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Auction Competitive Dynamics and Guide (List) Prices in a Bubble Market

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The auction literature finds that competition drives price outcomes and has both rational and psychological components. In bubble markets, emotional factors are heightened, potentially impacting on the interaction between the strategic setting of guide prices by auctioneers, competitive bidding and final auction price outcomes, themes not explored in the extant literature. In a real estate bubble, we find evidence that auction prices anchor on guide prices and that any emotional impact on competitive bidding associated with auction fever does not occlude the assimilative role for the guide price as an anchor. Interestingly, however, we find evidence consistent with real estate agents systematically setting guide prices at deep discounts relative to fundamentals, prima facie consistent with a belief in the reversal-of-the-anchoring effect, suggesting their actions may, paradoxically, dampen the effect of the bubble rather than amplify it.

Introduction

During the period from January 1994 to early 2007 Irish residential real estate prices nationally rose in excess of 500% and then in April 2007 they started to collapse, with a sustained decline continuing for almost six years eventually stabilising in March 2013. From peak to trough this fall (both nationally and in the Greater Dublin region) was in excess of 50% and in modern times is second only to Japan in terms of magnitude. The first warning that the Irish residential property market was significantly overvalued came in April 2003 (IMF, 2003) with further warnings made in quick succession (Economist, 2005; IMF, 2004).

Scherbina and Schlusche (2012) argue that bubbles are ubiquitous in residential real estate markets as such markets are dominated by 'unsophisticated households' who often develop optimistic views by over-extrapolating from past price movements.[1] There are far reaching and material implications of a convulsive real estate market for the real economy (Bengtsson et al., 2018) and the financial sector (Carmichael & Coën, 2018). There is, however, scant field evidence, in this critically important *growth-of-bubble* market phase, regarding the factors that persuade these real estate bidders to bid high. Thus, in such a setting there may be opportunities for professional real estate agents to strategically set auction guide prices to influence the number of bidders and bidder behaviour to generate higher auction prices.

1 Anomalies are difficult to arbitrage away due to (1) high transaction costs, and (2) the inability to sell short in such markets (Scherbina & Schlusche, 2012).

Shi and Kabir (2018) report that the number of properties auctioned increases as a proportion of the total volume of property transactions in boom periods. Han and Strange (2014) find that the gap between (list) guide prices in residential real estate transactions and ultimate selling prices is wider in boom markets than in flat or declining markets. Both of these studies speculate that their findings may be attributable to the nature of the competitive dynamics among competing bidders in boom market conditions. However, both studies do not formally test these speculations as they do not have access to bidder data. In addition, the purpose of these studies is to address broad (aggregated) time-series comparisons of prices obtained conditional on different market conditions to test for potential differences. They do not cross-sectionally test across auctioned properties *within* a boom market for the impact of guide (list) prices on (1) competition, and (2) price outcomes.

An extensive auction literature finds that more auction competition triggers higher price outcomes, for instance Holt (1979), Harris and Raviv (1981), Milgrom and Weber (1982), as well as empirical research in the real estate literature such as Lusht (1996). In our study, we address two interrelated research questions not heretofore explored in the extant literature on auctions and competition in bubble market conditions. First, does the strategic setting of the level of the guide (list) price by an auctioneer have a role in stimulating auction competition? Secondly, does the guide price act as an anchor in determining auction price outcomes? Or, is the prospective assimilative effect of the guide occluded by the impact on competitive bidding behaviour of *auction fever*, where such fever may be intensified in a bubble market context? Our sample consists of residential real estate auctions in the Dublin market over the 18-month period from September 2004 to February 2006.

Ku et al. (2006) argue that in the *social* setting of an auction a lower starting (guide) price may result in higher selling prices. In their model, setting a lower guide price attracts more competitors and the psychological processes that occur in the *social context* of an auction setting trigger a herding effect (Banerjee, 1992), causing a higher sales price to be achieved. They frame their argument for competitive behaviour and herding in terms of a low guide price stimulating market entry, generating *escalation of commitment* with increased participation, conveying value and fuelling further bidding. Escalation of commitment has both cognitive and emotional dimensions (Wong et al., 2006). Ku et al. (2006) argue that the "*complex social interactions*" (p. 977) arising from these factors will negate the assimilative role of the guide as an anchor. Though they motivate their study by reference to anecdotal reporting in the press that lower residential real estate asking prices generate higher sales prices (p. 975), their sample of auctioned items consists of low-value items such as rugs, cameras and shirts. They find evidence, in eBay auctions, of items starting with a low guide price ending up generating more competition, resulting in a higher ultimate selling price consistent with what they term the *reversal-of-the-anchoring* effect. For home purchasers, on the other hand, where house values can be several times the households' net worth (Flavin &

Yamashita, 2002), there are incentives for prospective purchasers to engage in more substantive search activity prior to the auction (Holt & Laury, 2002) and not be "fooled" by an artificially low price. Thus, it is an open question whether the empirical findings of Ku et al. (2006) in an auction setting are replicable in the context of high stakes transactions.

Interestingly, over the time period of our study there was widespread anecdotal newspaper speculation that auctioneers set low guide prices, thereby creating artificially high prices at residential property auctions by generating a frenzy of interest in property transactions, and that prices could only go in one direction: upwards.[2]

A related literature in behavioural economics, psychology and in other business disciplines, notably marketing, characterising auctions as a social setting, finds that the influence of competing bidders in an auction setting stimulates an emotional response by other bidders, a phenomenon referred to as *auction fever* (e.g. Adam et al., 2015; Ehrhart et al., 2015; Jones, 2011; Malmendier & Lee, 2011). Emotions can restrict attentional capacity (Mano, 1992), leading to increased risk-taking and less robust information-processing (Mano, 1994). Auction fever is enhanced by the excitement associated with the social interactions arising from the physical presence of other bidders at an auction and where there is increased time pressure (Maule et al., 2000). Auction fever has been shown to trigger physiological responses consistent with heightened emotional states (Astor et al., 2013). The impact of time pressure is more manifest with the English style of ascending-bid auctions[3] than with their descending-bid counterparts (Cheema et al., 2012). In this literature, the guide price plays a role to the extent that it stimulates auction competition.

In contrast to auction fever and the *reversal-of-the-anchoring* effect, there is an extensive corpus on anchoring as one of the purest forms of behavioural phenomena and it is among the most robust observations in the psychology literature. The anchoring and inadequate adjustment phenomenon is a cognitive bias arising from individuals' cognitive limitations in making decisions (Tversky & Kahneman, 1974). Research on *anchoring and insufficient adjustment* has repeatedly demonstrated that there is insufficient adjustment up or down from a starting position and exposure to even irrelevant numbers makes individuals' subsequent quantitative judgments *assimilate* to the anchor. Anchoring has been shown to have a considerable effect on buyer–seller negotiations where final outcomes are highly correlated with first offers (Galinsky & Mussweiler, 2001) and is present in a wide range of literatures, including those on: financial transactions (Chang et al., 2013);

2 For example, Property problems. *Irish Times*. August 6, 2005; Are advised minimum prices any better than guide prices? *Irish Times*. March 9, 2006; Auction guide prices still don't add up. *Irish Independent*. August 28, 2006.

