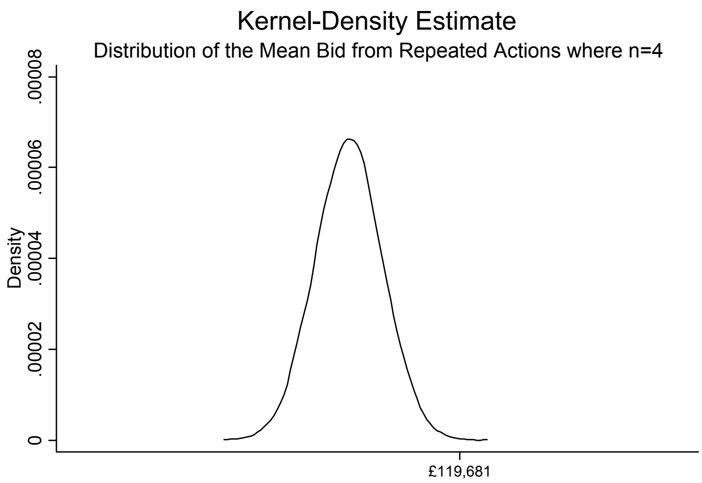
Figure 4 Simulated Distributions: 4-Bid Auctions

A



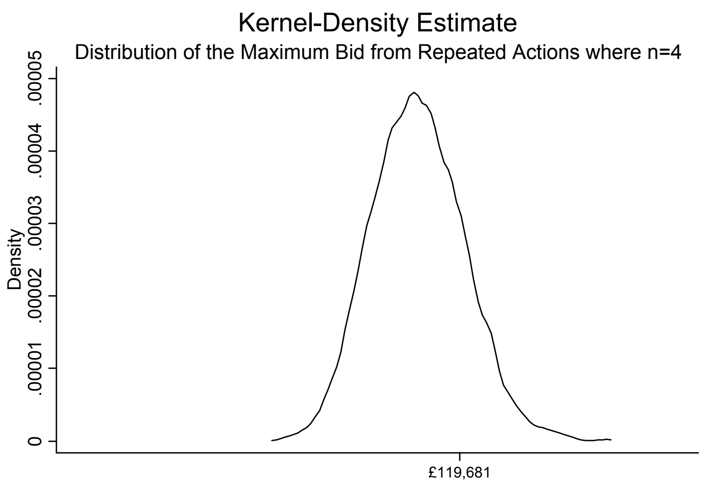
% potential bids > £119,681 = 5.00%

B



% mean bids > £119,681 = 0.045%

C



% mean bids > £119,681 = 18.13%

More detailed information on our simulations is presented in Table 1. As the number of bids per auction rises, the average value of the mean bid stays fairly constant at around £100,000, in contrast to the average value of the maximum bid which rises steadily to over £117,000. The movement of the average maximum bid away from the average mean bid is plotted in Figure 5 as a declining ratio. The proportion of bids over £119,681 rises with the number of bids per auction to nearly 34% for the distribution of the maximum with eight bidders (Figure 6). The proportion of mean bids over £119,681 falls with the number of bidders per auction, declining quickly to zero. Note, though, that in both distributions the standard deviation declines (as does the coefficient of variation) but less so for the distribution of the mean. Essentially, as the number of bids rises, the mean bid in each auction will give an increasingly reliable estimate of the mean value placed on the property in the population as a whole, whereas the maximum bid in each auction will converge towards the value placed on the property by the potential buyer who values it most highly in the population as a whole.[1]

Table 1 Descriptive Statistics on the Distributions of the Mean Bid and the Maximum Bid

Distribution of the Maximum Bid (from 20,000 auctions with *n* bids of properties of type *k*):

n	mean	median	sd	95c	99c	%Mean bids > £119,681
1	£ 99,936	£ 100,093	£ 12,002	£ 119,697	£ 126,643	5.010%
2	£ 99,987	£ 99,956	£ 8,382	£ 113,826	£ 119,345	0.900%
3	£ 99,880	£ 99,943	£ 6,867	£ 111,173	£ 116,001	0.220%
4	£ 99,967	£ 99,976	£ 5,955	£ 109,831	£ 113,714	0.045%
5	£ 100,006	£ 99,982	£ 5,383	£ 109,002	£ 112,617	0.005%
6	£ 100,040	£ 100,085	£ 4,900	£ 108,078	£ 111,455	0.000%
7	£ 99,977	£ 100,014	£ 4,537	£ 107,345	£ 110,389	0.000%
8	£ 100,041	£ 100,064	£ 4,248	£ 106,958	£ 109,964	0.000%