3 Irish residential real estate auctions are English-style ascending bid auctions.

public policy assessment (Plous, 1989); and judicial verdicts (Englich and Mussweiler, 2001). Auction guide prices may thus act as anchors on final price outcomes.

The auction fever and anchoring arguments are in direct contrast to hedonic asset pricing models (HAPM) that are widely used in the real estate literature, which consider prices to be set rationally and ultimately determined by attributes, such as location and amenities and other such characteristics (Sheppard, 1999; Sirmans et al., 2006). To the extent that the guide price is not an unbiased estimator of fundamental value, it will have no value in determining auction price outcomes. From this perspective market forces are expected to correct any mispricing behaviours.

In bubble market conditions, investors' susceptibility to emotional factors in their decision-making is heightened (Aliber & Kindleberger, 2015; Andrade et al., 2016; Shiller, 2014; Taffler, 2018).[4]

Thus, studying auction bidding behaviour in a bubble market context, and in the context of high-stakes decisions (in contrast with Ku et al., 2006) provides a rich context to explore whether there is an *assimilative effect* of guide price anchors present in such a setting. It is an open question whether the impact on competitive bidding behaviour of auction fever, heightened in bubble market conditions, may impede any assimilative role for the guide as an anchor on price outcomes in such a context, or indeed whether prices are driven by a HAPM and the guide price has no role.

Bucchianeri and Minson (2013) is the only extant research purporting to explore the predictions of Ku et al. (2006), and implicitly auction fever, in relation to competitive dynamics, guide prices and price outcomes in a high-stakes decision-making context, in a 'hot' market. They investigate the impact of list prices on the sales prices of residential homes in Delaware, New Jersey and Pennsylvania in the US over the period January 2005 to April 2009 and find that, after controlling for fundamentals, properties with a higher list price generate a higher sales price, which is consistent with purchasers anchoring on property list prices in buying a property. They test whether in 'hot' markets the relationship between list prices and sales prices would be different if a lower list price were set to generate more competitive bidding, thereby generating a higher sales price, consistent with the arguments of Ku et al. (2006). They, however, report no difference in their results, conditional on the hotness of the market.

In their paper, Bucchianeri and Minson (2013) characterise a 'hot' market as zip code transaction volume up 30% over the equivalent month in the previous year. However, this measure is not one of price activity *per se* for a number of reasons. First, in the real estate literature there is an ambiguous relationship

4 Aliber and Kindleberger (2015), in characterising bubbles, give examples of the various emotional terms used in the media to describe the euphoric state that arises in a speculative bubble: "Manias ... insane land speculation ... blind passion ... financial orgies ... frenzies ... feverish speculation ... epidemic desire to become rich quick ... wishful thinking ... intoxicated investors ... turning a blind eye ... people without ears to hear or eyes to see..." (p. 41).

between trading volume activity and price changes (e.g. Clayton et al., 2010; Genesove & Mayer, 2001; Stein, 1995). In fact, Clayton et al. (2010) find no correlation between property price increases and trading volume activity.

Secondly, Bucchianeri and Minson (2013) use zip code transaction volume as a proxy for the number of competitive bidders and hence a measure of the degree of herding behaviour in property transactions. However, there is no necessary connection between the number of real estate transactions in a zip code (postal district) and the number of bidders on properties. For instance, lower transaction volume in a zip code area could be associated with more bidders on each individual property transaction if the available properties in an individual zip code are scarce during that period due to an excess of demand over available supply. Thus, transaction volume activity in a zip code may only be an imperfect proxy for competitive bidding behaviour on individual properties within that zip code.

Thirdly, as they conduct their study using negotiated sales transaction data rather than auctions, the social context of observable competitive bidders is absent, which is a key ingredient in the Ku et al. (2006) model as well as in studies on auction fever. Indeed, Bucchianeri and Minson (2013) specifically acknowledge this potential problem in discussing their findings: "Herding requires a thick market with multiple buyers acting concurrently. It may be the case that this is simply not possible in the case of residential real estate where buyers are too few and too dispersed to influence each other." (p. 88).

Our study, in contrast, specifically investigates the impact of anchoring in the ultimate of 'hot' markets, a bubble market, where prices have been on a sustained upward trajectory during the entire time period of our study. In addition, we provide a *direct* measure of the intensity of competition for *each* of our sample properties rather than relying on zip code transaction volume as a proxy, as is done in Bucchianeri and Minson (2013). Also, we address the rationalisation by Bucchianeri and Minson (2013) of their findings that a lower list price does not result in a higher sales price in a hot market as potentially being attributable to the difficulty for prospective purchasers to herd if they are unaware of each other's bidding strategies. We can do this as our research is conducted in the context of public open outcry house auctions where the number of competitive bidders can be directly observed, as they are all in a *central location* (the auction room) and their bidding behaviour is apparent to all present at the auction. Such factors have been shown to be drivers of auction fever (e.g. Ehrhart et al., 2015).

Our research findings are interesting from a number of perspectives. We find, consistent with theory, that greater auction competition generates a higher auction price. However, we report no relationship between the intensity of auction competition and the level of the guide price set by the auctioneer. In other words, a lower guide price relative to fundamentals does not induce a greater number of competing bidders to enter the auction process, as predicted by Ku et al. (2006). Furthermore, we find that the *assimilative role* of the auction guide price plays a significant role in determining auction outcomes,

consistent with anchoring and insufficient adjustment. Accordingly, those properties that have a lower guide price relative to fundamentals generate lower sales prices than those properties that have a higher guide price relative to fundamentals. Thus, any potential emotional impact of competition in an auction setting in a bubble-market setting does not drown out the power of the guide price as an anchor in such a context. Our results are consistent with anchoring being a robust phenomenon in an auction setting in bubble markets.

Interestingly, we find that auctioneers, in setting guide prices, consistently set the guide price low relative to fundamentals and, in many cases, substantially lower than fundamentals, which counters our findings that such a strategy does not generate more competition and drive up auction prices. This appears, prima facie, to be consistent with the belief that setting a lower guide price may be a better strategy for maximising sales revenue and an implicit belief in the authenticity of the assumptions underlying the reversal-of-the-anchoring effect. However, we suggest that a primary motivator in the setting of guide prices below fundamentals is a marketing mechanism to create an illusion of scarcity, generating newspaper headlines of auction prices systematically exceeding guide prices. Thus, the actions of auctioneers in setting low guide prices relative to fundamentals may, in fact, dampen the effect of the bubble rather than amplify it.

The rest of this paper proceeds as follows. In the next section we set out the mechanics of the residential auction process in the Dublin auction rooms. In the following section we describe our sample characteristics. In the next section we explain how we determine the fundamental values of our sample of auctioned properties. We present our initial results on the relationship between auction guide prices and the level of auction competition in the following section to explore whether the level of auction competition is related to the auctioneer's setting of the guide price. In the penultimate section we present our results on the relationship between auction guide prices and the prices achieved for auctioned properties. In the final section we conclude.