Distribution of the Maximum Bid (from 20,000 auctions with *n* bids of properties of type *k*):

n	mean	median	sd	95c	99c	%Max bids > £119,681	Average mean bid as % of Average max bid
1	£ 99,936	£ 100,093	£ 12,002	£ 119,697	£ 126,643	5.010%	100.0%
2	£ 106,732	£ 106,433	£ 9,750	£ 122,955	£ 130,132	9.685%	93.7%
3	£ 110,015	£ 109,821	£ 8,783	£ 124,634	£ 131,583	13.800%	90.8%
4	£ 112,215	£ 111,947	£ 8,266	£ 125,921	£ 133,135	18.130%	89.1%
5	£ 113,935	£ 113,723	£ 7,867	£ 127,107	£ 134,624	22.680%	87.8%
6	£ 115,145	£ 114,926	£ 7,579	£ 127,870	£ 135,109	26.800%	86.9%
7	£ 116,075	£ 115,803	£ 7,282	£ 128,226	£ 135,150	30.160%	86.1%
8	£ 117,014	£ 116,753	£ 7,113	£ 129,083	£ 136,355	33.990%	85.5%

[1] If we increased n to its largest possible value so that all 30,000 of our potential bidders submitted a bid in an auction (n = 30,000) ,then the maximum bid in that auction would exactly equal the maximum value placed on the property in the population as a whole.

Figure 5

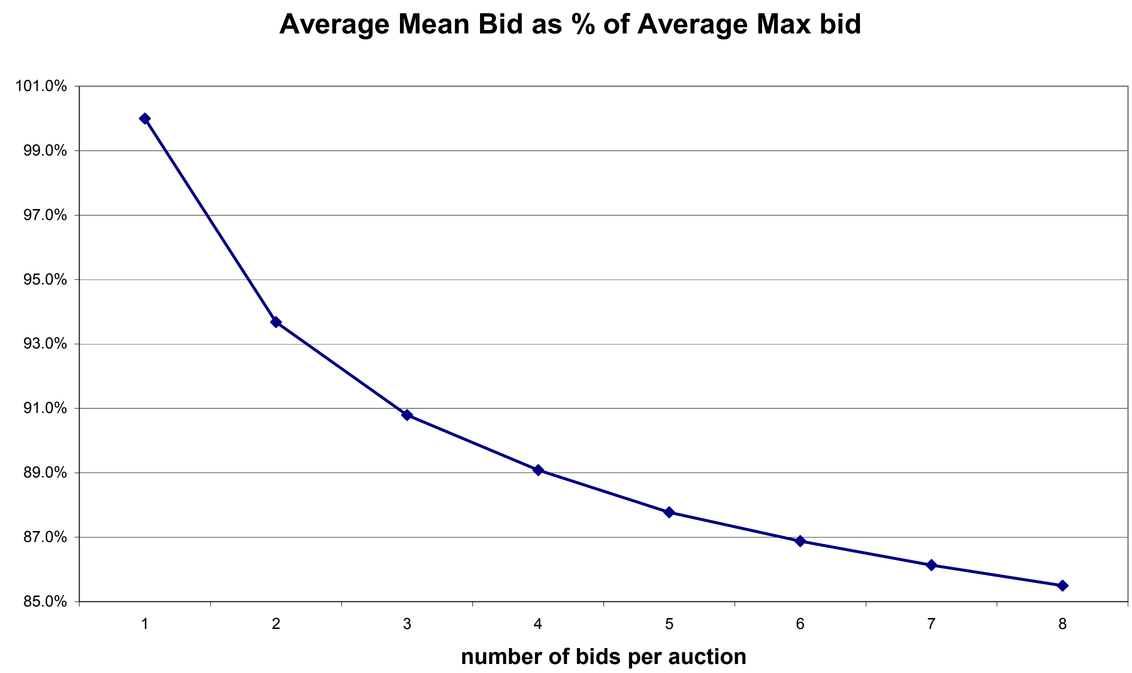
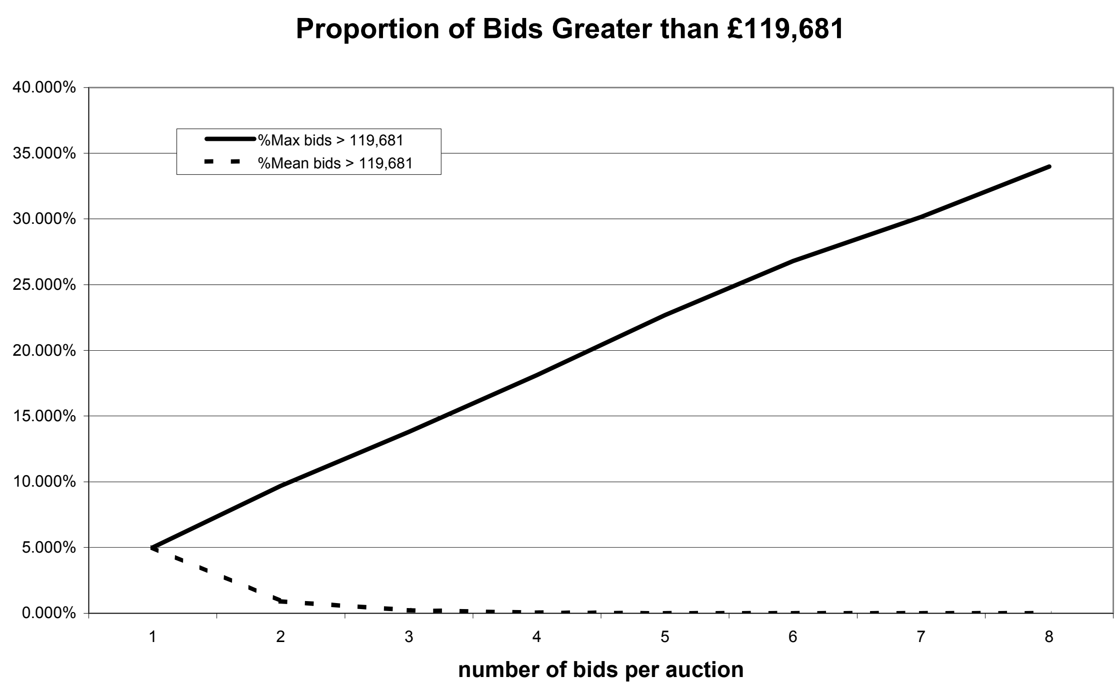


Figure 6



5. The Meaning of Surveyor Valuations

Our simulations suggest that the difference between the distributions of the mean and maximum bids will increase as the number of bids per auction increases. This raises some important questions about the goal and meaning of survey valuations. Is the surveyor attempting to estimate the *final sale price*, or is he/she attempting to gauge the *average value* that all potential buyers would put on the property (or indeed some confused combination of the two) at a particular point in time. There is a case for suggesting that the definition of valuation for a valuer is the appropriate price on which lenders should base their mortgage allocation decisions. The nature of the housing market differs between periods of relative price stability and periods of boom. Multiple bids drive the actual selling price farther along a given distribution of buyer valuations. It is reasonable for the valuer, however, to base his estimate of the long term value of the house on the *average* value potential bidders would place on the property – rather than the fortuitous outcome of a single auction. Because the Central Limit Theorem dictates that the mean of all sample means will equal the population mean when the sampling process is random, the valuer will attempt to ascertain the distribution of the *mean* bid, not the distribution of the *maximum* bid because it is the former, not the latter, that will be the best guide to the true average value that the market places on the property for the purpose of collateral value to a mortgage lender. This distinction between the definition of valuation for mortgage purposes and the value of a property achieved in a particular auction, provides the simplest explanation for the widening gap between valuer valuations and the selling price during a boom – the divergence occurs because the maximum bid diverges from the mean bid as the number of bids per auction increases.