Mechanics of the Auction Process in the Dublin Auction Rooms

Irish residential real estate auctions are conducted with the English open-outcry (ascending-bid) auction[5] mechanism.[6] The auctions are held in a public auction room and the results are published in national newspapers. In English-style auctions the auctioneer opens the auction typically by inviting offers for

5 Cramton (1998) shows that an English open-outcry ascending-bid auction mechanism dominates the use of sealed bid auctions and leads to greater efficiency and higher price outcomes in a common value auction, such as a property auction. The argument in Cramton (1998) is that in such an auction setting bidders can add to their own information set about common value by observing the bidding behaviour of other bidders. Thus, open bidding, especially by many bidders, reduces uncertainty by imparting information that the bidders can use to update their estimates of value, leading them to bid more aggressively. However, as Shi and Kabir (2018) note, observing other bidders can provide false comfort about value and reinforce bidding strategies that move prices from fundamentals.

6 Residential real estate auctions may have some features of private value auctions which relate to assets that appeal to bidders' aesthetic sense. Auctioned real estate property values, however, also have a substantial common value element. The cross section of international property values can be largely explained by objectively observed property features and traits (Sirmans et al., 2006), and the Dublin auction rooms for residential real estate, even at the height of a so-called bubble market, are shown in this paper to be no exception to this general rule.

the property at the auction guide price and if there are no bids they then reduce the bidding until a starting bid is received. At that stage, the auctioneer suggests a level for the second bid and bidding would proceed with the auctioneer announcing the next price level.[7] When the bidders complete bidding, the auctioneer looks around the room to all previous bidders to encourage further participation. If no further bids are forthcoming, the auctioneer announces "going, going twice, sold" or alternatively the auctioneer indicates that the vendor's undisclosed reserve price has not been reached and that the property is withdrawn. In such circumstances, the auctioneer indicates the highest unsuccessful bidder at that stage would for a certain time period (typically a day or so) have exclusive rights to negotiate with the vendor following the auction. There is no requirement to publicly disclose the reserve price and it is not done in Irish residential real estate auctions.[8] Vincent (1995) argues that in common value auctions, non-disclosure of the seller's reserve price is optimal as it encourages the entry of more bidders to the auction.

In the event of a successful auction, the highest bidder is immediately invited to meet the vendor and pay a non-refundable deposit of 10% of the sales price, and sign contracts normally within six weeks of the auction date. As Dublin real estate auctions require the successful bidder to pay the deposit for the property immediately after the auction, a potential bidder is likely to have spent funds on a property survey and a title search prior to the auction. In comparison, in negotiated private treaty sales the deposit is refundable up to the date contracts are signed, normally four-to-six weeks after the price is agreed.

In Ireland, the law requires that three weeks prior to the actual auction a guide price is set for a property. The auction guide price is not a legally binding commitment for either the seller or the buyer as to the final sales price. Also, it is important to note that the guide price and the auction reserve price are not the same thing and that the guide may not necessarily influence the reserve.[9]

Sample Characteristics

Our sample period consists of the 18 months from September 2004 to February 2006 (**Table 1**). This period ended 14 months prior to the start of the unravelling of the bubble in April 2007. Prior to our sample period, the Irish residential real estate market had been on an upward trajectory since January 1994, with no quarter during that entire period exhibiting a price drop (**Figure 1**). Prices in September 2004, the start date of our sample period, were up in

7 In some cases, bidders pre-empt the auctioneer and announce a bid in excess of the previous pattern of increment increases.

8 Even in those jurisdictions where seller reserve prices are disclosed, the reserve price is an imperfect proxy for value. The real estate literature finds that buyers are in general better informed than sellers about value, whereas the seller has more information about the condition of the property (Levitt and Syversen, 2008). This asymmetry in relation to condition can be resolved by a property inspection or a survey prior to the auction.

9 Stevenson, Young and Gurdgiev (2015), using confidential Irish real estate agent data, report (Table 1, p. 385) that mean and median guide prices bear no relationship to the seller's reserve price and are typically less than "undisclosed" reserve prices. They speculate, but do not test, that the setting of the guide below the reserve may act as an incentive for bidders to enter the auction, stimulating bidding activity and generating higher auction prices. This untested conjecture is consistent with the predictions of the *reversal-of-the-anchoring* effect (Ku et al., 2006).

Table 1. Auction Results for September 2004 To February 2006

Period	Total auctioned	Total sold at auction	Sold prior to auction	Sold directly after auction	Withdrawn and sold within six weeks of the auction
September to December 2004	405	155	156	61	174
January to April 2005	331	158	6	77	90
May 2005 to August 2005	421	179	30	83	129
September 2005 to February 2006	408	174	17	72	145
Total	1,565 (100%)	666 (44%)	68 (3%)	293 (19%)	538 (34%)

This table presents background statistics on the total population of auctions taking place in the Dublin residential real estate market over the period September 2004 to February 2006.

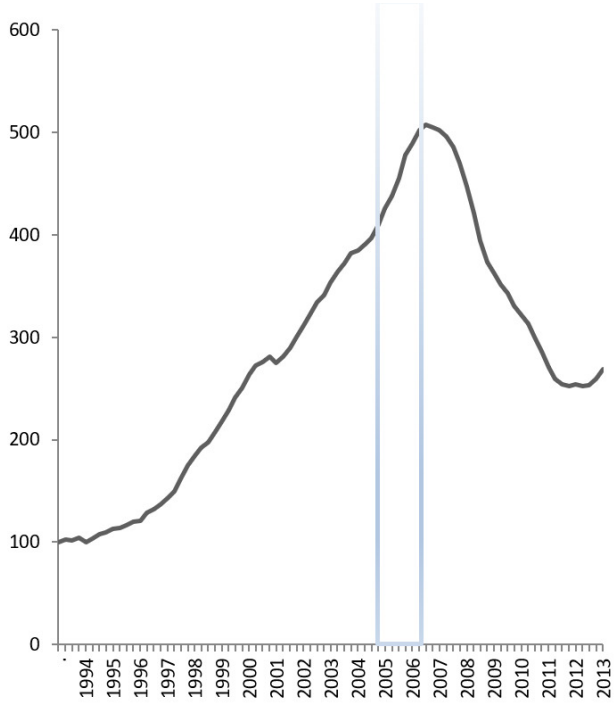

Figure 1. Irish Residential Real Estate Prices 1994–2013.

This figure presents the trajectory of Irish residential real estate prices over the period 1994–2013, with 1994 set as 100. The rectangular box highlights the time interval of our observed auctions from September 2004 to February 2006.
Source: OECD (https://data.oecd.org/price/housing-prices.htm).

excess of 375% since January 1994. When the property bubble finally burst, it had disastrous consequences, not only for the housing market in Ireland, but also for the banking system and, critically, the entire Irish economy. It eventually triggered a €64 billion bailout from the International Monetary Fund, the European Commission and the European Central Bank in November 2010 (Nyberg, 2011).[10]

10 Such was the dominance of the real state sector in the performance of the Irish economy during the bubble period that it distorted macroeconomic aggregates, including, importantly, the interpretation of GDP growth (e.g. Donovan & Murphy, 2013).