6. The Divergence of Asking and Sale Prices

We have so far focussed our attention on why sale prices – the maximum bids in each auction – deviate from surveys commissioned by the *buyer*. Can our tale of three distributions offer any insight into the question of why selling prices appear to diverge from upset prices (i.e. "list" prices or "asking" prices) during a boom? Estate agents are quick to deny allegations of market-fixing, as the following quote demonstrates:

> "It would be worrying if undervaluing a property was a tactic that was increasingly being used. Certainly the ESPC would not support that. The notion that the upset price should be a minimum that the seller should wish to realise is a good one. However, there may very well have been incidences where prices have been underestimated - it is not a science, it's an art."[2]

The final sentence of this quote is revealing. It suggests that it may be uncertainty rather than conspiracy that is the primary cause. Clearly, this is the explanation that estate agents would prefer us to adopt, but is it consistent with our theory?

This explanation would be perfectly plausible if it were not for the fact that the valuation provided for the *seller* is not typically for mortgage purposes – it is purely an aid to identifying the upset price. The mortgage valuation is usually based on a separate, more thorough inspection, which under the present system in Scotland is commissioned by the *buyer* (though this would change if the Single Seller Survey and Home Information Packs were introduced). An interesting question, then, is whether estate agents' valuations for sellers diverge from either (or both) upset prices or final selling prices during a boom. Unfortunately, this is not something we have empirical information on at present and so we can only speculate. It is possible that the upset price, like the mortgage valuation, may be based on a surveyor estimate that is to some extent trying to gauge the average price that buyers would offer for the property, rather than the maximum that could be achieved in a given auction. In other words, the explanation offered in the previous section may well still hold – as these two distinct statistical entities diverge during a boom, so does the difference between asking and selling prices.

An additional implication of our finding, however, is that estate agents and sellers may have an incentive to increase the number of bidders *per se* because the chances of an extreme bid rises rapidly with every extra bidder that participates in an auction. If this can be achieved by artificially suppressing the asking price, then estate agents and sellers have an incentive to set a lower asking price. However, even under assumptions of bounded – rather than perfect – rationality, this tactic could only succeed for a limited period. Buyers would simply adjust their interpretation of the asking price accordingly and not bother to bid unless they believe they have a reasonable chance of success.

There remains the question of why the incentive to lower the asking price should be greater during a boom? Are not the incentives equally great (if not greater) to undervalue the upset price during a slump? There are possible explanations for why estate agents do not lower the asking price in order to attract more bids during a less buoyant market. For example, one could argue that the price-setting process switches from being an auction-based system to a bi-lateral bargaining-based system as the market slows. Once the seller is in a bi-lateral

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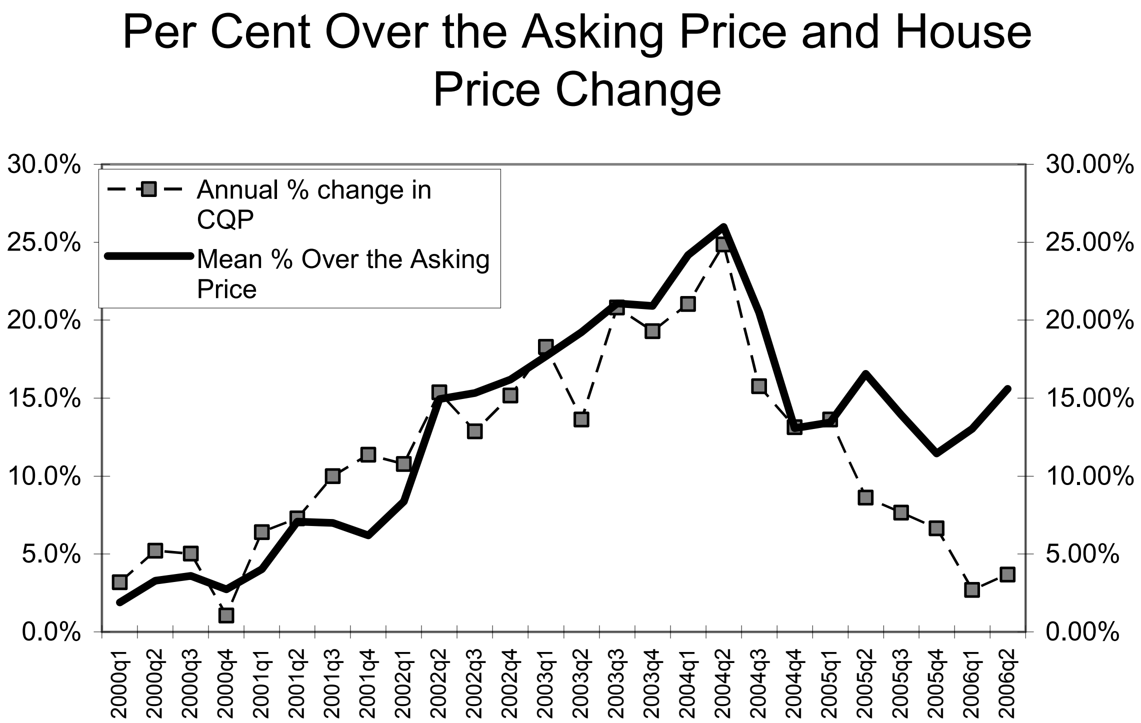
[2] Simon Fairclough, of the Edinburgh Solicitors Property Centre, quoted in "House hunters trapped in bidding war", Frank O'Donnell And Shona Darroch, *The Scotsman*, Mon 22 Sep 2003, in the context of rising proportionate differences between the asking price and selling price in Edinburgh

bargaining situation, it is counter-productive to set an artificially low asking price that may be interpreted as a signal that the seller is willing to accept a low price.

This regime switching story is by no means implausible but it does suggest qualitative breaks in dynamics of the transactions process that should reveal themselves in the data. For example, one might expect sudden falls in the average proportionate difference between asking and selling price when the market slows as sellers switch from an anticipated auction system to an anticipated bargaining scenario – sellers raise the asking price (cet par) because of the risk of finding themselves in a bilateral bargaining situation. However, the opposite appears to be true, at least for Glasgow. In Figure 7 the per cent over the asking price rises at almost exactly the same rate as rate as the change in constant quality prices *CQP* (see Appendix for the underlying hedonic regressions) but appears to decline at a slower rate after the boom has peaked.

Figure 7



Source: GSPC data on Strathclyde.

The regime switching argument is only consistent with the evidence if one combines it with additional assumptions, such as the belief that this particular market scenario is unique, and that sellers and agents are only learning incrementally the benefits of suppressing the asking price as the market booms. Since many buyers are also sellers one has to assume that buyers quickly become aware of the tactic.

7. Discussion

In the introduction to this paper we set out the case for rejecting convoluted explanations of extreme bids when a straightforward one will suffice. Our reference to Unwin's Shopping Mall Vignette was of course a restatement of Occam's razor, which in itself embodied similar arguments made by Thomas Aquinas in the 13th century ("If a thing can be done adequately by means of one, it is superfluous to do it by means of several; for we observe that nature does not employ two instruments where one suffices" (Aquinas, quoted in Wikipedia).

We should note, however, that Occam's razor is not without its critics and there have been attempts to devise 'anti-razors'. This fact is rather pertinent to our current discussion because our attempt to offer a simple explanation for extreme bids has, upon further reflection, itself led to some rather complex market scenarios. The words of Walter of Chatton, a contemporary of William of Occam, who took exception to Occam's razor, seem particularly apt: "If three things are not enough to verify an affirmative proposition about things, a fourth must be added, and so on". Immanuel Kant also sought to quality Occam's dictum and he developed his own anti-razor: "The variety of beings should not rashly be diminished."