During our sample period, there were a total of 1,565 auctions, of which 666 (44% of the total) resulted in a successful sale on the day of the auction. The authors attended 210 of these auctions. These 210 auctions were chosen randomly from a selection of residential real estate auctions in the Dublin area.[11] The auctions were held mid-week, usually on Tuesday, Wednesday and Thursday afternoons, in the auction rooms of the real estate agents, with a number of auctions taking place in sequence. The auctions generally occurred at concurrent times in the different auction houses. In order to ensure a representative sample of auctions to attend, we proceeded by counting from the property supplements of the main newspapers the number of auctions that took place in the Dublin region in the year immediately prior to our sample period (September 1, 2003 to August 31, 2004). We noted the number of auctions per month, the identity of the auctioneering firm and the Dublin postal district (zip code) in which the auction took place. We then selected the auctions to attend post September 1, 2004 to ensure that our sample is representative of these features. For instance, as more auctions take place in March than in January, proportionately more auctions were attended in the March period than in January. Different auctioneers have differential market power as measured by the number of properties they auction. They also tend to dominate particular postal districts. Thus, we weighted the number of attended auctions in proportion to this 'market power' in the September 1, 2003 to August 31, 2004 period, after we had determined the number of auctions to attend per month.[12]

Of the 210 auctions, 106 of these resulted in a successful auction on the day of the auction, with the remainder selling within approximately one month following the auction via the negotiated sales mechanism. Ultimately, we restricted our sample from 106 to 87 as we needed to be able to compare the prices achieved at our sample auctions with a portfolio of similar properties (see below).

In addition to attending the 210 auctions, the authors went to the public viewings of in excess of 700 properties to be auctioned during the sample period. In each case, the authors asked the real estate agents showing the properties what they expected the properties to go for at the auction. Interestingly, in all cases, the agents indicated that they expected prices to be in excess of the guide price, usually indicating ranges of 20%–30% over the guide prices, with many commenting that there is strong buyer interest.

11 The city and its region account for almost one third of the population of Ireland and generate close to 40% of GDP. Dublin is subdivided in to 22 postal districts.

12 As a check on the representativeness of our sample auctions across postal districts we performed a chi-squared test of the proportions of our attended auctions per postal district vs. the entire sample reported in Table 1 and were unable to reject the hypothesis that our attended auctions are not representative of the population of 1,565 auctions. However, it is noteworthy that properties in certain postal districts are more likely to be auctioned than in other postal districts (see footnote 15).

Reference Prices for Benchmarking Purposes

To test the role of auction guide prices in determining price outcomes, we require robust estimates of an auctioned property's benchmark value to act as a reference point. We adopt a dual approach, discussed below. Our primary benchmark is a reference price based on the average of similar properties, which we will style as *self-similar* properties, to the property being auctioned, using professional real estate agents who are experienced auctioneers to identify these comparable properties. The advantage of this approach is that experienced auctioneers are well placed to identify characteristics of the properties that are value relevant that a HAPM model may not fully capture. (To obviate concerns of bias by the auctioneers, the authors did not communicate directly with them the purpose of the study, other than to state that the research is an investigation of prices achieved at auctions.) The second benchmark, employed as a robustness test, is a reference price derived from a hedonic asset pricing model (HAPM).

Average Price of Self-similar Properties

To calculate the average value of the self-similar properties we commence with the 106 successfully auctioned properties that were attended by the authors. We construct a self-similar portfolio of real estate prices for each of our auctions in the following way:

1. All 666 successful auctions from **Table 1** are arranged according to the criteria: time period of the auction; location; house type; square footage; number of bedrooms; and condition of the property.

2. The identification of these criteria, and their ordering in terms of importance, were provided and agreed by two experienced auctioneers (one a current director and one a recently retired director of a major real estate agency). They considered these variables and their ordering to be the key variables in identifying self-similar properties in the first instance and to be the most important characteristics in setting the auction guide price.[13] In cases where neither of our experienced auctioneers had direct knowledge of our successfully auctioned properties (e.g. the property is located in a postal district with which they are not familiar), the authors employed the services of two back-up real estate agents. The services of these backup agents were also used where our two experienced auctioneers are unable to agree on *self-similar* properties.

3. Self-similar properties are selected in respect of each of our sample of 106 successful attended auctioned properties. They are identified in respect to the above criteria and in the order specified above. By "time period of the auction" we mean that in order to be a potential

13 The criteria selected by the two independent auctioneers all proved to be significant factors determining price in the HAPM discussed below, which provides a robustness test for the matching process.

candidate as a self-similar property, the property must have been successfully auctioned no longer than one month prior to that of our sample auctioned property.[14] In terms of "location", the property must be located in the same postal district as our sample of auctioned properties. (These criteria are more restrictive conditions than adopted in the HAPM below, where we amalgamate postal districts into discrete areas for the location variable and we use quarterly dummies for time.)

4. Once the authors had completed the matching process recommended by the auctioneers, the matched portfolios of self-similar properties were checked by each of the auctioneers independently for consistency and to spot any anomalies. At this stage some of our sample properties were excluded if, in the opinion of our auctioneers, there were distinguishing features (unique characteristics) in relation to those comparable properties, or indeed our sample properties, which may have made a comparison inappropriate, e.g. corner site, house sold with planning permission for extension already obtained, south-facing garden, exceptional décor, etc. This is important to ensure that, as far as practicable, potentially price-relevant unique characteristics, of which the authors are unaware, are not influencing the auction guide price. Also, in a number of cases the auctioneers selected properties in adjacent postal districts if they considered them a better match than properties located within the postal district in which the property auction itself was located.

5. The mean of the auction price of self-similar properties is calculated: $(\bar{x})$

As a result of the matching process, our sample of successful auctions was reduced from 106 to 87 in order to have a reasonable sample of at least three self-similar properties to make a price comparison.

Hedonic Asset Pricing Model (HAPM)

The model is estimated in log form (Sirmans et al., 2006). The following regression is run:

$$In(\text{SP}) = \alpha + \sum \beta_{iXi} + \varepsilon \quad (1)$$

where selling price (SP) is expressed in log form, α is a constant term, β_i is the regression co-efficient for the i-th housing characteristic, X_i, and ε is the residual error term.

The characteristics evaluated in the model are broken down into their physical features (property size, number of bedrooms and bathrooms, garden, type of property, property condition). In addition, we explore the properties'

14 Employing a longer window, such as two months, would have increased the number of comparable self-similar properties. However, adopting a longer window also potentially increases the likelihood that prices may be potentially stale.

locations, the size of the real estate agency marketing the properties, and the time period in which the properties are auctioned. Property size is measured by the log of the square footage of the property. In relation to gardens, we adopt a dummy variable approach taking on a value of 1 if the garden size is under 50 feet in length, and zero otherwise. The property's condition is also evaluated using a dummy variable approach. Condition takes on a value of 1 if the property is in excellent or good physical condition and zero otherwise. The data for the condition variable is extracted from the estate agents' brochures for the auctioned properties and, where these are not available, from the agents' websites or from the property descriptions in the national newspapers. In relation to property types, these are decomposed into four categories (apartment, semi-detached, detached, period property). The property type dummy excluded is period property. A dummy variable approach is adopted in relation to the size of the real estate agency marketing the property. The top six real estate agencies account for over 70% of auctions and a dummy variable is set equal to 1 if the auctioned property is sold through one of these agents and zero otherwise. In relation to location, the Greater Dublin area is divided into Dublin Central, North Dublin, South Dublin and South County Dublin.[15] These areas are identified by postal district codes and are grouped accordingly. The location variable excluded is North Dublin. Time dummies are also included to capture changes in price activity over the period. These time periods are September to December 2004, January to April 2005, May to August 2005 and September 2005 to February 2006. The time dummy excluded is September 2005 to February 2006.[16]

The results of the hedonic asset pricing model, Equation 1, are reported in **Table 2**.

We would expect, with the exception of the garden variable (expectation of negative and significant), that the coefficients on the physical property characteristics such as property size, number of bedrooms, number of bathrooms, etc. would be positive and significant. The reported coefficients are in line with expectations, with many of the variables significant at the 1% level. The property types are all significant, with the exception of the apartment category. In relation to the location dummy variables, they are all significant, with the exception of Dublin Central. The South County Dublin area is highly significant. The real estate agency dummy variable is not significant. The time dummy variables are all negative and significant, with the exception of the May to August 2005 period, which, though negative, falls slightly short of significance at the 10% level. The negative coefficients on the time dummies are reflective of a rising property market over the period. It is noteworthy that

15 Location is dominated by two key submarkets, namely South Dublin and South County Dublin. These are the two most highly priced areas in Greater Dublin.

16 We also reran our HAPM regression using monthly rather than quarterly dummies with no impact on our reported results.

Table 2. Hedonic Asset Pricing Model Regression

Variable	Coefficient	T-statistic
Constant	9.75	26.71***
Square feet†	0.54	9.90***
Bedrooms	0.07	3.31***
Excellent condition†	0.09	2.84***
Small garden†	- 0.23	- 6.67***
Apartment†	0.19	1.53
Semi-detached†	- 0.19	- 4.88***
Detached†	0.079	1.92*
Bathrooms	0.048	2.77***
Dublin Central†	0.011	0.14
South Dublin†	- 0.44	- 2.95***
South County Dublin†	0.23	5.05***
Big agent†	- 0.05	- 1.11
Sept-to- Dec04†	- 0.22	- 4.91***
Feb-to- April05†	- 0.12	- 2.87***
May-to-July05†	- 0.06	- 1.51
R^2 adjusted	64.3%	

This table shows the results of the hedonic asset pricing model regression (HAPM), Equation 1. The model is estimated in log form (Sirmans et al., 2006). The characteristics evaluated in the model are broken down into their physical characteristics (property size, number of bedrooms, number of bathrooms, garden, type of property, property condition). In addition, we explore the properties' location (postal district), the size of the real estate agency marketing the properties and the time period in which the properties are auctioned. Property size is measured by the log of the square footage of the property. In relation to gardens, we adopt a dummy variable approach taking on a value of 1 if the garden size is under 50 feet in length and zero otherwise. The property's condition is also evaluated using a dummy variable approach. Condition takes on a value of 1 if the property is in excellent or good physical condition and zero otherwise. In relation to property types, these are broken down into four categories (apartment, semi-detached, detached, period property). A dummy variable approach is adopted in relation to the size of the real estate agency marketing the property. The top six real estate agencies account for over 70% of auctions and a dummy variable was set equal to 1 if the auctioned property is sold through one of these agents and zero otherwise. In relation to location, the Greater Dublin area is divided into Dublin Central, North Dublin, South Dublin and South County Dublin. These areas are identified by postal district code and are grouped accordingly. The location variable excluded is North Dublin. Time dummies are also included to capture changes in price activity over the period. These time periods are September to December 2004, January to April 2005, May to August 2005 and September 2005 to February 2006. The time dummy excluded is September 2005 to February 2006. Dummy variables are denoted by †. The level of significance is denoted by: *** p≤ 0.01, ** p≤ 0.05**, * p≤ 0.10.

the R^2 associated with the model is 64.3% indicating a good fit and is broadly comparable to the magnitudes reported in the HAPM literature (e.g. Sirmans et al., 2006).

Guide Prices and Auction Competition

In this section, we test the relationship between the level of the guide price relative to fundamentals and the intensity of auction competition. If a lower guide relative to fundamentals stimulates more auction competition, then this would be supportive of the reversal-of-the-anchoring effect hypothesis. We address two questions: (1) do auctioneers set guide prices low relative to fundamentals? and (2) do guide prices influence the intensity of auction competition in the way suggested by the reversal-of-the-anchoring effect hypothesis?

In **Table 3** we present summary statistics on the relationship of guide prices relative to our two measures of fundamental value: the mean of self-similar properties and the HAPM derived price. **Table 4** then explores the relationship between the auction guide price and the degree of auction competition.

Table 3. Frequency Distribution of Guide Prices Relative to HAPM and Mean Prices of Self-Similar Properties

% Range of guide prices relative to reference benchmark	Guide price relative to HAPM	%	Cumulative % (descending)	Guide price relative to mean price of self-similar properties	%	Cumulative %
More than 20						
10 < x ≤ 20	3	3.4%	100.0%			
5 < x ≤ 10	0	0.0%	96.6%			
0 < x ≤ 5	2	2.3%	96.6%			
-5 < x ≤ 0	2	2.3%	94.3%			
-10 < x ≤−5	6	6.9%	92.0%			
-20 < x ≤−10	21	24.1%	85.1%			
-30 < x ≤ −20	25	28.7%	61.0%	12	13.8%	100%
-40 < x ≤−30	18	20.7%	32.3%	73	83.9%	86.2%
-50 < x ≤ −40	7	8.1%	11.6%	2	2.3%	2.3%
-60 < x ≤ −5 0	2	2.3%	3.5%			
-70 < x ≤ −60	1	1.2%	1.2%			
Less than -70						
Average	- 24.1%			- 32.8%		
Standard Deviation	16.0%			10.0%		
t-statistic	14.0			91.4		
Median	- 22.9%			- 32.2%		
Minimum	- 69.9%			- 40.1%		
Maximum	14.4%			- 25.1%		
Total	87			87		

Table 4. Regression of Competition Proxies on Guide Reference Price Relatives.