So where does this leave us? It is clear that our tale of three distributions does not preclude strategic behaviour on the part of sellers and estate agents. There is, however, a certain inevitability about the existence of extreme bids as the market rises that may warrant our explanation being considered as the first cause. Subsequent strategies and counter-strategies are governed by this law of the market rather than determining it. A surfer rides the waves but does not direct the movement of the ocean. Lowering the asking price to attract more sellers may be a rational response at the individual level, but this strategy would not determine the pace or direction of the market as whole. To suggest otherwise is to succumb to the fallacy of composition. If one seller lowers their asking price he/she may attract more bidders. If, however, every seller lowers the asking price, there is no net increase in the number of bidders relative to sellers, and the impact is neutral. Ultimately, primal market forces will prevail. Average prices in an area will rise when there are more buyers than sellers of properties in that area. And when there are many bidders per house auction, there will be a greater chance of an extreme bid, due (at least in part) to the laws of probability that govern the relationship between the distribution of the maximum bid and the number of bidders.

If there are no further shifts in demand or supply (which is a big "if" given the potential for constant changes to income, labour markets, population flows, new construction and planning policy), prices will rise to a point where the number of buyers will roughly equate to the number of dwellings for sale. At that new equilibrium there will be fewer bids per auction (particularly when there is a significant cost to bidding) and less chance of extreme bids occurring.

It is important to note that nothing in our story precludes price fixing and attempts at market manipulation. What remains to be proved, however, is whether these shenanigans at the individual level, have any significant impact at the level of the market. Perhaps the most profound complication raised by our hypothesis is its implication for the meaning of "value" in the context of a house auction system. If the distribution of the mean bid was fundamentally the same as that of the maximum bid, there would be less of a problem. But it is not so and we are left with the question of what buyers, sellers, estate agents and indeed surveyors mean when they talk of the value of a house. Are they referring to the average mean bid or the mean maximum bid?

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Appendix:

Hedonic Regression Results used to Create the Constant Quality Price Index

Variable	Coefficient	t	Quarter Dummies	Coefficient	t
acre	73316.8	22.3	y1999q2	1325.1	1.0
alarm	-236.5	-0.4	y1999q3	1860.8	1.5
bay	15320.9	35.1	y1999q4	3756.8	2.7
bedrooms	16816.4	73.7	y2000q1	1925.0	1.4
detached bungalow	51180.7	49.0	y2000q2	4557.6	3.2
semi bungalow	26703.4	22.3	y2000q3	5002.3	3.3
terrace bungalow	6543.9	2.1	y2000q4	4433.6	2.7
distance to Glasgow	-1.3	-39.6	y2001q1	5936.9	3.9
conservatory	6259.7	6.0	y2001q2	9309.1	6.2
conversion	54519.1	39.6	y2001q3	11564.4	7.8
deprivation score	-667.7	-8.5	y2001q4	11829.4	7.7
driveway	-566.4	-0.9	y2002q1	13112.3	9.9
ensuite	15579.8	19.3	y2002q2	20071.0	14.9
flat 1st floor	-947.0	-1.8	y2002q3	20856.2	16.1
flat 2nd floor	549.2	0.9	y2002q4	22819.2	17.3
flat 3rd floor	3434.4	2.0	y2003q1	26608.2	20.4
lower flat	-4690.0	-5.4	y2003q2	31074.5	24.0
main door flat	9709.9	6.7	y2003q3	37815.0	29.3
upper flat	-5292.7	-7.0	y2003q4	38925.5	28.6
garage	10880.3	24.0	y2004q1	44967.4	32.9
garden	-2229.9	-5.2	y2004q2	53866.0	40.9
gas central heating	5284.4	15.7	y2004q3	53334.5	39.9
house	4603.3	7.1	y2004q4	51996.3	37.8
luxury	19799.8	20.5	y2005q1	59364.7	44.2
mature	-745.1	-0.7	y2005q2	63742.7	48.1
no. of bathrms	23994.8	7.7	y2005q3	62070.9	47.2
needs upgrading	-10406.0	-5.8	y2005q4	59483.5	43.6
cottage	14660.1	9.0	y2006q1	62596.4	47.7
parking	8330.9	17.2	y2006q2	68319.9	50.5
public rooms	23995.1	65.7			
spacious	673.6	1.8	constant	-41613.1	-12.5
stone	4247.1	8.5			
traditional	6555.5	14.0			
Victorian	18743.6	8.1			
views	6919.1	9.9			
detached villa	29618.7	33.2	Adj R-squared	0.71	
semi villa	4953.8	7.9	n	35,566	