	Intercept	G_t= ln(Guide/HAPM)	G_t= ln(Guide/Mean)	R^2
Panel A				
Competition = No. of bidders				
	3.11 (3.06)***	-0.39 (-0.13)		1.16%
	3.25 (17.45)***		0.038 (0.06)	1.17%
Panel B				
Competition = Average number of bids per bidder				
	1.01*** (3.73)	-17.26 (-1.15)		1.52%
	5.90*** (8.61)		-3.21 (-1.15)	0.95%

This table presents the results of our two regressions from Equation 3. The independent variable in both instances is the deviation of the guide price from a reference price. In the HAPM regression the reference price is the price generated from the HAPM regression reported in **Table 2**. In the case of the "Mean price of self-similar properties regression", the reference price is the mean price of similar properties that were successfully auctioned in the same time period as our sample of 87 auctions, using a number of the characteristics from the HAPM model (**Table 2**), specifically: time period of the auction, location, house type, square footage, number of bedrooms and the condition of the property. In both cases, the actual winning bid is divided by the reference price and the natural log calculated. The competition variable is the number of bidders at the auction (Panel A) or the average number of bids per bidder (Panel B). The level of significance is denoted by *** p≤ 0.01, ** p≤ 0.05**, * p≤ 0.10.

Table 3 presents the frequency distribution of reported guide prices relative to both the mean price of self-similar properties (G_t) and also to the HAPM equivalent, where:

$$G_t = \ln\left[\frac{Qt}{P_{m,t}}\right] \quad (2)$$

and Q_t is the guide price for property t and $P_{m,t}$ is the reference price for the t-th property. 'M' can take on one of two values: the mean price of the self-similar properties or the HAPM predicted prices that were determined in the previous section.

Table 3 shows that the average guide price as a percentage of the HAPM is -24.1%, the minimum is -69.9% and the maximum is 14.4%. The t-value of the average discount to the mean price of self-similar properties is significant at the 1% level. Interestingly, in 94.3% of cases the guide price is set at less than the HAPM. Measuring the guide price relative to the mean price of self-similar properties the average discount is -32.8%, again significant at the 1% level. The minimum is -40.1% and the maximum is -25.1% and in all cases the advertised guide price is less than the mean price of self-similar properties. In aggregate across both reference prices, these results reflect a systematic understating of the value of the property by the estate agents in setting their guide prices and suggest that the guide price is not a good estimator of property value. Rather, it may be a tool to attract bidder interest and stimulate the intensity of auction competition consistent with the predictions of the reversal-of-the-anchoring effect.[17]

We test whether there is an inverse relationship between the guide price and competition at the auction by performing the following regression:

$$C_t = \gamma_0 + \gamma_1 G_t + \varepsilon_t \quad (3)$$

where G_t, the independent variable, is defined as in Equation 2 above. We employ two measures of competition (C_t) for robustness purposes: the first proxy is the number of bidders in auction t; the second proxy is the average number of bids per bidder that an auction takes to reach its conclusion from the initial bid (Tse et al., 2011).[18] The average number of bids per bidder is thus the total number of bids in the auction divided by the number of bidders at the auction. ε_t is the residual term.[19]

17 Interestingly, both authors of this paper had independently sold a property via the auction mechanism just prior to the sample period. In both cases, the auctioneer had advised setting the guide price substantially below the expected auction sales price to stimulate interest and auction competition. Such personal experience stimulated the authors to gather data to write this paper.

18 An average of 3.2 bidders bid at each auction with an average 6.7 bids per bidder. The maximum number of bidders bidding at an auction is 6 ("average number of bids per bidder" is 21.5) and the minimum number of bidders is two ("average number of bids per bidder" is 2.3).

19 The average number of bids per bidder may capture a different aspect of competitive dynamics at an auction. Ku et al (2006) argue that the more bids that a person makes the more committed they are to win the auction; they accumulate sunk costs in time and energy. Each time they bid they are for a moment the new owner of the property. For that moment they may be the subject of the *endowment effect*. When they are outbid their sunk costs and the endowment effect may encourage them to escalate their commitment and bid more. The endowment effect associated with auction fever is particularly pronounced in situations of valuation uncertainty (Ehrhart et al., 2015).

The results are reported in **Table 4**. If a lower guide price relative to either the HAPM or mean price of similar properties stimulates more competition in the auction, we would expect a negative and significant relationship between G_t and both competition proxies.

Though in the expected direction in three of the four regression equations, we find that the relationship in Panels A and B is not even close to being significant.[20] In addition, we report that none of the R^2s associated with the four regression equations has an explanatory power in excess of 1.5%, suggesting that the guide price is not an important determinant of the intensity of competition at the auction. Thus, it is interesting to note that though the real estate agents appear to set the guide price below the reference price, this does not translate into increased competition for those properties. Auctioneers may have an incentive to set a low guide price to enhance the probability of a sale at the auction as opposed to maximising the price at an auction. Real estate markets are prone to standard agency problems as real estate agencies receive only a small percentage (typically 1.5% to 2.5%) of the sales proceeds as commission (e.g. Levitt & Syverson, 2008) and hence their share of the sales proceeds is relatively low. We test whether this occurred by performing a difference in means test for the G_t variable between those properties sold at auction and those withdrawn and subsequently sold through the negotiated sales mechanism, and find no significant differences in means, indicating that the level of the guide price was not a factor leading to an unsuccessful auction.[21] Thus, it appears that the level of the guide price relative to fundamentals does not have an impact in terms of driving the likelihood of sale in an auction setting rather than the property being withdrawn and sold later by means of a negotiated sales transaction.

Our findings, while not in line with potential agency considerations, are potentially consistent with the literature finding that in bubble markets experts are also subject to mistakes and biases in decision-making, as has been shown in studies on their less experienced counterparts (e.g. Cheng et al., 2014; Hussam et al., 2008).[22] Thus, it may be that our real estate agents believe in the reversal-of-the-anchoring effect hypothesis, even though it does not appear to have any validity.

Is it the case that auction prices are determined rationally based on housing characteristics adopting a HAPM approach (e.g. Sirmans et al., 2006) and that the setting of artificially low guide prices may have no demonstrable impact on auction prices? Given the value of auctioned real estate relative to an

20 As an additional robustness test, we perform two additional regressions using data from the portfolio of self-similar properties. Specifically, we run the regressions using (1) the maximum value, and (2) the minimum value from these portfolios for each of the properties as the independent variable, rather than the mean price of similar properties. Our results in both cases are similar to those reported using the mean (average) value of self-similar properties.

21 To perform this test, we adopt the same methodology to calculate the mean prices of self-similar prices as that adopted for the portfolio of successful auctions.

22 For example, Cheng et al. (2014) find that professional banker lenders in the middle of the US property bubble were exposed to biased behaviour in forming their own property portfolios in the same way as less experienced individuals.

individual's wealth (Flavin & Yamashita, 2002) there may be more incentives for information search prior to engaging in the auction and therefore less reason for bidders to use the advertised guide price as a valuation signal (Holt & Laury, 2002).

In the next section we test the relationship between guide prices and auction sales prices. If it turns out that our subsequent results are consistent with auction winners anchoring on the guide price, then it would be the case that paradoxically the actions of auctioneers through setting low guide prices relative to fundamentals may have potentially dampened the impact of the Irish residential property bubble rather than amplified it.

Guide Prices and Final Auction Prices

Model

Our proxy to reflect the impact of the various factors on bidding behaviour and auction outcomes is based on the deviation of the winning auction bid from our two reference prices discussed above.

We estimate the following equation:

$$B_t = \gamma_0 + \gamma_1 C_t + \gamma_1 G_t + \varepsilon_t$$
$$B_t = ln\left[\frac{P_t}{P_{m,t}}\right] \quad (4)$$

Our dependent variable, B_t, is the deviation, of the winning bid price, p_t, from its reference price, $p_{m,t}$, where p_t is the value of winning bid for the t-th property and $p_{m,t}$ is the reference price 'm' for the t-th property. 'M' can take on one of two values: the average price of the similar properties or the HAPM predicted price. The subscript t denotes the t-th auction. The γs are regression parameters to be estimated. Guide 'G' for property 't' is calculated in a similar manner to B_t and is the same variable as set out in Equation 2 above. The advantage of this approach is that the regression coefficients can be interpreted in percentage terms (Tse et al., 2011). We employ the same two measures of competition (C_t) in auction 't' that we employed in the previous section.

Prior auction research has consistently demonstrated that higher competition leads to higher auction prices and has both rational and psychological drivers. Bazerman and Samuelson (1983) interpret competition in terms of its impact on auction participants bidding to their own reservation price. In their model, as the number of bidders increases, bidders will bid closer to their own reservation prices and the expected sales revenue increases. In the absence of competition, there are fewer incentives for bidders to bid up to their own valuation prices and it is less likely that there will be a successful sale. Thus, in their model bidders *rationally* respond to the number of bidders at the auction. Other models of competition argue that the competitive process itself may generate its own momentum, triggered by behavioural and emotional factors causing prices to detach from fundamentals (e.g. Adam et al., 2015; Ku et al., 2006).

Table 5. Winning Bid Price Relative Regressions Using Number of Bidders as the Competition Proxy

Variable	HAPM	Mean price of self-similar properties
Constant	0.129 (0.94)	0.74 (1.76)*
Competition	0.06 (5.38)***	0.06 (54.47)***
Guide	1.03 (3.11)***	0.89 (13.13)***
R^2	29.66%	70.01%

This table presents the results of our two regressions from Equation 4. The dependent variable in both instances is the deviation of the winning bid from a reference price. In the HAPM regression, the reference price is the price generated from the HAPM regression reported in **Table 2**. In the case of the "Mean price of self-similar properties regression", the reference price is the mean price of similar properties that were successfully auctioned in the same time period as our sample of 87 auctions, using a number of the characteristics from the HAPM model (**Table 2**); specifically: time period of the auction, location, house type, square footage, number of bedrooms and the condition of the property. In both cases, the actual winning bid is divided by the reference price and the natural log calculated. The competition variable is the number of bidders at the auction. The level of significance is denoted by *** p≤ 0.01, ** p≤ 0.05**, * p≤ 0.10.

Table 6. Winning Bid Price Relative Regression Using Average Number of Bids Per Bidder as the Competition Proxy

Variable	HAPM	Mean price of self-similar properties
Constant	0.29 (2.43)	0.21 (6.53)***
Competition	0.01 (3.44)***	0.01 (3.22)***
Guide	1.22 (3.66)***	0.93 (12.34)***
R^2	17.05%	64.71%

This table presents the results of our two regressions from Equation 4. The dependent variable in both instances is the deviation of the winning bid from a reference price. In the HAPM regression, the reference price is the price generated from the HAPM regression reported in **Table 2**. In the case of the "Mean price of self-similar properties regression", the reference price is the mean price of similar properties that were successfully auctioned in the same time period as our sample of 87 auctions, using a number of the characteristics from the HAPM model (**Table 2**), specifically: time period of the auction, location, house type, square footage, number of bedrooms and the condition of the property. In both cases, the actual winning bid is divided by the reference price and the natural log calculated. The competition variable is the average number of bids per bidder at the auction. The level of significance is denoted by *** p≤ 0.01, ** p≤ 0.05**, * p≤ 0.10.

Guide Prices and Auction Outcomes

In **Table 5** and **Table 6** we report on the effects of the guide price and competition on realised auction prices. **Table 5** presents the results with the level of auction competition proxied by the number of bidders at the auction and **Table 6** presents the results with competition proxied by the average number of bids per bidder. These tables are based on the results arising from Equation 4 above.

We find in **Table 5**, consistent with auction theory, that the greater the level of competition, as proxied by the number of active bidders at the auction, the higher the ultimate auction price. Using the HAPM, the addition of one bidder increases the final auction price by 6%. The comparable impact of one additional bidder using the mean (average) price of self-similar properties as the reference price is also 6%. Both coefficients are significant at the 1% level.

In Table 5 we find that a higher guide price relative to either the HAPM or mean price of self-similar properties is positive and significant at the 1% level, indicating that higher guide prices relative to fundamentals lead to higher auction prices and lower auction guide prices lead to lower auction prices.[23]

Our results are consistent with auction winners using the guide price as a price anchor in their bidding behaviour. As a robustness test, Table 6 presents the comparable results to Table 5 but using the average number of bids as the competition proxy. The reported results in Table 6 are identical to those reported in Table 5. Thus, in aggregate our results are invariant to the competition proxy employed.

The R^2 using the HAPM as the reference price in Table 5 (Table 6) is 30% (17%) versus 70% (65%) for the mean price of self-similar properties. This is not surprising, as the methodology employed in calculating the mean price of self-similar properties used real estate experts to determine the comparable properties and explicitly took into account any unique characteristics of either our sample of successful auctions or the comparable properties that may have rendered a comparison potentially inappropriate. Our results in this regard are also interesting in light of the distribution of guide prices relative to both the HAPM and mean price of self-similar properties as reported in Table 3, where the distribution of guide price relative to fundamental values is much tighter using the portfolio of self-similar properties as the benchmark.[24]

Our finding of a significant assimilative impact of the auction guide price on prices contrasts with the findings of Ku et al. (2006). In addition, our results are interesting in light of the findings presented in Table 3 and Table 4, where guide prices are set consistently at a discount to the HAPM and mean price of self-similar properties, and that there is no relationship between auction competition and auction guide prices.

The Ku et al. (2006) model is predicated on a low guide price being a stimulator of auction competition by reducing barriers to entry, increasing sunk costs and escalating commitment. Thus, any assimilative effect of the anchor in auctions is, in their model, more than counterweighed by the impact of auction competition once the auction commences. Such a view of auction competition is also consistent with auction fever, in that the emotions associated with the presence of other people in an auction setting generate excitement and a strong desire to win (Malhotra et al., 2008), overriding any potential anchoring impact of the guide price.

23 For robustness purposes we reran our regressions, first by dropping the competition variable and, secondly, using the residual from Equation 4 rather than the actual competition variable, with no change to our reported results.

24 Using the HAPM as the benchmark price, we report in Table 3 that in a small number of cases the guide price is above fundamentals. This may be potentially driven by some unique characteristics in our sample auctions that are not reflected in the HAPM specification.

Our findings, in contrast, are supportive of both competition and the assimilative effect of the guide price as an anchor being significant determinants of price outcomes across our auction data set. Our results are interesting in light of the persistent behaviour of the auctioneer across our sample period to set the guide price at a discount to fundamental values (Table 3).

Our findings in a bubble market are consistent with anchoring playing a significant role in establishing prices achieved in property transactions. They are not consistent with the reversal-of-the-anchoring effect hypothesis promulgated by Ku et al. (2006). Thus, those properties that were advertised with a high price relative to fundamentals achieved a higher price than those advertised with low prices relative to fundamentals. In other words, residential real estate property buyers anchored on the list (guide) price. Our finding is that in a bubble market, where emotions are likely to play a significant role (e.g. Shiller, 2014) auction bidders anchor on the guide price and the competitive process at the auction does not subsume the role of the guide price as an anchor. In addition, setting a low guide price does not stimulate more auction competition as predicted by Ku et al. (2006). We can conjecture that their finding may be attributable to the nature of the items being auctioned. Their auctioned items were all low monetary value items such as cameras, rugs and shirts. In such circumstances bidders may have been potentially drawn into the auction by the price. In contrast, in the case of our study, given the value of auctioned real estate relative to an individual's wealth (Flavin & Yamashita, 2002), there are more incentives for information search prior to engaging in the auction and therefore fewer reasons for bidders to infer value from the guide price.

Conclusion

The auction literature finds that the intensity of competition drives price outcomes and has both rational and psychological components. Our paper is the first study to test the impact of auction guide (list) prices on both competition and auction price outcomes in a bubble market. Bubble markets provide a rich context to explore the potential impact of behavioural biases and emotions in investors' decision-making processes (Aliber & Kindleberger, 2015; Andrade et al., 2016; Shiller, 2014; Taffler, 2018).

We explore the potential impact of guide prices on price outcomes in residential real estate auctions in the Dublin market over the period September 2004 to February 2006. We address two specific research questions in relation to bubble markets. First, do auctioneers set artificially low guide prices relative to fundamental values and does such a strategy stimulate the intensity of auction competition as found by Ku et al. (2006)? Secondly, does the guide price act as an anchor in determining prices or is any prospective assimilative effect of the guide occluded by any potential psychological factors arising in the auction room and from broader market conditions driving the intensity of auction competition?

Consistent with the auction literature, we find that more intense auction competition is associated with a higher auction price. In addition, we find that final auction outcomes are influenced by the auction guide price. Specifically, we find that those properties with higher guide prices relative to fundamentals result in higher auction prices and those properties with lower auction guide prices lead to lower auction prices. Thus, competitive intensity in English-style open-outcry ascending-bid auctions in a bubble market environment does not occlude the importance of the guide price as an anchor on the determination of winning bid prices in such a setting. Thus, independently of the impact of any emotional factors arising from auction fever, there is a strong assimilative effect of the guide price as an anchor.

We find auctioneers consistently set guide prices low relative to fundamentals, sometimes substantially lower than fundamentals. However, we report no relationship between the setting of the guide price and the intensity of competition at the auction. Thus, it appears that real estate agents are acting as if they believe in the reversal-of-the-anchoring effect.

In this context, it is noteworthy that the proportion of total properties offered for sale by real estate agencies through the auction mechanism increased dramatically as the bubble period progressed, increasing by 36% between 2003 and 2004, coinciding with the first warning by the IMF in early 2003 that the market was exhibiting bubble-like characteristics, and by approximately 15% a year in each of 2005 and 2006. It was only in 2007 as the bubble peaked and started to burst that the proportion of properties auctioned started to decrease.[25] We speculate that such an increase in auction activity is consistent with an implicit belief by auctioneers in auction fever, whereby in the emotional cauldron of an English-style open-outcry ascending-bid auction, setting a low guide price would attract more bidders and generate a higher price. Our results are interesting in light of the findings of Shi and Kabir (2018) who find, using US data, that the proportion of properties auctioned increases as a proportion of the total volume of property transactions in boom periods, and that that the ratio of auctions sales to total real estate transactions is a better predictor of real estate booms than price-to-rent ratios. However, due to data availability, they are unable to explore the relationship between competition and price outcomes, or the role of guide prices in driving competition and its relationship to prices. Our contribution to this literature is that the setting of the guide price by the auctioneer appears to have no role in triggering more competition and our results confirm the strength of anchoring even at the height of a bubble market.

Why then would real estate auctioneers rationally set guide prices below fundamentals and in many cases significantly below fundamentals, as found in **Table 3**? We suggest that a primary motivator in the setting of guide prices

25 As no publicly available searchable database existed during the period, this data was extracted based on a manual counting of newspaper advertisements for houses offered for sale via auctions and negotiated sales transactions.

below fundamentals is as a marketing mechanism to create an illusion of scarcity generating newspaper headlines of auction prices systematically exceeding guide prices. In this context, auction results are published weekly in newspaper property supplements on Thursdays and Fridays. This strategy may be of particular importance in the Irish context. In our sample period, information asymmetries between real estate agencies and residential real estate purchasers are a quintessential feature of the Irish market, as, except in the case of auctions, prices achieved in property transactions are not a matter of public record. Thus, prospective property purchasers may be led to infer the frothiness of prices achieved at private negotiated sales transactions from prices obtained in the auction rooms.

In addition to this suggested explanation, by setting deeply discounted guide prices in many instances, auctioneers may have mistakenly believed that there is a reversal-of-the-anchoring effect. This is potentially consistent with findings in the economics literature that in bubble markets experts may be equally as subject to biases and errors in their decision-making processes as their less sophisticated counterparts (Cheng et al., 2014; Hussam et al., 2008).

Interestingly, from a public policy perspective, there was a belief as the bubble reached its peak that artificially low guide prices were making auction prices frothier and consequently this led to the enactment of the Property Services Regulation Act 2011, which provided, inter alia, that auctioneers instead of guide prices disclose an advised market value (AMV). This has a statutory definition as a price reflecting the expectation of the amount that would be achieved in an arm's length transaction where the buyer acts "knowledgeably" and "prudently". There are significant penalties for non-compliance, including disbarment from the real estate business. Our research suggests that were the AMV to have been in place during our study period, it may, paradoxically, have potentially exacerbated prices.

We add one caveat: we cannot dismiss the possibility that an unobserved variable not accounted for in either the HAPM specification or the portfolio of self-similar properties is associated with both guide prices and realised auction prices and thus may play a role in driving our results.

In aggregate, our results are consistent with auction bidders anchoring on the auction guide price in formulating their bidding strategies, even in bubble markets, and that the actions of auctioneers in setting auction guide prices low relative to fundamentals may, in fact, dampen the effect of the bubble rather than amplify it.

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